

Research Article

Knowledge Co-Production Of The Global Food Waste N The Circular Economy Era

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Abstract

The Circular Economy emerged as a favored alternative economic and environmental solution to manage the issues of food waste. Knowledge co-production approaches can be used to elaborate on this issue, due to the emerging idea in various institutions, discourses, identities, and representations. These approaches change the value of waste into something beneficial to the economy. The establishment of various institutions, agendas, agreements, and civil movements caused the politics of waste to become a fruitful discourse. Transitioning to a circular economy that includes social, political, and even technological changes can be either a challenging or a good solution for some nations. Every actor has an important role and requires good cooperation to transition to a circular economy to tackle the food waste problem, while facing the challenges in implementation in each value regarding to different beliefs.

Keywords: Food Waste Regime, Circular Economy, Knowledge Co-Production

Introduction

Waste management has become one of the rising environmental issues throughout the global community. Food waste issues are complex and frequently appear as urgent to be solved. The food chain is not yet efficient in developed or developing countries. Urban areas tend to have food variations but are not always sold when a developing country produces food. However, lots of them are wasted, including the powers, resources, good nutrition, and other things that still have value. Many types of research appear and provides many insights about this issue. Various institutions have started to explore and understand more regarding food waste. To tackle this issue, global awareness supports the emergencies, advocacies, and eventually lead to regulation from the governments.

The knowledge about food waste is flourishing, especially in the global north, which makes food waste a widespread issue. However, food waste is still only considered as an environmental problem, despite its wide effects and implications to many other sectors, including economic and social. This means that food waste cannot only be categorized as a natural issue, due to its inevitable impact in the social sectors. Knowledge co-production approaches can be used to understand the issue deeper, or what Jasanoff calls the 'bridging' or entanglement of the natural and social issues of food waste.

The authors aim for knowledge co-production to assist in a deeper understanding about the issue while searching for solutions and better policies through multi actor research. Spreading awareness can also be conducted through a localized global order. The principles of Circular Economy can be a way to tackle these issues that provides a win-win solution between the environment and society under one policy. However, countries and other actors have conditions regarding food waste and the circular economy, and transitioning to a circular economy while managing food waste can be challenging for many nations.

Nevertheless, his issue goes beyond taking care of waste and advancing technology. We need to see food waste from a political perspective as a power-related topic. Thus, this research aims to explore how the Global South countries still have difficulties in implementing science-based policies and its role in knowledge co-production.

Literature Review

To address the notion of food waste, the authors agree with the definition proposed by David Evans, Hugh Campbell, and Anne Murcott in 2012 titled "A brief pre-history of food waste and the social sciences". This journal elaborates on the history of food waste since the early 18th – 20th century (Evans et al., 2012). The author admits that the food waste issue is still less discussed in social sites. According to food sociology, food waste issues are complex, in fact, it brought us food scarcity (Evans et al., 2012). This issue has been continuously submerged and reemerged over time. In the 18th century, the food waste issue appeared in an article (a cookbook) from Isabella Beeton in 1891 called "Book of Household Management," which provided advice in handling household food waste. After a wave of development of new authors addressing the same theme, the 1950s era started a big transition towards the global food system for the first food regime in the industrial revolution called the Imperial Food Regime. However, this regime collapsed between World War 1 and The Great Depression, so a new regime emerged, called the Cold War Regime. This regime had huge success in gaining more food surplus after the World War.

The surplus of food made the food waste issue became irrelevant (Evans et al., 2012) and reappeared in 2008 when the global crisis also contributed to food waste. The development of policies around the world also contributed to make this issue relevant. For example, the European Union and the UK made the non-profit organization named Waste and Resources Action Programme (WRAP). The UK and EU funded this institution to tackle the waste issue and advocate for practical solutions in resource efficiency. By 1999, the European Union made a big transition by establishing the 1999 Landfill Directive (1999/3/EC) as a guideline in tackling food waste in landfills and its problems to human health and the environment. In 2011, the Food and Agriculture Organization (FAO) started to highlight the food waste issue. Then civil society activities started to arise. However, the problem at that time are existing wide gaps between the environment and social science in researching this issue. Many lifestyle practices such as freegans, vegans, and zero waste, and many other campaigns started to rise, spreading the message of preventing and lessening food waste. Many institutions were starting to make associations for food services, such as Sustainable Restaurant Association and NGOs that redistribute food surplus and food waste movements, such as Food Bank, Food Cycle, Second Harvest, and more (Evans et al., 2012). From Evan's view, we learned that food waste has become a huge threat to the environment, particularly contributing to organic pollution due to the heavy production cycle, while on the other hand still leaving a scarcity as a social problem.

