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Foreword

Since 2017, graduate students and PhD candidates from across the world have attended the Inter-Policy School Summit. We are a student-led conference seeking to bring together policy students and practitioners from around the global to brainstorm and curate innovative and tangible solutions to some of the most pressing global issues of our time. We do this through partnering with think-tanks, non-profits, and organizations that are looking for fresh solutions to existing problems in their communities. Our mission is to revolutionize the landscape of policy conferences by using the collective knowledge and skills of our participants to offer innovative, relevant and rigorous recommendations for a current policy issue. Over the past five years we have had 145 participants from 40 universities across the globe.

For the 2021 Summit, we partnered with PYXERA Global to address the issue of Transforming Inclusive Circular Economies and virtually held events over the first weekend of March. Graduate students and PhD candidates from sixteen universities came together six weeks prior to develop innovative policy solutions that would create a prosperous and sustainable future for communities in Chicago, Alaska and Montana Tribal Nations, Ghana, Prague and Singapore.

Participants were broken into five teams, each focused on one of the previously mentioned regions and paired with an expert in that region to act as a mentor. On day two of the Summit, the teams presented their findings to experts from PYXERA Global and their mentors, receiving critical feedback to sharpen their final policy papers. These briefs present the findings of each group.

We would like to thank John Holm and Alexandra Smith-O’Connor from PYXERA Global for their support and expert contributions to the Summit. We are also grateful to the content area experts who mentored our teams and/or provided critical feedback on team presentations: Adwoa Coleman, Chandar van der Zande, Jared Silverman, Johathan Pereira, Karina Cady, Susan Ruffo, Lauren Phipps, and Ana Fraisse-Tilden. Thank you to our speakers and panelists for their contribution to our program: John Elkington, Garry Cooper, Adwoa Coleman, Alhassan Muniru, Vivien Luk, Anahma Shannon, Alicia Marseille, Jessica Stago, Ellie Jorgensen, Weslynne Ashton, William Schleizer, Garr Punnett, Jonathan Pereira, Mark Fisher, and Renay Loper. Finally, thank you to the Harris School for its support and resources, especially to David Chrisinger at the Harris Writing Program and our advisor, Adam McGriffin.

We acknowledge and thank our sponsors the Harris Student Government and the UChicago Graduate Council for their financial support.

The 2021 Executive Board of the Inter-Policy School Summit
University of Chicago, Harris School of Public Policy

The views expressed in these papers are those of the authors and not those of PYXERA Global or the Harris School of Public Policy.

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Executive Summary

Nome, Alaska is threatened by plastic pollution. While some of the plastic is created by the roughly 10,000 residents in the Nome area, the majority comes off the Bering Strait onto Nome’s shorelines. Annually, millions of tons of plastic are disposed of rather than recycled (Ellen Macarthur Foundation, 2017). Circular practices are a cultural norm among many tribal nations, but as plastics, many of which are single-use come ashore, these practices are threatened. Bi-annually the Nome community organizes a beach cleanup, but the scope of this initiative is limited because the current recycling center does not accept plastic waste. Kawerak, a regional nonprofit organization directed by the leaders of the Nome region’s tribes, is planning a new recycling center that will potentially accept plastic.

To reduce the plastics waste-issue while preserving circular economic processes, we propose leveraging the Nome Recycling Center to convert plastic waste into usable goods that benefit the local shipping and construction industries. Shipping is a major industry given the remote location of Nome, and all recycling not currently used in the community is palletized and shipped. According to the Alaska Housing Finance Corporation (2017) housing is a critical need as homes are over-occupied, or do not have complete bathrooms or kitchens.

This whitepaper offers possibilities to ameliorate Nome’s unique combination of challenges. For consideration by the Nome community, we present a native-owned and operated plastic conversion cooperative to turn single-use plastic waste into usable items such as plastic building bricks and plastic pallets. The set of possibilities presented are not prescriptive. Rather, they are ideas for the Nome community under the stewardship of Kawerak to consider, reject, modify, or advance.

Reflexivity Statement
Reflexivity in qualitative research is commonly used as a form of unearthing inherent power imbalances with regard to knowledge and representation. Since our project focuses on policy solutions for Native Alaskan tribes, we provide the following reflexivity statement. All five of the authors are female-identified graduate students at non-native institutions of higher education. None are from the Nome region nor from an Alaskan tribal nation. Early in the writing process, the group discussed concerns related to power and knowledge seeking to center the voices, experiences, and desires of the community where possible. Limited resources hindered the ability of our group to directly engage with community stakeholders. Instead, we relied on publicly available community and economic development documents. Our group also attended a publicly advertised recycling meeting. Regretfully, we learned our attendance at this event may have been intrusive and for that, we apologize.

**Background**

The Nome Census Area encompasses almost 23,000 square miles of land in Western Alaska. The tribal nations in the Nome area are historically dependent on natural resources such as the ocean. As a fishing community, the plastic debris polluting the oceans threatens both economic and cultural livelihoods. Approximately eight million tons of plastic ends up in oceans, and at the current trajectory by 2050, plastics in oceans will outnumber fish (Ellen Macarthur Foundation, 2017). For Nome, much of the ocean debris comes from ships in the Bering Strait as it is a popular international shipping channel.

Like other communities in Alaska, the waste management system in Nome relies on community buy-in and participation, using complicated and expensive transport of waste products to Anchorage, Fairbanks, and in some cases, a 2,000 mile trip to Seattle (Kelly, 2019a). Some regions in Alaska keep and recycle glass and paper, which turns into lining for underground pipes and roadways and insulation, but the remaining waste lives in a debris-filled purgatory, adversely affecting community livelihood and well-being (PYXERA Global, 2020).

Ongoing plastic pollution continues to rise and contaminate our oceans and world. Globally, only nine percent of plastics are recycled, while 79 percent of plastics end up polluting the environment or go to landfills (Geyer et al, 2017). The inappropriate and insufficient disposal of plastic wastes leads to pollution of nature and marine environments, impacting marine life and
subsequently human life (Awoyera & Adesina, 2020). There are increasing fears for our environmental future due to the ever-accelerating increased speed of environmental pollution and the lack of counterattacks we are globally attempting.

Figure 1.
The population of the Nome Census Area by Ethnicity.

75% of Nome population identifies as American Indian or Alaska Native

<table>
<thead>
<tr>
<th>Non-Native</th>
<th>American Indian or Alaska Native</th>
</tr>
</thead>
<tbody>
<tr>
<td>2471</td>
<td>7533</td>
</tr>
</tbody>
</table>

U.S. Census Bureau, 2019

The large presence of American Indian or Alaska Native people (according to the Census classification in Figure 1) in Nome signifies a strong cultural way of life, with an emphasis on multigenerational households. Households in Nome have an average of 3.3 persons per household (US Census Bureau, 2019). Yet, a consensus exists among local Nome residents that the Census and official means of measurement are not accurately reflecting living conditions. According to Alaska Public Media, residents fear being truthful about their cramped conditions when responding to surveys like the Census, leading to approximately six to eight percent of Alaska Natives uncounted (Hovey, 2020). Coupled with the large expense of housing materials, tribal communities are forced into existing structures and do not receive adequate funding for building renovations and public projects.

Nome, the largest city in the census area with a population of approximately 3,600, lies on the Bering Strait, a geographic position enabling it to be an economic hub of local communities, but also isolated from larger cities like Anchorage or Juneau. The United States Navy identified Nome as a potential site for a deep-water port as commerce continues to move north (Mason, 2021). The following whitepaper proposes using the Nome Recycling Center as a means to alleviate the ongoing strain placed on the tribes in the Nome region. A convergence of bulky waste management systems and inadequate local resources, the Nome Recycling Center promotes an entry point into the circular economy. Building on this, we propose the possibility of a cooperatively and native-owned plastic conversion venture to create pallets useful in the
shipping industry and bricks to build or retrofit residential and commercial properties. Going forward, the Nome Recycling Center and the cooperative venture, under the stewardship of Kawerak, can be a community-driven hub for local commerce and innovation.

**Key Findings**

Researchers point to the detrimental and unequal effects of environmental pollution as impoverished communities and people of color are affected at higher rates (Geyer et al, 2017). Individuals in power continue to postpone and or avoid active initiatives that can reconcile the time-sensitive issues driven by plastic and overall pollution. For example, the Executive Director for Alaskans for Litter Prevention and Recycling, a privately-owned non-profit, advised disposing of plastics into landfills in 2019 instead of disposing of the plastic in an environmentally and socially responsible way (Kelly, 2019b). It is becoming increasingly clear that communities, especially disenfranchised communities, require policies to safeguard the progress that has already begun and supports more active responses to pollution and plastic disposal.

The Nome community has shown particular interest in the importance of recycling. The residents of Nome engage in an annual beach and highway plastic clean-up every Spring, demonstrating a collective investment to clean plastic waste from the beach, much of which enters the shore from the ocean. A press release documented a number of specific reports, including one from August 3rd, in which, “two Gambell residents filled 19 trash bags with plastic over a three-mile stretch of beach, each bag weighing around 50 pounds,” (Smith, 2020). According to Austin Ahmasuk, a climate activist, “residents of Nome have taken it upon themselves to clean up the beaches and document this trash,” (Smith, 2020). Along with organizing clean-up efforts, Kawerak has also been collecting information about the debris found in the ocean and urging state and federal agencies to take concrete action. The Kawerak Environmental Program has operated a 10-year EPA-funded regional recycling program that assists member tribes in properly recycling certain household hazardous materials. Kawerak staff works with each community to backhaul recyclable items from nearby villages to Nome and then on to Seattle for proper disposal (PYXERA Global, 2020).
Storing, sorting, staging, and transporting waste and recycled material currently occurs outdoors in Nome. For much of the year, the recycling center staff carries out recycling operations in the wind, snow, rain, and cold. It is the hopes of the community to build a facility that eliminates harmful conditions from affecting workers’ health and activities. The Nome Native Community Strategic Development Plan developed in 2004 provided developmental goals from their community including the implementation of tribally-owned lumber, hardware, and building supply stores (Kawerak, 2004).

*Recycling and Repurposing Initiatives*

While there are limited waste management systems in Anchorage, Alaska that have the ability to recycle #1 and #2-grade plastics, Nome’s current facility does not accept any plastic. Plastics recycling may be advantageous for the Nome community as it can be used to create plastic bricks such as those produced by NevHouse, which makes weather-reliable plastic bricks that can be used for the recycling center facility as well as potentially for new housing or retrofits, where needed (NevEarth, 2020). Moreover, addressing the high cost of housing while increasing the housing stock are both top priority projects for the Nome Eskimo Community (Kawerak, 2013). To this end, we identify an opportunity to turn plastic waste into building materials that can be native-owned and operated *from collection to construction*, as well as ensuring this initiative contributes to increased quality of life.

To mitigate environmental concerns on a global scale, we need to reconsider the level of activity at which we attempt to reduce the use of plastic from end-to-end, how we are recycling various recyclable material, and acknowledge the opportunity costs on a global scale when we do not repurpose plastics and other recyclable waste into new functions. For example, engineers have developed ways to use polyethylene (PE), the type of plastic used in bags, with earth-based clay material to produce plastic sand bricks (Thirugnanasambantham et al., 2017). Along with a decrease in the accumulation of plastic, plastic sand brick can help conserve energy and reduce the overall cost of construction.

Sathiskumar and Karthikeyan (2019) reviewed existing methods for recycling tires. Using processes such as grinding and thermal decomposition, tires have been recycled for a variety of purposes, including rubber products for playgrounds, sports surfaces, and modified asphalts, as
well as viable alternatives for engine fuel. Nike’s Reuse-A-Shoe Program adopts a similar grinding process to turn used athletic shoes into basketball courts and play-top surfaces (Nike, 2019). A best practice from a Housing and Urban Development (HUD) report on tribal housing projects highlighted the use of repurposed lumber and other sustainable materials as best practices for the preservation of traditional heritage and the construction of energy-efficient communities (Blosser et al., 2014). The Nome community already uses glass and paper products in pipes, roadways, and as insulation, in addition to expressing interest in utilizing cardboard for home building materials. As the capacity of the Nome Recycling Center potentially expands, other uses for recycled materials can be explored.

Housing

In 2017, the Alaska Housing Finance Corporation (AHFC) conducted its Housing Assessment of the Bering Strait Region, which includes Nome, Alaska. Their findings indicate 2,818 occupied units, 27 percent (772 homes) of the regional population live in overcrowded housing, which is one of the highest rates in Alaska (Alaska Housing Finance Corporation, 2017). Overcrowding is likely caused by homelessness as room sharing becomes the only other option (US Department of Housing and Urban Development, 2017). Housing costs in the region require 114% of the median income to afford a two-bedroom unit. Among those who can afford housing, the AHFC estimates 44% (1,751 homes) require an energy retro-fit, 16% (363 homes) lack complete kitchens, and 21% (835 homes) lack complete bathrooms. Optimistically, they report these retro-fits are more cost-effective than rebuilding (Alaska Housing Finance Corporation, 2017). Such issues are compounded by 21.6% of the region’s population living below the poverty line (US Census Bureau, 2019).

The Bering Straits Regional Housing Authority awards three forgivable loans of $25,000 for repairs to low-income Alaskan Native households (BSRHA, 2020). According to AHFC, assuming a continued rate of three-loans a year, to only add bathrooms to the existing 835 homes without addressing the overcrowding, energy issues, or lack of kitchens would take 69.5 years.

In 2013, HUD piloted a series of case studies highlighting best practices and emerging trends in tribal housing (Blosser et al., 2014). The report highlights 17 tribal housing projects across the US featuring sustainable construction, which can “result [in] healthier, more energy-efficient,
and climatically appropriate housing stock that often incorporates strong cultural and historic tribal design elements” (Blosser et al. 2014: p. iv). The study details best practices in design, site, innovation, culture, green, and impact categories, ultimately showcasing holistic approaches incorporating community engagement, local partnerships and collaborations, site planning and financing, and tribal employment. Although none of the case studies included plastics as building materials, many sites utilized straw, lumber, and compressed earth as a reusable, climate-appropriate building material. Further, a development in the Navajo Nation of Arizona focused on single-family homes with specific elements for elder living and multigenerational homes.

**Policy Possibilities**

In Nome, there is evidence of community investment in removing and collecting plastic waste through grassroots collection efforts and the planning of a new recycling facility that will collect materials like plastic not currently recycled (Kawerak, 2004; Kawerak, 2013). In the case of resource-constrained communities like Nome, Vyas and Vines (2019) argue that (e-waste) recycling centers have the potential to promote the wellbeing and skill of community members, aside from the benefits of reusable products. In support of a community-centric approach, we propose developing a *native-owned and operated plastic conversion venture.*

Plastic and cardboard waste can be transformed into a variety of products to alleviate a range of social and economic issues such as pollution and overcrowding. Given a community-identified shortage of pallets, developing recycled-plastic pallets within the Nome Recycling Center can alleviate the strain on the system. We suggest developing plastic bricks to alleviate the compounding housing issues of high-costs, overcrowding, and needs for retrofits. Additionally, expanded polystyrene and newspaper can be turned into insulation presenting a viable possibility to energy retrofits. Tires can be turned into pavement for playgrounds, sidewalks, or other impervious surfaces.

Each of these policy solutions are intended to be *illustrative rather than prescriptive.* The scope of this project limited the amount of time and subsequently exposure to the tribal communities. Thus, we relied heavily on publicly available information and materials to inform these solutions such as the Kawerak reports detailing native community and economic development goals in

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Nome (Kawerak Community Planning and Development Program & The Bering Strait Development Council, 2013; Northwest Planning and Grants Development, 2004). Some materials produced by the federal government were not specific to the tribal nations in Nome, but more general to tribal nations countrywide therefore, some of the assumptions on which we relied may be flawed. We believe in the inherent right of tribal nations to decide on the direction of their own circular economies. Thus, we offer these circular economies as ideas that can be tossed, modified, or built upon. We propose the use of Community-Based Participatory Research as a framework and guide for sharing decision-making power (Israel, Eng, Schulz, & Parker, 2012).

Native-Owned and Operated Plastic Conversion Venture

We suggest structuring the native-owned and operated plastic conversion process as a cooperative to center community-based decision making including which products are developed, their intended purpose, and their final destination within the community. Possibilities include new constructions or retrofitting of houses, community centers, recycling hubs, and more. Including a tailored buy-back program could effectively target the plastic waste problem while building on the strong community clean-up investment. Such a program could effectively monetize waste collection and reduce the amount of plastic waste produced.

Plastic Possibility: Plastic Pallets

From information collected in the February 2021 community recycling meeting, several community members expressed concern regarding a substantial lack of pallets to ship recycled goods out of Nome. All products including recycled goods shipped out of Nome are done so by packaging the items onto pallets, and plastic pallets from recycled materials are becoming more popular (Wunderlin, 2018).

Pallets are a necessary component of distribution supply chains as they allow goods to be transported by ship, plane, trucks, and freight. There are a variety of pallets which vary depending on the shipping need, however, most pallets are made out of either wood or plastic. Wooden pallets have low material and production costs, and are estimated to represent 90 to 95% of the pallet market share in the United States (Buehlmann et al., 2009). Plastic pallets are steadily
growing in market share, and have inherent advantages over wooden pallets like durability, handling safety, quality, and low cost per use (Scheerer et al., 1996). As plastic pallets gain popularity in the shipping and logistics industry, there is also an increased demand to manufacture flame retardant plastic pallets (Witt, 2003). Flame retardant chemicals added to plastic pallets are toxic in nature, and the plastic pallet company, Intelligent Global Pooling Systems (iGPS), recently reached a voluntary agreement with the EPA to end the use of the chemical decabromodiphenyl as a flame retardant in its pallets (Harrington, 2009).

There is a possibility of repurposing plastic waste collected in Nome into plastic shipping pallets using a variety of manufacturing processes. Some suitable manufacturing techniques include the compression molding and injection molding. Introducing a manufacturing process like the one referenced above could be a variable mechanism to meaningfully repurpose plastic waste while also creating economic development opportunities in a manufacturing and export setting (WeePallet, 2017).

*Plastic Possibility: Plastic Bricks*

Turning plastic waste into usable building materials will decrease the impact of plastic waste on the natural environment, and save money as plastic is removed from the waste management system. It is also expected to decrease construction and insulation costs as wood is increasingly expensive, especially in geographically isolated regions like Nome. Finally, plastic bricks are lighter than traditional building materials leading to transportation savings (Awoyera & Adesina, 2020). In Halifax Canada, plastic is turned into solid plastic building materials. Their process is currently more expensive than wood, but with continued innovation it may be possible to decrease that cost (Wood, 2020). A Colombian venture called Conceptos Plasticos currently sells plastic bricks (Conceptos Plasticos, 2019). Plastic construction material could become an export product to further economic growth in the area. Currently in a number of African countries, the Pacific Islands, and Southeast of the United States, plastic bricks are used to construct schools, homes, and solid surface pavement (Ebert, 2021; Lazareva, 2019; Masterson, 2020; NevEarth, 2020).

*Other Recycled Component Opportunities*
The Nome community already uses glass and paper products in pipes, roadways, and insulation, and has expressed interest in exploring other recycling and repurposing opportunities (Pyrexa Global, 2020). As the capacity of the Nome Recycling Center expands, other uses for recycled materials can be explored. For example, Sathiskumar and Karthikeyan (2019) reviewed existing methods for recycling tires. Using processes such as grinding and thermal decomposition, tires have been recycled for a variety of purposes including rubber products for playgrounds, sports surfaces, and modified asphalts, as well as viable alternatives for engine fuel. For batteries and other types of electronic waste (e-waste), recycling centers can double as spaces to make, repair, and refurbish electronic products donated to the facility (Vyas and Vines, 2019).

Potential Funding Venues

There are several potential avenues of funding available for improving the Nome Recycling Center. For example, the US Environmental Protection Agency (EPA), “provides financial assistance to eligible organizations working on or planning to work on projects to address local environmental and/or public health issues in their communities” (EPA, 2020). Given the collaborative approach and community-centered nature of this project, an environmental justice (EJ) grant would be a strong funding fit. The tribe or tribal organizations as well as community-based organizations comprise promising candidates for environmental justice grants. Further, there is a historic precedent for securing funding for this community as Zender Environmental Health and Research Group (in partnership with Kawerak and others) secured a 2019 EPA Brownfields Job Training Grant to train students and graduates in jobs in the environmental field (EPA, 2019).

The EPA also offers Indian General Assistance Program (GAP) funding which, “provides funding for activities that build the capacity of tribal governments to plan, develop, and establish environmental protection programs consistent with the federal laws that EPA implements,” (EPA, 2021). This program specifically offers capacity-building activities for waste management and would provide EPA assistance with Integrated Waste Management Plans. Additionally, the Indian Housing’s Office of Native American Programs within HUD also offers Indian Community Development Block Grants. In this capacity, improving the recycling center would qualify for a single-purpose grant. Importantly, these grants can be used not only for housing.
(which may be a longer-term goal), but can also be used for community facilities and general economic development projects (HUD, 2021) which provides another potential funding stream for improving the Nome Recycling Center.

The funding streams suggested here are not exhaustive. Rather, they are meant to create a foundation of possible avenues; there should be continuous, active funding mechanisms in place to support the evolving goals and projects of the Nome Recycling Center and community initiatives.

**Conclusion and Next Steps**

This whitepaper described the overarching issues of plastic waste, in coordination with the flanking issues of recycling, shipping, and housing and infrastructure in Nome, Alaska. The proposed possibilities build on the existing circular economy momentum in the community such as strong desires to increase recycling and the promise of a new recycling center. As was previously mentioned, it was outside the scope of this whitepaper to detail how, where, and to whom improved or new infrastructure would be directed because we affirm the inherent right of self-determination by the native Alaskan communities. We propose Kawerak serve as the convening organization to support this community decision. Currently, each tribal nation’s leader serves on the board of Kawerak making it the ideal decision-making body.

Should the community determine plastic conversion to be a viable direction, we identify the following next steps. Additional research is required on the safety, viability, durability, insulating-properties and cultural-appropriateness of plastic conversion. The health and safety of the community resulting from any plastic conversion is a top priority at all times. Currently, plastic bricks are used in many localities including Halifax and Norway indicating they may be viable in the arctic climate of Alaska. Additional research may be needed to ensure bricks are both technically and culturally appropriate to the communities of Nome. In addition to the technical and design components, the logistics of building need to be outlined. Outside support will be vital to the cooperative structure we propose. We believe there is opportunity within the federal government’s work on environmental justice to identify funding for land and materials,
and there may also be opportunity to partner with the private sector through corporate responsibility efforts.
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Valeria Ceballos Jauregui is a first year MPP fellow (‘22) at the Luskin School of Public Affairs, UCLA. Her policy interests are Immigration, Social Policy, International Development and Comparative Policy. Currently, she is a graduate student researcher (GSR) for the Undocumented Student Program (USP) at UCLA and is working on several research projects and reports to further advocate for the social and economic gaps undocumented and underprivileged students experience. She is originally from Chile, but has lived most of her life in Los Angeles, CA. She has an extensive background in the non-profit field and actively volunteers to assist immigrant communities that are underrepresented and socially neglected. Before starting her Master, she was a transfer undergraduate student at UCLA. She majored in Anthropology and minored in Labor Studies. At UCLA she took focus on health care for American Indians, Native American language and culture, race and history in Archaeology, Urban Anthropology, as well as a focus on immigrant rights and International Human rights. These concentrations served her to be better prepared to understand the intersectionality of current social dilemmas, such as the effects of policies on low-income, underrepresented, and disenfranchised communities. She is eager to learn and find better ways to mend policies and decisions that augmented these disparities as well as creating new more tangible options that are more conscious for the future of our world.