The heavy food cycle results in even more waste in the process, especially when a product is not sold. Through much research and discussion, scholars are proposing new economic models that lead to environmentally friendly production. To understand the Circular Economy, we use the definition of Circular Economy from Geissdoefer in their journal article published in 2017, titled "The Circular Economy – A New Sustainability Paradigm?". We now see the circular economy as a system that influences the linear economic path into a closed loop, so the resources are efficiently usable while keeping the environment 'clean.' According to Geissdoefer et al., it is:

"...a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling" (Geissdoefer et al., 2017).

Geissdoerfer et al. also explain that this includes waste prevention by reusing waste as a new valuable resource, giving new opportunities, and efficacy in materialization (Geissdoerfer et al., 2017). It is believed that adopting Circular Economy principles can benefit industries due to its effectiveness in using resources. Many institutions have started advocating this concept to influence policymakers, industries, businesses, and even governments at various levels (Evans et al., 2012). Many countries (in local or national governments), until industries, are starting to use the circular economy in their economic process.

The Circular Economy approach is more commonly practiced by the Global North, that are more advanced in technological innovation. The Circular Economy concept is believed to be able to minimize or tackle the issues of food waste. Much of food loss and waste are produced by the household, and the harvests, industries, and waste management processes are important to tackle the growing numbers of food waste. Using the concept of Circular Economy, 'waste' is now a 'value' to the economy and the environment. However, transitioning from a linear to a closed-loop economy can be challenging. The challenges require new technology, infrastructures and innovations, social, and behavioral changes (Lehtokunnas et al., 2022). In the journal titled "Towards a circular economy in food consumption: Food waste reduction practices as ethical work", Lehtokunnas et al. focuses on household practices. This article helps guide us through the main challenges in the ethical aspects of transforming food waste. Referring to Foucault's idea, changes in daily habits are as important as promoting the value of the Circular Economy, as moral tasks are the first important factor to make the Circular Economy work. From this explanation, we know that the values of the Circular Economy in combating food waste is not just about spreading the knowledge to global citizens about its hazards, but also shifting personal beliefs to choose to solve the issue. To untangle the process, this article will specifically elaborate on the issue using the knowledge co-production approach, where connecting the food waste issue into circular economy policy does not only to solve the problem but invites benefit towards the economic cycle and society.

Knowledge co-production is used for collaboration or cooperation in every discipline to explain how we see an issue (Osuteye, et al., 2019). What is interesting is that Osuteye et al. explain that co-production from the Global South made for the Global South is an action to prevent bureaucracy and norms, and contradicts wellbeing in the urban context. Thus, co-production encourages society to be involved in the development policy for urban justice (Osuteye, et al., 2019). The explanation above helps to guide the meaning of knowledge co-production itself. Sheila Jasanoff in the book "States of Knowledge" tries to link science and policy, and differentiates scientific and political actions (Jasanoff, 2003). Osuteye et al. summarize Jasanoff's approach, mentioning civil participation and better policy. She tends to focus on four aspects, the purpose (framing), people who are impacted (vulnerability), who gets the benefits (distribution), and what and how we need to know (learning). In her book, Jasanoff argues that power and political dynamics cannot be separated, meaning that power is knowledge. There are ways to create instruments for control by making identities, representation, discourse, and institutions. In her book, she states that technology or human abilities can work together to create solutions. Thus, knowledge co-production, can explain boundaries and differences and give a better description or illustration about an issue.

By combining food waste with a circular economy and knowledge co-production as an analytical tool, we believe that it will provide many perspectives on how we see this issue and how to handle it from various aspects. Food waste is a new problem that the global society must solve, using the Circular Economy, advances in technology, and new approaches to the economic transaction that can help reduce the amount of food waste. This includes multidisciplinary cooperation through knowledge co-production.

Methods

In this article the authors use qualitative research to understand the phenomenon of food waste using the concepts of knowledge co-production and the circular economy. The authors collect data from journals, books, news articles, annual reports, internet sources, or related literary works. The next chapter discusses food waste, Circular Economy, and food waste in knowledge co-production sites. This article uses a collaborative approach of Circular Economy and knowledge co-production to analyze and explain the phenomenon of food waste.