Tracey Freiberg is a PhD Candidate in the Milano School of Policy, Management, and Environment at The New School in New York, NY and a Visiting Professor of Economics at the Peter J. Tobin School of Business at St. John’s University in Queens, NY. Her research expertise and interests are interdisciplinary in nature with a focus on worker rights, labor economics, public policies, and community well-being. Specifically, her dissertation research focuses on firm responses to paid family and medical leave policies in the United States, notably the Families First Coronavirus Response Act in 2020. Professionally, she has over 10 years of experience in insurance, financial services, consulting, research, and academia. Ms. Freiberg holds a Bachelor of Arts degree in Economics and Business Administration from Coe College in Cedar Rapids, Iowa and a Master of Arts degree in Economics from Duke University in Durham, North Carolina. She currently resides in the Upper West Side neighborhood of New York City.

Julia Godinez is an MPA Fellow (‘21) at the Cornell Institute for Public Affairs concentrating in Economic and Financial Policy. At Cornell University, Julia has managed several evaluations spanning consulting the Peruvian Ministry of Foreign Affairs in evaluating financial models to implement United Nations (REDD+) programs to evaluating a $50,000,000 Engaged Leadership Program. Julia has also recently been published by the Aspen Institute for her work on climate adaptation and resilience in Lagos, Nigeria. Julia also participated in a practicum that
determined how resiliency is being used as a design criteria in the rebuilding of Puerto Rico after Hurricane Maria and the recent earthquakes. This project included a week of field work in Puerto Rico where the team met with key regional and national stakeholders in the rebuilding process. Most recently, Julia worked at the Federal Reserve Bank of New York assisting with pandemic response by creating business continuity plans for the COVID-19 Credit and Liquidity Facilities. Julia also created an attestation tool for essential on site employees. Before attending Cornell, Julia served as a Peace Corps Volunteer in Guatemala working in the domains of youth skill development, sexual education, and program evaluation. Julia is interested in mixed-method policy and program Monitoring and Evaluation (M&E). She received her B.A. in Economics and History from Mount Holyoke College and is a Posse Scholar. Julia is fluent in Spanish and is currently learning Portuguese.

Lia Kelinsky-Jones is a Ph.D. candidate at Virginia Tech in the Agricultural, Leadership, and Community Education department. Her work broadly focuses on power, participation, and inequity within the global food system and international development. Her dissertation looks at how USAID policy influences the views and usage of agroecology by land-grants for international agricultural development. As the Advocacy Chair for the Virginia Tech Science Policy, Education and Advocacy Club, she co-leads a project focused on developing climate-resilient food security policy recommendations for her locality. Prior to pursuing her Ph.D. in a full-time capacity, she held various administrative roles at Virginia Tech focusing on international affairs, project management, grant proposal management, data visualization, and program evaluation. In her spare time, she’s an avid cyclist, gardener, and mom to an adventurous Labrador and lazy cat.

Special thanks to:
- Jared Silverman and HATCH
- Anahma Shannon and Kawerak
- Nome Recycling Center
- IPSS Sponsors: PYREXA Global and U. Chicago
- Kiana Nunez (St. John’s University) for additional research support
Circular Chicago: Aligning Existing Infrastructure to Drive Sustainable and Equitable Economic Outcomes

Brad Jacob (USC), Devika Singh (UChicago Harris), Elizabeth Anderson (Columbia University), Jonah Messinger (UIUC), Paola Sastre (The New School)
Mentor: Jonathan Periera (Plant Chicago)

Executive Summary

The city of Chicago has a history of sustainability and economic initiatives (Sustain Chicago, n.d., Wetli, 2020). These initiatives encompass elements and infrastructure needed to create a circular economy (CE) but are siloed in a linear framework. A CE is a framework that seeks to decouple economic initiatives from a linear structure that consumes finite resources towards an economic model that designs out waste, repairs and reuses products and materials, and regenerates natural systems (Ellen MacArthur Foundation, n.d.). Implementing a CE utilizing a concurrent top-down and bottom-up framework represents a practical approach towards aligning stakeholders and existing infrastructure while developing a resilient, sustainable, and equitable CE (Lieder & Rashid, 2016; Ibn-Mohammed et al., 2020). The purpose of this memo is to discuss the creation of a Circular Chicago initiative that aligns existing infrastructure to build a centralized top-down framework for a citywide CE, coupled with decentralized bottom-up initiatives that expand economic opportunity and facilitate positive environmental outcomes. To accomplish this, Chicago can leverage existing infrastructure to create CE policies and programs that facilitate a decentralized composting program, promote centralized and industrial composting with a food waste ban, create a materials marketplace, and initiate circular procurement policies over the short term. Chicago should also create a task force of public, private, nonprofit, minority business enterprises (MBEs) and other interested stakeholders to connect CE participants, facilitate economic opportunity in marginalized communities, and identify additional inclusive and equitable CE opportunities over the long term. To address research gaps, Chicago should study the economic impact of CE diversion, reduction, reuse, and procurement programs.

Background Information: Chicago and CE Infrastructure

Aligning resources between the public, private, nonprofit, community actors, and civil society is necessary to build the foundation for a circular economy (CE) (van Heel et al., 2020). Rizos et al.
(2016) state that a “successful transition to a circular economy can only be achieved through collective effort, requiring exchange and dissemination of knowledge and innovation among different stakeholders in the value chain” (p. 4). In North America, CEs are driven by capital investment in CE infrastructure, innovation that enables circularity, policy that encourages circularity, and partnership across all actors (Closed Loop Partners, 2020). Actively engaging relevant stakeholders is a critical component of creating a CE (Levoso et al., 2020).

Different cities in the US have initiated a shift to a CE by implementing waste and resource management plans, economic initiatives, business incubators, innovation labs, and circular marketplaces. These cities have developed a roadmap to reach medium and long-term goals, including aligning resources and partnerships between the public-private sectors and civil society.

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Goal</th>
<th>Successful Programs</th>
</tr>
</thead>
</table>
| Reimagine Phoenix (City of Phoenix, n.d.) | Achieve Zero Waste by 2050 | • Since its creation in 2015, the city has successfully improved its diversion rate by 30%.  
• The initiative partnered with Arizona State University to create the Resource, Innovation and Solutions Network Incubator, which has raised 1.35 million dollars in capital to fund new circular economy business and initiatives.  
• It also created the Industrial Composting of Palm Frond, which has created 12 new jobs. |
| Austin Resource Recovery Master Plan (City of Austin, n.d.) | Reach Zero Waste by 2040 | • From its creation in 2011, it has implemented 34 programs related to CE involving diverse stakeholders and transforming different problems in the city, including: diversion plans, revitalization of green areas, creation of materials marketplace, community composting plan and capacity building programs (including fix and reuse workshops). |
| New York Circular Initiative (New York Circular Initiative n.d.) | Reach Zero Waste by 2030 | • Recently created, this initiative aims to be a recovery plan from the negative impacts caused by the Covid-19 Pandemic. It aims to create economic opportunities for the most vulnerable communities by enabling materials marketplaces, developing procurement guidelines, incorporating CE into zoning, and promoting awareness through education and communication campaigns. |

Figure 1: Circular Economy initiatives in the U.S.

**Chicago Demographics & Socioeconomic Summary**

In 2019, Chicago’s population was nearly 2.7 million, making it the third-largest city in the United States by population (U.S. Census Bureau QuickFacts, n.d.). Chicago is a stratified city, with vastly different racial, socioeconomic, and other characteristics across its wards. Chicago’s Southside is over 75 percent Black and has a 29.1 percent poverty rate (U.S. Census Bureau, n.d.a). The Westside is 50 percent non-white and has an 11.5 percent poverty rate (U.S. Census
Bureau, n.d.b). A CE can enable equitable economic opportunity, and CE policies should consider ways to address poverty and economic inequality (van Heel et al., 2020).

**Key Findings**

*Chicago’s Current Waste Management Structure*

The Department of Streets and Sanitation (DSS) oversees the management of Chicago’s waste, and contracts private firms when needing additional support. The DSS collects refuse and recyclables from single and multi-family homes of up to four units. For all residences with more than four family home units, private haulers are contracted to collect refuse for landfills, and recyclables. Refuse is collected on a weekly basis and recyclables are collected on a biweekly basis, assessed at $9.50/unit/month for these services.

Currently, the city of Chicago does not have a centralized mechanism in place to collect residential and commercial organic waste, apart from yard waste. Yard waste is collected on a scheduling basis with DSS. This leads to about 546,000 tons of food waste reaching Chicago’s landfills annually (CDM, 2010b). In 2015, the city of Chicago passed a compost ordinance allowing urban farms and gardens to accept and compost food waste without having to register as a composting facility (Pai et al., 2019). The ordinance allowed urban farms to accept off-site organic waste for on-site compost without a compost permit as long as the pile is set back 150 feet from residential zones, records are kept, and compost size does not exceed 10 cubic yards, or 25 cubic yards with written permission from the commissioner of DS (Amendment of Municipal Code Titles 7, 11 and 17, 2015).

*Aligning Existing CE Infrastructure*

Chicago’s existing infrastructure is robust, albeit decentralized, and currently not directed towards a CE. Current initiatives and infrastructure can be delineated into four categories: waste, reuse and repair, economic development, and sustainability. The stakeholders that could be involved in implementing circularity in Chicago are mapped in Appendix A.
Figure 2: Existing infrastructure and initiatives which can be aligned with a Circular Chicago

Despite a plethora of waste initiatives, Chicago’s waste diversion rates are among the lowest relative to other jurisdictions for low-density residential and private hauler diversion rates, as seen in Appendix B and Appendix C (CDM, 2010a). Per the IFSC (n.d.), Chicago has 11 private, decentralized food waste pick-up service providers for residential areas. While the outsourcing of waste pick-up services provides economic opportunity to local businesses, disaggregated data on waste collection across the City remains proprietary and unavailable for analysis (Pai et al., 2019).

Reuse and Repair initiatives in Chicago include the Rebuilding Exchange, a nonprofit organization that facilitates the repurpose and reuse of building and construction materials in the Chicago area. Founded in 2009, the nonprofit’s 2025 goals are to divert 15,000 tons of waste from landfills, train 300 apprentices, generate $3 million in revenue from reused or repurposed products, and educate 10,000 community members (Rebuilding Exchange, n.d.). Importantly, the construction and demolition sector is responsible for just over 60 percent of the city’s waste, roughly 228,000 tons of which is from lumber (CDM, 2010a). The Creative Chicago Reuse Exchange is a nonprofit that reuses materials, supplies, and equipment for teachers and educators in the Chicago area.
On June 11, 2020, Mayor Lori Lightfoot announced the hiring of a new Chief Sustainability Officer, whose mandate is to advance Chicago’s environment and climate agenda, including stakeholder engagement and community-based solutions (Wetli, 2020). The City of Chicago’s 2017 Greenhouse Gas Inventory Report noted a 15.4 percent reduction in greenhouse gas (GHG) emissions from 2005 to 2017 (AECOM, 2019), which is in line with the City’s 2025 target of 26 percent to 28 percent reduction in GHG emissions (Chicago Mayor’s Press Office, 2017). However, the City’s 2050 goal requires a further 80 percent drop in GHG emissions from 2017 levels (AECOM, 2019).

Organic Waste Data

As of 2010, Chicago’s organic waste landfill diversion rates for waste producers using private haulers were less than 1 percent for food waste, 19 percent for yard waste, and 11 percent for wood pallets, which are the three organic waste categories reported by the City (CDM, 2010a). Despite Chicago’s poor recycling and diversion rates, there is significant untapped potential for organics waste diversion from landfills. Organic food scrap waste is prevalent in Chicago’s waste stream, ranking fourth by weight (CDM, 2010b). Large-scale food processing facilities contribute roughly 100,000 tons of organic waste (EPA, 2019), or 18 percent of Chicago’s food scrap waste, annually (CDM, 2010b). In addition, Chicago’s landfills are quickly filling up. According to the Illinois Environmental Protection Agency (Illinois EPA) (2020), the average life expectancy of Chicago’s surrounding landfills is projected to be only 12.4 years. This rate is the lowest in the state, making it even more important for the city to divert and manage its waste sustainably (Illinois EPA, 2020). Appendix D and Appendix E show projected lifetimes of Chicago’s landfills, and compare Chicago’s average landfill lifetime to other regions in Illinois, respectively (Illinois EPA, 2020).

As of 2017, Chicago only composted roughly 600 tons of organic waste (AECOM, 2019), approximately equivalent to one percent of 2010 food scrap waste and zero percent of 2010 overall organic waste (CDM, 2010b). Organic waste composting is an opportunity for Chicago in pursuit of a CE. Chicago’s vast composting infrastructure consists of compost drop-off locations, industrial composting facilities, and private haulers. Appendix F highlights the existing centralized composting infrastructure in and around Chicago (IFSC, n.d.). Of note, the entirety of
Chicago falls within the service territory of at least one private hauling company that offers compostable waste pick-up services, ranging in price from $9 to $15 per pick-up (Pai et al., 2019).

While this centralized compost infrastructure will play a key role in a CE and can be used to divert residential food scraps and other organic waste, it is ideal for large-scale commercial and multifamily unit waste producers. Residential food scraps account for nearly 40 percent of Chicago’s total food scraps waste (CDM, 2010b). Furthermore, the City’s 2010 waste characterization study failed to report residential food scrap waste diversion. Leveraging community-scale composting strategies will help to divert more residential organic waste from landfills. Urban farms and local organizations with compost drop-off locations, serving as aggregators of organic waste, are examples of such strategies. Appendix G conveys the extensive number of urban farms (over 800 in the city, nearly 100 of which have existing on-site composting operations) and highlights the wide-spread spatial distribution across Chicago of both urban farms and compost drop-off locations (Chicago Urban Agriculture Mapping Project, n.d.; IFSC, n.d.).

Importantly, a CE requires edible food waste to be diverted from disposal and compost operations to food banks or soup kitchens to feed food insecure populations. An estimated one in six Chicago area residents are food insecure (Kramer, 2015), and the Environmental Protection Agency’s (EPA) food recovery hierarchy lists feeding hungry people as the second most preferred option after food waste reduction (EPA, 2015). However, there are limitations inherent in this option given the difficulty in assessing and maintaining the quality of food waste diverted to food insecure populations, and hygiene parameters especially in light of COVID-19.

Circular Initiatives in the United States

A number of states and cities across the US have passed laws banning or limiting food scraps from going to the landfill. These cities include Austin, Boulder, Portland (OR), New York City, and Seattle, while these states include New York, California, Connecticut, Rhode Island, Vermont, and Massachusetts (Sandson & Broad Leib, 2019). While most of these laws target organic waste produced by businesses, San Francisco and Seattle require compost collection at the individual household level (Sandson & Broad Leib, 2019). Even if the law focuses on food
waste produced by commercial entities, more composters and related composting infrastructure is likely to open up, reducing the cost and increasing access to household-level composting services. Besides diverting waste from crowded landfills, composting food waste results in revenues from composted products, GHG emission reductions, and hauling and processing jobs (Sandson & Broad Leib, 2019).

**Sampling Economic Outcomes of Circular Initiatives in the United States**

Transitioning from a linear to a circular approach could enhance circular business models to decouple economic growth and natural resource consumption while driving greater competitiveness (OECD, 2020). There are highlights of the first results in different cities. Estimates from the New York Circular City Initiative indicate that 11,000 new jobs can be created within a citywide circular economy by 2030 (van Heel et al., 2020), and the Great Lakes Region Circular Economy initiative estimates the creation of 13,000 new full-time jobs across the region while saving up to $5 billion by 2050 (U.S. Chamber of Commerce Foundation, 2020). The city of Phoenix designed an industrial organics waste program to utilize palm fronds and convert them into livestock feed materials. This strategy aims to generate an estimated $10 million in sales, annually. Also, through its Resource, Innovation, and Solutions Network Incubator it has created 26 full-time jobs, four part-time jobs, 19 internships, raised $1.35 million, launched 10 products, and filed two patents (C40, 2018).

**Economic Opportunities of a Circular Chicago**

Given that CEs represent a nascent economic initiative, there is limited evidence on the economic impacts of a circular initiative. Some estimates, such as the Delta Institute (2014) project that by 2040, 39,000 new jobs could be created in the Chicagoland area by diverting 60 percent of its waste towards composting and recycling from landfills. Decentralized diversion of residential food waste through pick-up and drop-off composting can lead to positive economic outcomes and savings (Pai et al., 2019). Pai et al. (2019) estimate that 87,193 tons of food waste, or 40 percent of Chicago’s total residential food waste (CDM, 2010b), can be diverted from Chicago’s landfills, yielding $45 per ton in savings to the City. The estimated cost savings from landfill diversion is over $3.96 million, totaling 9 percent of DSS’s total budgetary allocation for solid waste disposal (Pai et al.). Pai et al. estimates this decentralized approach could achieve
$1.84 million, or $21 per ton of diverted organic waste, in compost purchase cost avoidance. In the context of urban farms, if allowed to sell compost to off-site buyers, including the City, this value could stay in the community. Projected savings retained by the City can be redirected towards improved solid waste management research implemented by a Circular Chicago Task Force; and for organic waste pick-up and drop-off services to start a composting CE.

**Circular Chicago Policy Recommendations**

The six most common policies to facilitate a CE are public procurement, creating collaboration platforms, providing technical support to businesses, fiscal policy, public education campaigns, and adapting regulatory frameworks (Becque et al., 2016). The roadmap for Circular Chicago assesses the feasibility of these six policies and utilizes a top-down and bottom-up framework to accomplish three goals. First, create a task force comprising MBEs, the city of Chicago, community leaders, small and large private sector partners, community-based organizations, nonprofits, and the general public. The task force would elicit input from all stakeholders to set equitable socioeconomic and environmental goals of Circular Chicago. Second, authorize top-down CE initiatives that align existing infrastructure related to composting, food waste, organics procurement, a materials marketplace, and a circular public procurement policy, while supporting bottom-up initiatives that build collaborative business models, circular supply chains, and equitable economic outcomes. This includes a public information campaign to raise awareness of the benefits of a CE. Third, authorize a research study that quantifies the economic impact of reduce, reuse, and procurement programs, and identifies how MBEs can participate in and benefit from a Chicago CE.

*A Top-Down/Bottom-Up Framework*

A practical approach to implement a CE can occur through a concurrent top-down and bottom-up framework (Lieder & Rashid, 2016). A top-down approach aligns a public institution's policies, legislation, resources, stakeholder management, and oversight towards the implementation of a CE (OECD, 2020). Chicago's Chief Sustainability Officer, in partnership with the Mayor's office, should oversee the top-down alignment of existing city infrastructure, and create a public information campaign to educate the public regarding the benefits of a Chicago CE. Once the mandates and resources of top-down actors are aligned to support the development of a CE,
successful implementation strategies involve designing collaborative business models and circular supply chains from the bottom-up (Lieder & Rashid, 2016). To build a collaborative and circular bottom-up CE infrastructure, a diagnosis should be conducted that identifies key stakeholders in the value chain while discovering problems and challenges specific to Chicago CE implementation (Levoso et al. 2020). The Circular Chicago Task Force can review the CE diagnostic and provide recommendations that emphasize creating equitable economic opportunity in marginalized communities. These recommendations will then be submitted to the city to finalize the top-down framework.

**Circular Chicago Framework and Programs**

*Organics: Composting, Food Waste Ban, and Urban Farms*

To tackle Chicago’s burden of organic food waste, Chicago should initiate policies at the industrial and residential levels, while requiring the procurement of compost to create strong and dependable market demand. At the industrial-scale, we recommend that Chicago ban larger food waste generators from disposing of food waste in landfills, while, at the residential and neighborhood scale, we recommend a number of reforms to make it easier to compost. Illinois should follow the lead of other states and ban food waste generators of a reasonable size, on the order of thousands of tons, annually, from disposing their food waste to a landfill. Economies of scale created by a food waste ban will expand composting facilities and collection services available, leading to increased accessibility to composting at an individual household level (Sandson & Broad Leib, 2019, p. 36). In addition, we recommend the City make efforts to require privately-contracted waste haulers to make their waste characterization, volume, and diversion data open to the public for further research and analysis. To encourage composting at the residential and neighborhood level, the City could provide financial support to organizations providing composting services and enact reforms to make it easier and more financially viable for urban farms to compost. These reforms include removing barriers for urban farms via considering expanding allowable permit-less compost volume and reducing the setback; streamlining the permitting, registration, and recordkeeping process; and allowing urban farms to collect tipping fees and sell their compost off-site. The City could require buying local compost as part of its landscaping procurement process, channeling funds to local economic activities. To combat potential bad actors, education on best composting practices should be provided.
Reduce & Reuse: Circular Marketplace

Circular marketplaces exist in online or physical locations and facilitate the buying and selling of secondary materials (World Business Council for Sustainable Development, n.d.). The Austin Materials Marketplace (AMM) is an online platform that creates a “closed-loop, collaborative network of businesses, organizations and entrepreneurs where one organization’s hard-to-recycle waste and by-products become another organization’s raw material” (Austin Materials Marketplace, n.d.). AMM focuses on a triple-bottom-line and is joined by materials marketplaces in Ontario, Tennessee, Michigan, and Ohio. Leveraging nonprofit and public infrastructure such as the Rebuilding Exchange, as well as local participation through an Innovation Challenge to create a citywide materials marketplace, can further assist in the creation of a Chicago CE. Chicago should consider joining the Materials Marketplace to further expand buying and selling opportunities in the region.

Circular Public Procurement

Procurement is a key economic activity of governments and circular public procurement (CPP) can help facilitate positive economic outcomes for CE participants (Brammer & Walker, 2011, as cited in Witjes & Lozano, 2016). Four approaches to circular public procurement (CPP) include the procurement of improved circular products or services, facilitating innovative circular business concepts, procurement of circular products, and the development of circular ecosystems (Alhola et al., 2018). Chicago should establish a CPP policy in collaboration with CE stakeholders to close organics and materials loops, reducing waste while reusing permissible materials in a manner that prioritizes expanding economic opportunity to minority business enterprises (MBE’s). To successfully implement a CPP initiative, Chicago should include this program in the CE public information campaign. Additionally, training and education for MBEs on how to participate in CPP are essential for its success (Sönnichsen & Clement, 2019).

Areas for Further Research

Current literature on the economic and environmental impact of creating a CE in Chicago is lacking. Research regarding CE initiatives in the global and European regions is robust, and analysis of CE initiatives in the U.S. is burgeoning (Alhola et al, 2019; Levosa et al., 2020;
Sönichsen & Clement, 2020; van Heel et al., 2020). The lack of Chicago-specific studies or evidence on the impacts and opportunities created by a circular initiative, particularly for marginalized and economically underprivileged sections of society, is a significant limitation. This is partly due to the “newness” of city-wide circular initiatives, where plans and policies are being tested in pilot phases. To address the research gap, Chicago should assess the economic, environmental, and job creation benefits of a Circular Chicago. This study should quantify these measures at the city level and for Chicago wards that are in the bottom 50th percentile of median income in Chicago and identify ways that the economic opportunity of a CE can be rooted in these communities. Studies on the impacts of various programs, such as the impacts of waste reclamation (including long-standing bottle deposit programs) on low-income populations and economies are also needed. Studies that do exist, such as Chicago’s Waste Diversion Study, did not include public data for food waste.

CE is still an iterative process more than it is a concrete framework. Because of this, the existing monitoring and evaluation schemes to measure its performance are scattered. Chicago’s sustainability and economic opportunity programs that can be aligned towards a CE are siloed and scarce, besides its efforts to augment its landfill diversion. Quantitative and qualitative data are incipient in the City and there is no current directory or platform where information can be accessible for everyone.