Result and Analysis

Many researchers have discovered that controlling the amount of production waste can make a difference to food waste and the Circular Economy. Cooperation between environmental, social, political, and economic knowledge can be a good policy to combat food waste globally. Therefore, we need to understand the food waste debate and how the co-production of Circular Economy and knowledge can explain how to understand food waste.

Food Waste Debates

There has been prior confusion to the discussion of food loss and waste, as there are many terms and definitions used to describe them. For instance, food loss and waste issues may also relate to packaging waste, because the amount of food we waste is equal to the amount of packaging waste we produce. Therefore, further research is required in regards to the contestations in the issues of food waste other than its environmental concerns. The meaning of food waste varies depending on the institution. This creates the problem where every institution varies in estimating the amount of food waste figures, and may result in different data (Priestley, 2016). For example, UNEP defines food waste as “food waste from the consumption stages by the consumers or retailer's because it is expired, spoiled, and so on”.

Meanwhile, food loss means the food is unconsumed by the production, post-harvest, processing, and supply chain stages (distribution) because the quality is reduced when the food is processed. Both are the same but in different situations (UNEP, 2021). FAO on their official website also defines food waste as when food's quantity and quality are decreased at the hands of the retailers, food service providers, and consumers. Usually, the food are wasted because they are removed from the supply chain due to not passing the standards (shape, color, size). Food are thrown away due to numerous terms of expiry/best before dates contribute so much to food waste. Households are the biggest factor (FAO, 2021). Meanwhile, food loss means when food usually comes from post-harvest or is thrown away from the food supply chain (harvest/slaughter/catch up). This is not included in the consumer and retail phase (FAO, 2021).

Individuals can contribute to food waste numbers from their leftovers in the fridge, unfinished meals, buy the food they do not want, or be afraid of being a glutton (CIMSA UI, 2020). A more complex definition from FUSION-EU explains that,

"Food waste is any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed of (including composted, crops plowed in/not harvested, anaerobic digestion, bioenergy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)."
(FUSION EU, 2016)

As explained above, we can see that FUSION EU did not use another term besides food waste. Their definitions are more broad but compact. FUSION EU argues that the definition of food waste can impact the policy defining food waste or anything related to it is essential to make a better waste policy¹. Most actors still use the UN's definition of food waste and loss. In this research, we will use the term "food waste".

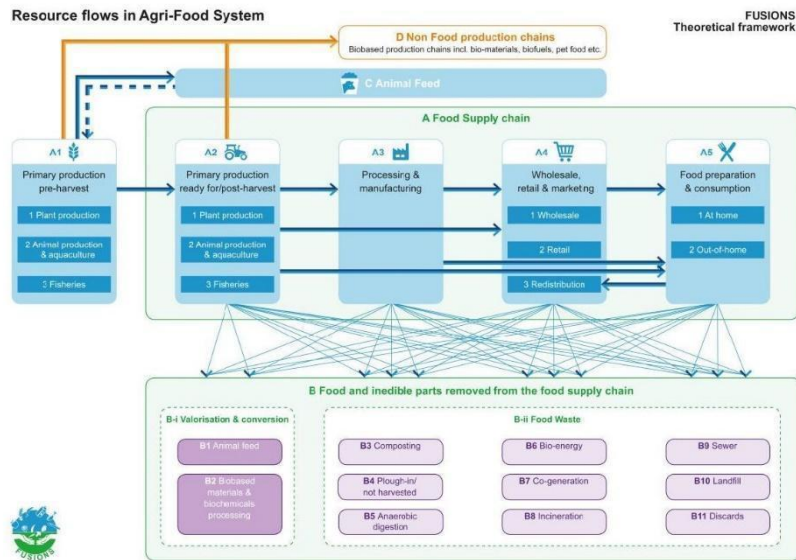


Figure 1. FUSION EU's Theoretical Framework on Food Waste
Source: FUSION EU, 2016

The terminology of food waste is still debatable. Institutions are competing to create an exact meaning and category of food waste. The UN, represented by UNEP, created their own definition of food waste terms in every Food Waste Index Report. Mostly, many institutions began to use the UN's version in defining food waste because the UN has an important role globally. Therefore, nations can have various perspectives on whether food waste is an important issue or not.