**Conclusion**

Chicago's sustainability and economic initiatives, as well as its existing public, private, and nonprofit infrastructure, can create the foundation of a CE. Currently, these initiatives and stakeholders are siloed, operating in a linear economic and environmental framework. The proposed Circular Chicago initiative seeks to align stakeholders and infrastructure to close organics and materials loops, reduce waste while reusing permissible materials, and prioritize expanding economic opportunity to MBE’s. To accomplish these goals, Circular Chicago has three components. First, create a CE task force comprising MBEs, the city of Chicago, community leaders, small and large private sector partners, community-based organizations, nonprofits, and the general public to set equitable socio-economic and environmental goals. Second, authorize top-down CE initiatives that align existing infrastructure related to composting, food waste, organics procurement, a materials marketplace, and a circular public
procurement policy, while supporting bottom-up initiatives that build collaborative business models, circular supply chains, and equitable economic outcomes. Third, authorize a research study that quantifies the economic impact of reduce, reuse, and procurement programs, and identifies how MBEs can participate in and benefit from a Chicago CE.
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https://www.epa.gov/sustainable-management-food/food-recovery-hierarchy


https://illinoiscomposts.org/haulers-processors/


Appendices

Appendix A: Stakeholders’ Relationship for a Circular Chicago
Appendix B: Low Density Residential Waste Diversion Rates Compared to Other Jurisdictions

Appendix C: Private Hauler Waste Diversion Rates Compared to Other Jurisdictions

* Data for Los Angeles mandatory and voluntary programs are modeled estimates based off expert opinion, various potential improvements, and current diversion rates.

Data points listed as N/A indicate that the corresponding jurisdiction did not report data for that particular waste material.

### Appendix D: Chicago Area Landfill Capacity and Lifetime Data

<table>
<thead>
<tr>
<th>Landfill</th>
<th>Capacity (yd³)</th>
<th>Disposal Volume (yd³)</th>
<th>Average Disposal (Syr)</th>
<th>Life Expectancy (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Disposal Services Zion Landfill</td>
<td>17,725,365</td>
<td>1,706,160</td>
<td>2,153,070</td>
<td>8.2</td>
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<tr>
<td>Countryside Landfill Inc.</td>
<td>6,656,403</td>
<td>1,143,435</td>
<td>1,220,717</td>
<td>5.5</td>
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<tr>
<td>Laraway Recycling and Disposal Facility</td>
<td>12,927,133</td>
<td>2,120,010</td>
<td>2,152,240</td>
<td>6.0</td>
</tr>
<tr>
<td>Prairie View Recycling and Disposal Facility</td>
<td>61,391,636</td>
<td>3,840,723</td>
<td>2,431,429</td>
<td>25.2</td>
</tr>
<tr>
<td>Total</td>
<td>98,700,537</td>
<td>8,810,328</td>
<td>7,957,456</td>
<td>12.4</td>
</tr>
</tbody>
</table>

### Appendix E: Illinois Regional Landfill Capacity and Lifetime Data Comparison

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<thead>
<tr>
<th>Region Number</th>
<th>Geographic Area</th>
<th>Number of Landfills</th>
<th>Capacity (yd³)</th>
<th>Disposal Volume (yd³)</th>
<th>Average Disposal (Syr)</th>
<th>Life Expectancy (yrs)</th>
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<tbody>
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<td>1</td>
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<td>504,128,514</td>
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<td>2</td>
<td>Chicago Metropolitan</td>
<td>4</td>
<td>98,700,537</td>
<td>8,810,328</td>
<td>7,957,456</td>
<td>12.40</td>
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<tr>
<td>3</td>
<td>Peoria/Quad Cities</td>
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<td>150,475,284</td>
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<td>4,972,816</td>
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<td>East Central Illinois</td>
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<td>174,696,417</td>
<td>5,914,813</td>
<td>6,204,771</td>
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<td>5</td>
<td>West Central Illinois</td>
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<td>50,380,301</td>
<td>1,717,440</td>
<td>1,731,765</td>
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<td>6</td>
<td>St. Louis Metro East</td>
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<td>171,891,332</td>
<td>7,525,820</td>
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<td>Southern Illinois</td>
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<td>82,081,495</td>
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<tr>
<td>Total</td>
<td></td>
<td>37</td>
<td>1,232,353,880</td>
<td>63,433,903</td>
<td>50,355,822</td>
<td>24.47</td>
</tr>
</tbody>
</table>
Appendix F: Private Haulers & Compost Processors Map

Appendix G: Compost Drop-Off Locations & Urban Farms Map

Waste Reclaimers: The Key to Circularity in Ghana  
Mary Beth Desrosiers (Georgetown SFS), Vrinda Handa (Columbia SIPA), Anna Nikolova (Columbia SIPA), Eki Ramadhan (Harvard Kennedy), John Schmidt (UChicago Harris)  
Mentor: Adwoa Coleman (Dow Chemical)

Executive Summary:
Plastic pollution is a visible and rampant social issue in Ghana. The West African country’s growing population and expanding economy are rapidly increasing waste generation. At the same time, there is limited infrastructure for the collection and recycling of solid waste, with most of it disposed of in open dump sites that are hazardous to human health and the environment. Recycling is also nascent in the country and has not reached the necessary scale to be a solution to the problem (Kusi et al., 2016).

To accelerate the circular economy in Ghana, this paper proposes integrating waste reclaimers—known as “waste pickers”—into the plastics value chain in the country. Waste reclaimers in the informal economy lead almost all recycling efforts in Ghana by collecting plastics and selling it to recyclers. This is a high-value service that generates income for these individuals, removes waste from streets and landfills, and increases the material value of plastic through recycling. However, these workers face dangerous conditions, low pay, and lack of legal recognition that make the occupation unattractive and prevent recycling from growing as a practice.

Based on the plastic waste management environment and the challenges described above, this paper recommends two policy approaches to enabling a circular economy in Ghana: (1) better integration of waste reclaimers in the informal sector in Ghana’s plastic waste management sector, and (2) increased enforcement of existing regulations related to Extended Producer Responsibility (EPR) and the reinvestment of excise taxes. By creating policy centering on these two issues, Ghana can help boost its recycling rate, while also improving the health and livelihoods of the lowest-income Ghanaians.

Background
Ghana is a West African nation with a young and diverse population of 32 million. Economic growth and urbanization are both increasing rapidly in Ghana. The country’s gross domestic
product is growing at 8.4 percent per year, making it one of the most prosperous economies on the continent (CIA, 2021). Urbanization is growing at 3.3 percent and the urban population is projected to increase from 18 million at present to 35 million by 2050 (UN Population, 2018).

As Ghanaians are consuming more and living in denser cities than before, urban waste management has become a major challenge. An estimated 4.6 million tons of solid waste are produced annually and, of that waste, only about 14 percent is being collected (Miezah et al., 2015). As a result, most of the solid waste in Ghana is dumped in informal, unregulated landfills, causing major environmental and health hazards to the population (Kusi et al., 2016).

Plastic waste management is an especially complex challenge. Plastics constitute 17 percent of solid waste, but only about two to five percent of Ghana’s plastic waste is collected for recycling, overwhelmingly by workers in the informal sector who collect waste at dumping sites and sell it to recycling companies (Adama Tettey, 2012).

**Circular Initiatives in Ghana**

Ghana has a robust regulatory environment related to circular economy, but implementation and enforcement challenges limit their effectiveness. In 2013, the Environmental Excise Tax (EET) and Plastic Waste Recycling Fund (Act 863) were initiated by the private sector in collaboration with the government as a type of Extended-Producer Responsibility (EPR). The regulation imposes a 10 percent tax on semi-finished and raw materials to be used to jump start the recycling industry, but Ghana has not set up a Fund Authority to manage the tax revenue.

In 2015, the government published a directive on biodegradables requiring all flexible plastics produced in the country to include biodegradable additives. Oxo-biodegradable plastics (OXOs) are designed to degrade more quickly than regular plastic in the presence of oxygen. However, these plastics have faced skepticism due to fears they may actually worsen environmental problems. The Renewable Energy Act of 2011 promotes waste-to-energy power plants as an alternate use for plastic waste, however, due to Ghana’s existing energy mix, waste-to-energy projects have not been widely implemented.
Beyond these regulations, Ghana’s National Plastics Management Policy offers some hope for improved plastic waste regulation in Ghana moving forward.1 The policy will be implemented through activities under the Global Plastic Action Partnership (GPAP)2 in scaling up solutions to plastic pollution challenges (GPAP, 2021).

Waste reclaimers from the informal sector3 play a major role in the process of reclaiming plastic waste. Without adequate recognition and physical or legal protection, however, they face numerous challenges, including dangerous working conditions and exploitation by intermediaries, especially when there is no price transparency. The COVID-19 pandemic has introduced a new set of threats to the livelihoods of waste reclaimers as they lack personal protective equipment and risk exposure from materials disposed of by households and industries.

Initiatives to improve the livelihoods of waste reclaimers must take into account their needs and expertise. Two critical needs of waste reclaimers include: (1) stable and dignified work, including economic inclusion; and (2) healthcare, including protection from health risks and occupational hazards.

There are opportunities for better recognition and more dignified involvement of waste reclaimers in the circular economy system. First, their expertise and experience managing waste are indispensable to the success of the Ghanaian waste management system. Second, they have strong underlying social capital within their community that can be fostered for meaningful collective action and provide bargaining power against intermediaries that act in a monopsony.

The international market for recycled plastics is growing but the sector is constrained by insufficient economies of scale (World Bank, 2020). Ghana has made efforts to finance plastic waste recycling, but without a fund authority in place to manage the EET and administer the Plastic Waste Recycling Fund, tax revenue collected does not support this goal. As of 2019, the government has collected GHC 911.6 million from the EET levied on semi-finished and raw plastic material (GNA, 2019), which could be used to address constraints facing the recycling

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1 The draft National Plastic Management Policy was issued in 2018 then later revised and approved in early 2020.
2 GPAP has identified Ghana as one of three national partners along with Indonesia and Vietnam.
3 Waste reclaimers tend to work independently to recover plastic waste from streets and markets, scavenge at landfills and dumpsites, or offer micro-enterprise door-to-door services in many communities,
industry.

Call-Out Box: Data on Recycling

A hindrance to the growth of Ghanaian domestic recycling industry is the lack of recycling-related data, especially the amount of waste recycled. Without reliable data, market actors cannot make important business decisions and this may lead to underinvestment in the sector. This is because market actors rely on old projections which suggest that Ghana is a weak market for building recycling plants. Lack of data has also raised concerns related to the quality of recycled products (World Bank, 2020).

Lessons from other African countries underline the importance of collecting and consolidating data in central repositories (UNEP, 2018). In South Africa, for example, general household surveys administered by its national statistical office on a regular basis include questions on waste disposal methods, environmental problems identified, willingness to pay for waste disposal, and the recycling or selling of waste (Omotayo et al., 2020).

Proposed Policy Solutions

Based on the plastic waste management environment and the challenges described above, we recommend two policy areas that would best enable a circular economy in Ghana: (1) better integration of waste reclaimers in the informal sector in Ghana’s plastic waste management sector, and (2) enforcement of existing regulations related to Extended Producer Responsibility (EPR) and the reinvestment of excise taxes. With a focus on these two policy areas, Ghana can increase the sustainability and circularity of the plastic economy across the country. In the section below, we further detail our recommendations, key steps in their implementation, and possible risks and challenges that need to be considered.

Recommendation 1: Integrating informal waste reclaimers

A comprehensive and sustainable plastic management strategy in Ghana must recognize and address for the role of informal sector waste reclaimers. Integrating informal waste reclaimers into formal waste management systems will increase reclamation rates of plastic waste to
increase the likelihood of its reuse, while also improving the livelihoods of reclaimers through increased job security and potential pathways out of the informal sector.