The Impacts of Food Waste on Our Life: The Perspective of Knowledge Co-Production (KCP)

Food waste is closely linked to food security and food inequality. If an individual has too much food on their plate, it may lead to poor health effects. Food waste is beginning to be prioritized in the issue of waste management. Organic waste produces hazardous waste that can be harmful to the environment. Both developed and developing countries contribute to food waste. According to Bahadur KC et al., developed countries are more likely to have food waste generated from consumer behavior such as leftovers, retail expired products, etc. Meanwhile, developing countries generate food waste from farming, such as poor quality in their facilities for storage and processing of foods (Bahadur KC et al., 2016). In brief, it may seem that food waste is only associated with environmental problems, which is commonly neglected due to its indirect impact to humans. With knowledge co-production, it is possible to bridge the natural and social barrier of food waste and solve it with the circular economy. To simplify, food waste is seen as a 'natural' problem as opposed to 'social' due to how it impacts the environment more evidently. What is commonly neglected is the fact that environmental damage is irreversible. By the time it becomes a discussion among global society, it is likely too late to eradicate food waste completely. The knowledge co-production perspective suggests that providing data and linking its impact to society,

¹ More information about FUSION EU's definition can be accessed in <https://www.eu-fusions.org/index.php/about-food-waste/280-food-waste-definition>.

regulation and action through circular economy policy becomes an alternative to prevent food waste numbers.

The knowledge co-production (KCP) perspective started to grow popular because many fail to achieve much research outcomes through conventional knowledge resources. Osuteye et al. (2019) argues that the emergence of KCP aimed to manage problems through a collective internal process. As an example, KCP argues that the links between stakeholders, scientists, and civil society led to a wider variation of knowledge. Through this lens, a scientist and non-scientist have an equal position to produce knowledge. Therefore, every actor can contribute to the variations of knowledge production through their own experience and perspective (Osuteye, et al., 2019). This concept was brought up by Sheila Jasanoff, who argues that multidisciplinary knowledge can bring us to new methods on KCP (Jasanoff, 2004).

In conclusion, KCP can be a tool to help illustrate a complex phenomenon, whether it is from natural or social science, without abandoning each other. This concept is generally used for decision-making, but in this research, we will focus on the political side of KCP: the process, and instruments. The first step in viewing food waste through a knowledge co-production lens is to provide data and its impact on various fields, which, in this article, includes the environment and how it is linked social and economic impacts.

Environment impacts

There are lots of data that show the environmental impact of food loss and waste. This could come from the pre-harvest season before products are shipped to consumers. Most food waste ends up in landfills or household trash cans and has poor treatment by authorities. Data from the Food and Agriculture Organization (FAO) show that food waste produces 8% of greenhouse gasses globally, which is the third largest pollutant after China and the United States (FAO, 2020)². Food wasted in landfills can cause leachate from rainwater and when mixed with other types of waste can produce hazardous materials that contaminate water and soil, which breaks the water ecosystem (CIMSA UI, 2020). This also includes wasting resources such as water and mineral oils and reducing land use. According to the World Research Institute, 45 trillion gallons of water from agriculture, food production and waste processes, are misused annually (Barclay, 2013). Agricultural land use can also contribute to waste problems because some harvests are not used optimally. According to Foodbank Australia, around 45% of harvested vegetables and fruits are thrown away annually (Foodbank Australia, 2021). By disposing of food, we were discarding its packaging as well. This, in turn, increases the amount of waste.

Social impacts

As a basic need for human beings, the lack of control over food is damaging and causes other a plethora of social issues. The surplus of food does not always equal to an even distribution of food. One's inaccessibility to or surplus of food is related to the economic status of each person. Some places threaten food security by having unequal food distribution (Seberini, 2019)³. Some nations with food crises depend on food aid rather than growing their own. An example is Ethiopia, which suffers from a food crisis but still has food waste (Evans et al., 2012). This occurs due to food aid from the US getting disproportionately preferred for consumption instead of the local produce, causing Ethiopia's agriculture to suffer. In 2019, 690 million people all around the world were affected due to the COVID-19 pandemic, yet 3 billion people cannot have access to a healthy diet (Foodbank Australia, 2021)⁴. The FAO has

² "Wasted foods in landfill are rotten and creates chemical reaction to produce methane gases (greenhouse gas emission). Fuel pollution from a long-distance food distribution included to participate on adding carbon footprint." From Seberini, 2019.