Waste reclaims are the backbone of waste management, and integral to enabling a circular plastic economy in Ghana. While Ghana produces 2,700 tons of waste daily, waste reclaimers collect 95 percent of all recycled waste (Keesman, 2019; World Bank, 2020). Efforts to improve plastic waste collection that do not involve informal sector reclaimers risk disrupting these critical collection efforts while excluding reclaimers whose livelihoods are dependent on the existing plastic market from formal systems. Bolstering the capacity of reclaimers will increase the amount of plastic waste that is ultimately recycled and reused, reducing demands for virgin plastics, while simultaneously improving their livelihoods by enhancing job security and better connecting them with markets.

There are three main models which Ghana could pursue to better integrate informal waste reclaimers into the plastic waste management sector: (1) providing legal recognition and status to their work, (2) enabling cooperation amongst independent reclaimers, and (3) integrating reclaimers into formal, private sector firms. These approaches are not mutually exclusive, but rather mutually supportive, and would all support reclaimers position within Ghana’s circular economy. As noted in a 2015 OECD report, “the best-functioning systems are those which embrace an open strategy that includes both informal collectors and the existing value chain enterprises in the system” (UNEP, 2019).

Recognize waste reclaimers as independent entrepreneurs through incorporation into regulations. By allowing for legal recognition of informal waste reclaimers, reclaimers may be subject to increased control and monitoring such as registration or use of personal protective equipment, but they would also benefit from increased support including access to government-run programs and considerations in future waste management planning. In Colombia, waste reclaimers were granted legal recognition in 2011 when the Constitutional Court declared that “waste pickers are historically the holders of an environmental role of high importance.” Further, in 2015, a national decree recognized the collection of recyclable materials as “a complementary activity of waste management public service” (Rateau & Tovar, 2019). These regulations require waste pickers’ organizations to formalize accounting management and other requirements of a public service company, but enable waste reclaimers to be properly
remunerated for collected recyclable materials. By supporting waste reclaimers legal position within Ghanaian society, Ghana can better integrate their critical role in waste management systems and circularity. At the same time, legal recognition must be accompanied by social acceptance of informal waste management as a legitimate economic activity to achieve a fully inclusive circular economy (UNEP, 2018).

Enable and support the establishment of waste reclaimer cooperatives and groups. While reclaimers in the informal sector operate independently, establishing cooperatives or organizations increases waste reclaimers power to advocate for themselves and achieve more sustainable livelihoods. In South Africa, waste reclaimers cooperatives are legally recognized and the Government of South Africa actively promotes the establishment of cooperatives to stimulate job creation and enterprise development despite a growing informal sector (Godfrey et al., 2017). The establishment of cooperatives, which has rapidly increased over the past decade, is supported by enabling legislation and other government programs including procurement policies that allow for informal cooperatives (Godfrey et al., 2017). In Lagos, Nigeria, all waste reclaimers at the city’s main landfill site belong to a cooperative and maintain a membership subscription by paying weekly dues to the association. The cooperative has established conflict resolution mechanisms to ensure cooperation among independent reclaimers and offers members influence within public policy circles, as well as protection from middlemen and price gouging (Nzeadibe et al., 2010). Waste reclaimer associations exist within some Ghanaian municipalities such as the Kpone Landfill Waste Picker Association in Accra, which has advocacy from international organizations such as Women in Informal Employment: Globalizing and Organizing, but face challenges garnering support from the Ghanian government (WIEGO, 2020). Ghana should enable the formation of waste reclaimer cooperatives while supporting their legal status and position within larger waste management planning.

Integrate independent waste reclaimers into formal, private sector firms. While supporting informal waste reclaimers does not necessitate assimilating them into formal organizations, connecting reclaimers with formal recycling companies can provide them with a dependable buyer and pathways to enter safer and more secure formal sector employment. Mr. Green, a plastic recycling company based in Nairobi, utilizes an incentive structure to maintain informal reclaimers loyalty by allowing pickers to receive a fair and stable pay, increase revenue, and
eventually move into formal, salaried positions (HuilinginAfrica, 2019; CNBC Africa, 2021). Mr. Green utilizes a technology platform to create supplier profiles and track the volume of waste brought in by 2,000 waste collectors to estimate reclaimers ‘daily wage,’ helping reclaimers maximize income and providing the workers with an income track record that allows them to access credit and then creates pathways out of poverty for low-income reclaimers (TechCrunch, 2017; CNBC Africa, 2021). Innovative business models connecting private companies to informal reclaimers in Ghana provide an opportunity to increase plastics collection and recycling rates while transitioning informal reclaimers into more stable and profitable positions.

Recommendation 2: Enforcing existing policies
A successful circular economy in Ghana will require the implementation of existing regulations surrounding plastics and waste management. While the environmental excise tax was levied to some extent, the funds were not used to jumpstart the country’s recycling industry as was originally its stated goal. The plastic waste situation in Ghana did appear close to a breakthrough in 2019., As part of the GPAP, the government developed its Ghana Multi-Stakeholder Action Plan, with an anticipated debut in 2020, but this plan lacked broad commitment from the government and was ultimately never introduced. The root of Ghana’s problems dealing with the reduction and substitution of its plastic waste is largely due to a lack of government enforcement and accountability, rather than due to a lack of will from either the end-user or industry. Therefore, we recommend Ghana begin earnest enforcement of existing regulations. Prioritizing the implementation of these regulations will enable a complete transition to circular economy.

Risks and Challenges
Major risks facing efforts to formalize waste reclaimers in Ghana stem from high financial costs of registration, gendered division of labor, fragmentation between waste pickers and municipal workers, exclusion of children and monopolistic nature of recycling markets.

When formalizing informal cooperatives, waste reclaimers can face prohibitive costs in establishing contractual relationships with the municipality or with private firms. These include registration with tax agencies and compliance with existing entrepreneurial regulations like
invoicing, social security contributions, etc. The control of plastic waste management by private companies’ risks fueling fragmentations between waste pickers and municipal workers. It sometimes pits vulnerable workers against each other, thus undermining their bargaining power (Chen et al., 2017). Moreover, waste reclaimers can suffer enormously from monopolistic markets that generate high profits for middlemen who purchase recyclables at very low prices. They are vulnerable to dramatic price fluctuations, exploitation by middlemen, and artificially low prices (Chen et al., 2017).

There is a high risk that children working in dumping grounds in Ghana are excluded from the formal waste management economy since any privatization and legal recognition will have to comply with minimum age requirements for labor. Finally, women tend to have subordinate status in waste management activities. Men typically have access to higher value materials, leaving women to access lower value, dirtier materials from dumpsites. This gendered division of labor causes men and women to have differential exposures to specific health risks.

Conclusion

Although there exist potential risks and challenges in formalizing the plastic waste management value chain in Ghana, the expected benefits far outweigh the costs. Cooperatives pave the way for waste reclaimers’ transition to formality by providing them access to income security. Members can earn their living through payments based on recyclable materials collected, direct sales and other ancillary services. They can achieve significant economies of scale through bulk selling and pooling of resources, which can help in attenuating costs. Moreover, the support of larger organizations and networks can significantly increase the negotiation power of these cooperatives. Negotiating through a formal network has greater bargaining power compared to individual level negotiation.
References


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Circular Construction in Prague
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Executive Summary

In 2020, Prague signed the European Circular Cities Declaration, announcing its intent to halve municipal waste and carbon emissions by 2030 using circular economic principles. Prague’s construction industry, the city’s largest contributor to municipal waste, faces several structural and political barriers to the implementation of a circular model, including a cumbersome permitting process and a significant labor shortage. Addressing these both at the private and public level will allow for an expedient shift to a complete circular, resilient, and competitive economy.

We propose that Prague adopt a materials passport system that tracks the flow of construction materials used throughout all of built Prague; develop reuse hubs for reclaimed construction materials; and instate allied circular economy specifications at the municipal level that complement and expedite the Czech Republic’s permitting process and set the standard for circular construction in Prague’s built environment. Czech developers have an opportunity to shorten project timelines and solve worker shortages through the use of these systems and a move towards modular, off-site manufacturing. Czech lawmakers have a unique policy window, as momentum towards streamlined and responsible building policy is gaining momentum both at the local and national level. Now is the time for action on these proposed advancements.

Background

Prague is among the largest developed cities in the European Union. Its population currently accounts for 12.3% of the Czech Republic population and is projected to grow from 1.3 million in 2021 to 1.5 million in 2025 - at 15% growth in only four years (EU, 2020). Yet demand for affordable housing is outpacing supply as a result of a construction industry that is slow to adapt to change. (ČTK 2019). Prague has a competitive labor market, with an unemployment rate of 1.9% (Prague.com, 2021).
While the construction sector employs only 8% of Prague’s workers, it generates 65% of the city’s yearly waste and emits 159 kilotonnes of greenhouse gasses per year (Circle Economy, 2019). Addressing the linear life cycle of construction where unrecyclable building materials are disposed in landfills has continued to be a priority for the Czech government, demonstrated through policies such as the Waste Management Plan (2015 -2024), with the objective that at least 70% of construction and demolition waste be reused in building construction. This goal is in line with the EU’s ambitions laid out in Directive 2008/98/EC, which targets how municipal, construction, and demolition waste is to be managed (Bartl, 2018). Reaching the Czech government’s goals will require a more circular process throughout the life cycle of a building’s raw materials as well as a move towards deconstructible and modular buildings.

**Benefits of Circular Economy (CE)**

Prague’s push toward circularity in the construction sector has the potential to advance equity, affordability, and technological advancement in the city, while at the same time lowering the environmental footprint of the construction sector. Such initiatives in innovation and circularity include offsite manufacturing, zoning reform, and addressing legislation that creates barriers towards the adoption of circular practices. A move towards offsite manufacturing will improve work conditions for many trade workers while lowering the cost of new homes. The greater use of salvaged building materials will also lower costs. Currently, many building and zoning policies act as barriers to development and exacerbate the city’s housing shortage. Reforms that include input from all stakeholders will allow for quicker turnaround times of permitting and building processes while ensuring that development is equitable and considers the impact on residents.

A collaborative approach to the integrations of CE initiatives can also make better use of underutilized land in line with Prague’s 2016 Metropolitan Plan. Currently, unused brownfield sites in the city center cover an estimated 940 hectares, the equivalent of 1,000 soccer fields (Kanh, 2019). Many of these sites are the results of post-Velvett Revolution privatization, and subsequent efforts to reform land use have been stymied by conflicting land and building ownership claims as well as recent 2018 Building Act loopholes which allow for the piecemeal approval of large projects without environmental review. These brownfield sites provide unique opportunities for development, and the ability to grant an expedited permitting process will give
the city more leverage in how these sites are used by incentivizing developers to work more closely with City Hall.

The city can redevelop these unused lands into housing, business centers, or green space to create more affordable and community-driven neighborhoods. Regulators should also implement a preservation strategy, focusing on building rehabilitation utilizing both renewable and reclaimed materials thereby reducing construction costs and waste. Implementing these practices across the greater construction sector also offers potential savings from reduced GHG emissions through material reuse and a move towards pre-manufactured structures, which would reduce the construction industry’s reliance on worksite diesel generators (Truitt 2009).

A shift to circular economy practices will create incentives that encourage a new wave of younger employees to reenter Prague’s construction workforce. According to the Czech Confederation of Industry, the country lacks an estimated 300,000 skilled workers in various trades like masonry and electrical wiring (Schindler, 2019). These benefits will be realized more quickly if the city partners with private sector developers since they initiate 78% of development projects in Prague. Many major companies in Prague (Skanska, Sekyra Group, Metrostav, AZS 98, and ERC Tech) are leading innovation in this space and can serve as key potential partners. Additionally, the city can leverage their technology and resources to increase investments in research and development in eco-innovation, an area which has lagged and slowed the transition to a circular economy in Czech (EU, 2019). If coupled with a secondary raw materials policy, the city can further promote greater reclamation of construction and demolition materials (EU, 2019).

**Current Status of Circular Initiatives**

**Policies**

The City of Prague’s recent commitment towards a more circular economy was preceded by the European Union's policy objective to support sustainable development. Following the EU's path, the Czech Republic is expected to adopt a national strategy — "the circular Czech Republic 2040" (EU, 2019). This national strategy is embedded with financial innovation and development support for different stakeholders. In the construction sector, this will augment the
secondary raw materials policy adopted in 2017. Exceptionally, the City of Prague individually elevated its commitment to a more sustainable and resilient future when it pledged to switch to a circular economy during the signing of the European Circular Cities Declaration in October 2020. Enthusiasm and support for these initiatives are evident through local collaboration from organizations like Circle Economy, INCIEN, and the Prague Institute of Planning and Development (IPR).

Challenges and Needed Improvements

Prague is still in the early process of implementing these initiatives. At the national level, the private sector is struggling to meet the recycling targets set for the post-2020 period as the primary waste treatment option remains landfilling (EU, 2019). There are also opportunities to integrate recycling in the material procurement process as only 10% of Prague’s construction materials come from secondary sources; the materials not reused, although they may retain value, contribute to the industry’s nearly 3 million tonnes of waste a year (Circle Economy, 2019).

At the city level, Prague’s construction industry faces two major economic barriers: high labor costs and a long and complex permitting process. Any significant increase in project timelines or cost will be unpopular both with developers and residents looking for affordable housing. Therefore, initiatives that add complexity to the development process in the name of sustainability must be combined with cost reductions and increased efficiency.

The Czech Republic’s national zoning and construction permitting system are one of the slowest in the world (Kenety 2019). In Prague, it takes 1,100 days on average to obtain a site and building permit for apartment construction. Along with a shrinking workforce, this has slowed development, especially the construction of new multi-family homes (Budai 2019) Reacting to pressure from residents and developers to eliminate the backlog, the Czech government passed several new versions of the national Building Act to shorten the building permitting process from an average of 4-5 years to one year by, among other things, removing the public comment period for most projects (Topinkova 2020). These reforms, however, have not brought about the desired changes and have actually caused environmental degradation as environmental and community groups no longer have a voice in the planning process.
The cost of construction labor also led to a 70% increase in cost per square meter of housing between 2016 and 2019 as a result of the younger generation’s decreased interest in trade work. Trade work tends to be unappealing due to lower wages, high physical demand, and poor quality work environments, and Czechia loses an estimated 7,500 workers each year to retirement (ČTK, 2019). Any circular initiatives which require trade labor must also account for workforce recruitment and retention.

**Recommendations**

To address these barriers and promote circular construction, we recommend the city consider the following policy solutions focused on material passport systems, reuse hubs, an expedited permitting process, greening the Building Act, and labor force reforms.

*Material Passport System*

The frivolous use of the city’s abundance of domestic materials means that Prague is fast-tracked to deplete its resources. While nearly 90% of materials consumed in the construction industry come from domestic materials, only about 10% of those materials are recycled for future construction projects (Circle Economy, 2019). A better management system will support the reuse of construction materials and reduce waste. It will also minimize environmental impact, pioneer sought-after expert jobs within the construction industry, and increase the economic performance of the sector.

One such system is a materials passport system: a public, centralized platform with information on material quality, location, financial history, recovery, recycling, and reuse value (i.e. their circular value). Infrastructure requirements for this type of system are shown in Figure 1. Utilizing material passports can incentivize careful deconstruction and streamline the demolition permit request process with easily accessible data: building owners know exactly what materials are worth and where they are located. Additionally, pre-planned deconstruction as a sustainable practice may attract younger workers to the industry who are interested in green, technical jobs.
Utilizing blockchain technology will reduce implementation errors and scaling problems and can be used in tandem with centralized building information models (BIM). Prague can emulate AWS Amazon’s “Track and Trace with Blockchain” customer network or work with various information systems companies that can easily modify their blockchain processes to accommodate the city’s needs. The integration of blockchain-run materials passports into an online store would increase project transparency and eliminate technical knowledge barriers to the materials passport system.

Whether the city chooses a public, private, or cooperative model for their online marketplace, they will need to partner with the private sector to develop the technical infrastructure of materials passports system and train those in the construction industry on navigating the system. This will have the added benefit of leveling up current employees who may then be eligible to function as materials and circular experts and who can assist with tagging and processing current in-use materials’ lifecycle.

*Figure 2: An example of material passports*
**ReUse Hubs**

The city should look to convert the significant number of brownfields as they provide potential land for new development. One option is for the city to convert brownfields into reuse hubs, which can serve as community-focused circular incubators. These hubs serve as a flexible model that fills gaps missing from other waste reduction policies.

Reuse hubs are drop-off centers where eligible, unwanted materials can be refurbished, broken down into reusable parts, and sold at a discount or at market price with a more sustainable footprint and life cycle story. They can create jobs for site managers and trade workers who can oversee and educate the community on conducting repairs. Reuse hubs can be owned publicly, privately, or by the government, and each model has various oversight requirements and offers different use capabilities. Construction companies can negotiate leases with private owners of brownfields and set up temporary hubs to support large deconstruction projects. For permanent reuse hubs, the city will need to coordinate with the property owners for lease transfers or work in partnership to start development projects. It is crucial to collaborate with community stakeholders and avoid the stewardship of private investors that have led to this very state of property’s disuse and the resulting negative externalities impacting the surrounding communities.
Expedited Permitting Process

We propose developing an expedited permitting process for projects that contribute to the circularity of Prague's construction sector. Czechia’s lengthy permitting process has impeded development in the city, making developers resistant to additional steps like designing with available used materials (walls, beams, etc. from deconstructed buildings) or planning for the careful deconstruction of buildings. Priority in the permit approval process would encourage voluntary participation in circular building and greater compliance with existing circular policies like minimum secondary materials requirements. While the permitting process is subject to national law, many Prague City Hall offices are involved in building permit work, and the city can work with local leaders to encourage efficient management practices and inter-office collaboration. If the city decides to implement the previous strategies, their generated revenue might be used to hire additional government employees who can speed up the process. In addition, a push towards prefabricated and modular buildings may allow for single permits to be used for many identical manufactured structures, or sub-structures such as plumbing or electrical plans.

While developing expedited permitting processes, a first step may be to clearly define the documentation requirements to avoid delays caused by missing documents. Prague City Hall should seek feedback from all stakeholders, including groups such as Skanska construction group, who have committed to the Paris Agreement, or ERC TECH, a sustainable demolition and recyclable concrete manufacturer that has already done sustainable building in Prague (Skanska, 2020. ERC-TECH, 2018). These stakeholders’ years of experience working within the system may provide expertise around low-risk, high-yield system improvements.

Sustainability in the Building Act

Reforms to the 2016 and 2018 Building Act have not created expected improvements in the construction industry. Instead, loopholes created by the revisions have led to further environmental degradation. Prague should rally national political support to encourage resilient and environmentally conscious construction practices to be included in a future review of the act, which the industry expects to happen in 2022. This policy window, between now and 2022, offers a unique moment for legislators to introduce sustainability regulations into the Building
Act (Topinkova 2020, Budai 2019). Circular framing can utilize this opportunity for regulation reform to reinvigorate an equitable and sustainable construction sector into the future.

*Labor Force Development*

Given the city’s low unemployment rate and disinterest from young workers, the construction industry is finding it difficult to hire local tradespeople (Budai, 2019). To grow the construction sector’s workforce, the city must ensure that physical work conditions are safe, jobs offer continued training and career growth, and wages are equitable and competitive.

Sustainable practices, such as prefabricated manufacturing, can reduce the relatively high risk of danger and physically demanding nature of the work. Prefabricated manufacturing is done at an off-site facility through a more streamlined process to create more standardized parts of the building. Off-site construction is not only faster it reduces the time that workers spend in the field under harsh conditions like rain, extreme heat in the summer, and cold in the winter.

The city should also provide subsidized skill training to allow job mobility towards other occupations in the new circular construction industry. Implementing CE initiatives naturally requires and attracts talent across industries, such as technical roles required to create and maintain the materials passport system, and the city should aid individuals in acquiring the skills necessary to do these jobs. The city can possibly look to the Cohesion Policy Fund, granted by the EU for initiatives related to CE adoption, to fund these training programs. They can also partner with professional organizations, such as the Czech Green Building Council and the International Initiative for a Sustainable Built Environment, which may be incentivized to lead these programs.

**Conclusion**

Prague has an opportunity to lead Europe and the world in its push towards a circular economy. The city’s construction sector, which generates the biggest share of its waste, is primed for the increased efficiency and lower material costs that a well-executed circular plan could generate. The creation of a materials passport system, reuse hubs, and an expedited permitting process all have the potential to be integrated into the city’s overall plan towards circularity. Implementing circular practices will not only reduce the industry’s overall environmental impact but also
address some underlying issues that affect the quality of life in the city. These policy solutions have the potential to decrease housing costs through faster project timelines and lower construction costs, preserve the construction labor force by improving working conditions for trade workers, and provide more amenities and community spaces through brownfield development. Using their own long-term goals and these policy ideas as a starting point, the city can find viable, lasting solutions to their bureaucratic and demographic challenges via collaborations with all stakeholders, and in the process create a new, equitable, circular model.
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Reducing Post-Consumer Waste in the Food & Beverage Industry Through Reuse Models

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Executive Summary

In 2019 Singapore generated about 7.23 million tonnes of solid waste, with plastic comprising 930,000 tonnes, or about 13 percent of this total (NEA, Waste Statistics and Overall Recycling). Of this amount, only four percent of plastic was recycled, leaving a large margin for improvement to reduce plastic’s contribution to Singapore’s overall waste capacity problem. In order to address the plastic waste problem, a regulatory sandbox should be put into place to allow the government to collaborate with the private sector and experiment with policies. The sandbox framework creates a safe space for experimentation and will provide critical feedback in order to properly scale these policy recommendations. The three main recommendations to test within this sandbox framework are the following: 1) Incentivization for reusable plastic containers through feedback mechanisms; 2) Implementation of a targeted reuse campaign; and 3) Regulation of the use of plastic straws. To thoroughly test these recommendations, our proposed pilot program focuses on the bubble tea industry, a popular beverage in Singapore that generates a large amount of plastic waste through its single-use straws and non-reusable containers.

The Problem

As demonstrated in Table 1, plastic waste is the least recycled waste type in Singapore (NEA, 2019). These non-recyclable plastics can only be incinerated or landfilled, and the sole landfill in Singapore is expected to reach its peak capacity between 2035 and 2040 at current rates (The Straits Time, 2019). The remainder of the waste directly enters the environment, where it breaks the ecological balance, pollutes neighborhoods, and harms biodiversity.

Despite the broad range of interests and stakeholders involved, this paper focuses explicitly on youth behavior and attitudes towards plastic consumption. Youth aged between the 18 to 35 age bracket occupy a large proportion of the population in Singapore, as noted in Table 2. Although the national government has organized various activities in an effort to engage young people in
zero waste action, including an annual Youth for the Environment Day event (National Environmental Agency, 2019), the awareness among Singapore youth of the need for waste reduction is relatively low. Despite a high plastic consumption level, young Singaporeans lack incentives to reduce plastic waste.

**Table 1: Waste Recycled or Disposed in Singapore, 2019**

![Waste Recycled or Disposed in Singapore, 2019](image)

*Note: Singapore’s National Environment Agency (2019)*

<table>
<thead>
<tr>
<th>Entity</th>
<th>Age</th>
<th>Population</th>
<th>% to Total Population</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Secretariat/UNICEF/UNFPA</td>
<td>Youth: 15-24</td>
<td>459,771</td>
<td>11.38%</td>
<td>UN Instruments, Statistics</td>
</tr>
<tr>
<td>National Youth Council</td>
<td>Youth: 15-35</td>
<td>1,044,566</td>
<td>25.86%</td>
<td>Singapore National Youth Council FAQ</td>
</tr>
</tbody>
</table>

*Note: Singapore’s Department of Statistics Data (2021)*

**Casual Theory**
There are several determinants of the current issue with regards to the existing disposal cycle in Singapore. First, Singapore's recycling capacity is limited - 94.5 percent of plastic ends up incinerated and landfilled (Circular Capital, 2021). Such limited capacity is derived in part from an inefficient disposal system, including low-tech sorting and process inadequacies. From the industrial side, however, nearly 50 percent of companies in Singapore do not have recycling plans. There is also a general lack of local offtake markets for post-consumer waste generated domestically (Circular Capital, 2021).

Impact
As an island country, Singapore's severe plastic pollution has put extreme pressure on its surrounding environment. This pressure has numerous indicators, including the prevalence of microplastics in the nation's coastal marine area (Ng & Obbard, 2006). The NEA has also released a statement that with such a low plastics recycling rate, 6% in 2018, plastics reducing initiatives would lower the burden of the current waste disposal mechanism that relies on the Semakau landfill (Reuters, 2018).

Existing Efforts
To deal with plastic's threat to the environment, Singapore’s actions have ranged from public education campaigns to targeted individual behavior changes. These efforts can be categorized into four specific environments: political-legal, economic, social, and technological. The political-legal environment is composed of laws, government agencies, and pressure groups that influence and limit various organizations and individuals (Kotler, 1998). One such organization is the Packaging Partnership Program (PPP), which represents an industrial-led institution to support companies in fulfilling new obligations and practices in sustainable packaging waste management. There are 248 signatories comprising the program, and PPP’s efforts have aided in the reduction of 46,000 tons of packaging waste. Another notable effort is the attempt by Singapore to change the packaging habits of retailers by incentivizing the use of bioplastic packaging or even organic material like banana leaves in place of traditional plastic packaging.

Barriers and Opportunities
Fear is a tactic that is ineffective at nudging the Singaporean youth demographic towards the
reduction of plastic consumption (Chib et al, 2009). Research indicates that this is because Singaporean youths are apathetic towards environmental issues despite being highly aware of the existing challenges (Hoe, 2007; as quoted in Chib et al, 2009). Such apathy is hypothesized to be due in part to the lack of strategic campaigns tailored towards youth that highlight the negative consequences of existing environmental practices (Ibid).

In order to change Singaporean youths’ habits of plastic consumption, one must first understand their motivations and preferences. Existing literature indicates that tactics such as strategically drafted campaign messages featuring influencers promoting eco-friendly trends, or incentivizing youths to visit online websites and forums by providing financial rewards are potentially effective mechanisms in changing youths’ plastic consumption habits (Ibid).

**Policy Recommendations**

**Overarching Recommendation**: Adopt a regulatory sandbox for the bubble tea industry

**Objective**

A regulatory sandbox provides a safe space to experiment, collect experiences without having to face strict regulations (Hagan & Jimenez, 2019). The government can adopt such a sandbox to test different initiatives and regulations for reducing the use of plastic within the bubble tea industry.

**Rationale**

The choice of the bubble tea industry for an experimental regulatory sandbox is predicated on three reasons. First, bubble tea, like many other takeaway beverages, uses a large amount of disposable plastic. According to the ASEAN Post (2019), on average a Singaporean consumes 3 cups of bubble tea per month (205 million cups per year). Second, bubble tea is highly popular among young Singaporeans (Lai, 2019; Baker, 2020). That said, Singaporean youths are argued to be apathetic towards environmental issues (Hoe, 2007). For this reason, targeting the bubble tea industry can provide lessons for youth behavior change, thereby yielding a positive impact on the reduction of plastic consumption. Finally, the bubble tea industry is complex enough to be representative of the larger Food & Beverage industry. As bubble tea involves different stakeholders such as young consumers, bubble tea stores, delivery platforms, the lessons learned
from this pilot project through different feedback mechanisms will have far-reaching implications beyond the bubble tea industry. Figure 1 illustrates just one example of how different actors involved in the sandbox may interact with each other and provide lessons through feedback mechanisms.

Figure 1: An example of interactions and feedback mechanisms within the sandbox framework

Recommendation 1: Require food delivery platforms to make plastic containers optional at point of sale and encourage the use of personal reusable containers

Bubble tea is the most popular drink on food delivery platforms. Targeting the three most popular food delivery platforms (GrabFood, FoodPanda, and Deliveroo, Figure 2) will help alleviate the issue.
Deliveroo reports that 200 bubble tea stores are registered on its platform and 385,000 cups of bubble tea were ordered in 2018 (Chong, 2019). Similarly, Grabfood finds that bubble tea was the second most ordered item and that the average Singaporean consumes 3 cups of bubble tea per person per month (The ASEAN Post, 2019). It is possible to assume that those who order bubble tea via delivery platforms are either at home or have access to their own containers; therefore, they do not necessarily need plastic cups.

We recommend that the government mandate food delivery platforms to invest in reusable containers and include the option of “Do you have your own container?” on their ordering platform. If a customer chooses to use a reusable container, food delivery platforms will use that reusable container to deliver the food/beverage. Once delivered, the customer will remove their food or beverage and return the reusable containers to the deliverer. Finally, the deliverer will bring the container back to a designated location to be properly sanitized.

Amid the Covid-19 pandemic, which has caused a significant increase in the use of single-use food containers, the three main food delivery companies in Singapore have partnered with food container sharing services to help reduce the production of plastic waste (Today Singapore, October 2020). A study released in June 2020 showed that during the early days of the
pandemic, from April 2020 to June 2020, an extra 1,334 tonnes of plastic waste was generated from meal deliveries ordered to respondents’ households (Today Singapore, June 2020). In response, Foodpanda, Deliveroo, and GrabFood have partnered with BarePack and Muuse, two companies that provide disposable food containers which customers can return to participating restaurants (Today Singapore, October 2020). As of July 2020, BarePack reported that its collaboration with Foodpanda had saved over 50kg of disposable packaging, while Muuse said that it was on track to save up to 400kg of waste by the end of the year (Ibid). Bubble tea, which is often delivered by one of the three major food delivery companies that have these reusable container partnerships, is an excellent candidate for the continued implementation of reusable containers in the food and beverage industry as a means through which to reduce overall post-consumer waste.

**Recommendation 2:** Targeted marketing campaign as a reminder to recycle or bring your reusable container

In order to promote the use of reusable containers, this recommendation must be paired with a media campaign designed to remind consumers to use and reuse such containers. A 2019 study found that recycling behavior was strengthened when education or outreach campaigns accompanied regulatory instruments for recycling (Heidbreder, et. al. 2019). This outreach campaign should take the form of both digital and traditional print advertisements, aimed at the target 18-35 Singaporean youth demographic in order to maximize impact on bubble tea consumers.

Our confidence in this recommendation is based on existing literature, including a 2017 study of the effect of information instruments on willingness-to-pay for plastic bottles in France showed a decrease in willingness-to-pay as a result of information provided to consumers on the negative environmental effects, and decreased consumption (Orset et al. 2017). A similar information campaign will provide the positive reinforcement necessary to nudge consumers toward responsible consumption and reuse habits.

**Recommendation 3:** Regulating the use of plastic straws
Plastic straws are necessities for bubble tea because the beverage contains tapioca “bubbles” and other similar toppings. Most plastic straws, however, are not biodegradable and cannot be broken down naturally by bacteria and other decomposers into non-toxic materials (AZA, 2020). Regulations against plastic straws in regions like California and Taiwan already exist in an effort to cut down on the waste generated by the bubble tea industry and its dependence on straws. California introduced a strawless bill in 2019 that requires all restaurants not to provide straws to customers for beverages unless asked. Failure to follow the law can cost a restaurant $25 a day (Brueck, 2018). A similar but more strict policy has been implemented in Taiwan since June 2019, where the government bans single-use plastic straws in all dine-in establishments (Steger, 2019).

These case studies reveal a potential space for a similar regulation in Singapore. That being said, it is necessary to note that the purpose of the plastic straw ban in Singapore bubble stores is not to diminish demand or punish businesses but rather to encourage a new spark of innovation and inspiration through environmental awareness. For instance, Starbucks has introduced a stripe straw pack consisting of two reusable straws with a cleaning brush and portable pouch to avoid single-use plastic straws. McDonald's in China has developed a new drink container design that does not need a straw to adapt to its upcoming straw ban policy (Jain, 2020).

Based on existing policies, the recommended straw ban regulation in bubble tea retailers should be designed based on five aspects:

- **Requirement:** Constant but flexible regulations for plastic straw usage (for example, in California where customers can get the straw but only if they ask for it)
- **Target population:** Bubble tea retailers and their consumers
- **Punishment:** Shops violating the rule should be fined to a certain extent
- **Reward:** Bubble tea stores with any innovations regarding plastic straw reduction should be rewarded from either government or other cooperating organizations
- **Feedback:** As this is under our *sandbox design*, the policy should ask for feedback and evaluations to justify if it achieves the intended outcome
Conclusion

This policy paper focuses on the implementation of a circular economy in the island nation of Singapore. It examines its recycling capacity of plastic waste, analyzes mitigation efforts made by the Singaporean government and barriers to the progress of those efforts, and highlights the low awareness of Singaporean youth towards recycling.

To change the status quo, this policy paper has designed a regulatory sandbox with feedback mechanisms as a general recommendation. There are three initiatives under the framework: to incentivize the application of reusable materials, call for a marketing campaign, and reduce the overall consumption of plastic products at the point of sale through regulation. By implementing these recommendations within the bubble tea industry as a pilot program, Singapore can ensure a safe, thriving environment for all Singaporeans free from post-consumer plastic waste.
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APPENDIX I: AGENDA

Friday, March 5th, 2021

9:55am - 10:00am

**Opening Remarks**
Charity Coleman, IPSS Co-Executive Director
Ersilia Melchiorre, IPSS Co-Executive Director

10:00am - 10:55am

**Keynote Panel**
John Elkington, Chairman & Cofounder, Volans Ventures
Dr. Garry Cooper, Chief Executive Officer, Rheaply
John Holm, Vice President-Strategic Initiatives, PYXERA Global (Moderator)

11:00am - 11:55am

**Panel I: The Intersection of Human Rights, Circular Economy and Wastepickers in Ghana**
Vivien Luk, Executive Director, WORK
Adwoa Coleman, Country Manager, DOW
Alhassan Muniru, Cofounder, Recycle Up! Ghana
Alexandra Smith- O’Connor, Key Client Manager, PYXERA Global (Moderator)

12:00pm - 12:30pm

**Networking & Lunch**

12:30pm - 1:25pm

**Panel II: Tribal Nations & Circular Economy**
Anahma Shannon, Environmental Program Director, Kawerak
Jessica Stago, Director of Business Incubation, Change Labs
Alicia Merselle, Director of Innovation, Arizona State University
Ellie Jorgensen, Senior Program Manager, PYXERA Global (Moderator)

1:30pm - 2:45pm

**Panel III: Circular Chicago**
Johnathan Periera, Executive Director, Plant Chicago
Garr Punnett, Chief of Staff, Rheaply
Weslyne Ashton, Associate Professor, Illinois Institute of Technology
Bill Schleizer, Chief Executive Officer, Delta Institute
Mark Fisher, Chief Executive Officer, Council of the Great Lakes Region
Renay Loper, Vice President-Program Innovation, PYXERA Global (Moderator)

2:45pm - 3:00pm  Closing Remarks
Charity Coleman, IPSS Co-Executive Director
Ersilia Melchiorre, IPSS Co-Executive Director

Saturday, March 6th, 2021

10:00am - 10:30am  Presentation I: Singapore
10:35am - 11:05am  Presentation II: Ghana
11:10am - 11:40am  Presentation III: Prague
11:40am - 12:10pm  Lunch Break
12:10pm - 12:40pm  Presentation IV: Alaska/ Tribal Nations
12:45pm - 1:15pm  Presentation V: Chicago
1:15pm - 2:30pm  Closing Reception
APPENDIX II: PARTICIPANTS AND BOARD MEMBERS

Participants

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John Schmidt, The University of Chicago
Vrinda Handa, Columbia University
Mary Beth Derosiers, Georgetown University

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