³ Developed countries throw food, and some developing countries citizens are struggling or don't have access to buy healthy food.

⁴ Foods thrown from household, retails, restaurants, or other service could be valuable for every people on the earth.

estimated that 2 million people cannot get access to a healthy diet, while 750 million are experiencing food crisis (FAO, 2020).

Economic Impacts⁵

With soaring numbers of food waste, economic sectors are damaged due to the loss and wasted food. The amount of food (that would be sold or consumed) should be beneficial to producers but they do not. One third of annual national economic losses are from global food waste, amounting to around \$940 billion⁶ (US EPA, 2021). Economic losses stem from the manufacturing sector, retail, household food waste, and treatment waste management treatment and disposal.

Circular Economy as Alternative Solution on Food Waste

After providing data on the socio-economic impact of food waste, this research will link the issues caused by food waste with policy making in the circular economy. The KCP perspective has four sites to determine the instrument of order that is related to natural and social science, shown in the graphic below (Jasanoff, 2004):

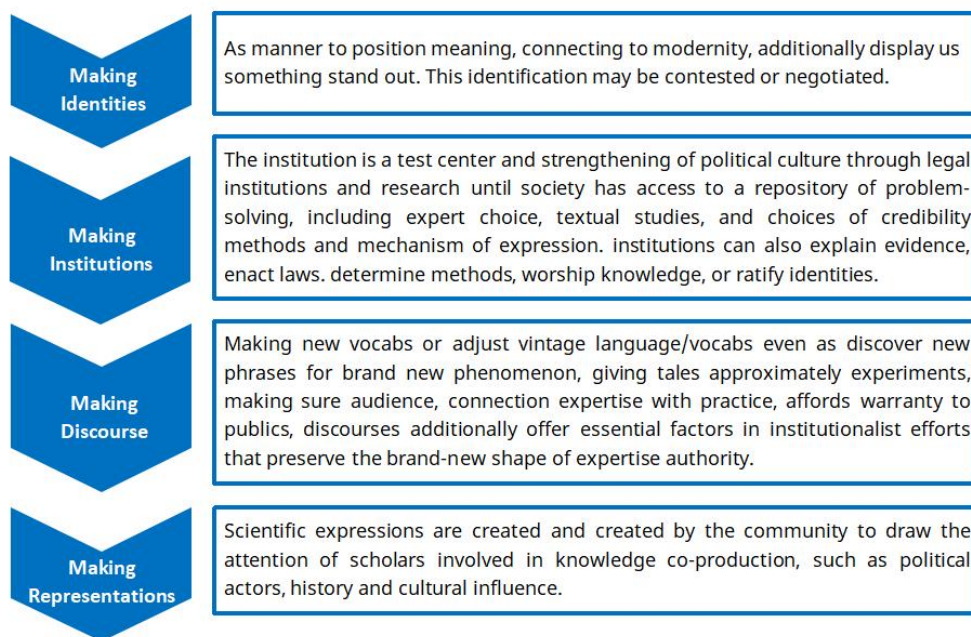


Figure 2. Graphics on sites of knowledge co-production
 Source: Jasanoff, 2004

From each link, the author attempts to analyze each factor that explains the phenomenon of food waste.

Making Identities

In knowledge co-production, each actor has their own way of giving meaning to their role. In this case, individuals, NGOs, institutions, governments, business or food service owners, or any other actor has roles in tackling food waste. Some consider food waste essential to solved because of its negative

⁵ Roles of consumer and producers’ behavior can give impacts to the economic system in food waste.

⁶ According to WRAP and the Global Commission of the Economy and climate in 2015, by reducing food waste to 20-50% can help the economic crisis caused by food waste up to US\$300 in 2030.

economic, environmental, and social impacts. However, each actor has their own perspective on how they define food waste and create difficulty to be conclusive on what is considered as food waste or not. Different institution guidelines may write a new meaning to food waste or refer to an existing meaning. In order to build a universal meaning, it requires the teamwork of every expertise.

Making Institutions

Institutions have a huge role in managing food waste. As the issue grew prominent, new institutions started emerging to specifically address or include food waste in their goals. Waste and Resource Action Program (WRAP), EU FUSION, United Nations (UN) by United Nations Environment Programme (UNEP), Food and Agriculture Organization (FAO), and United Nations Development Program (UNDP), World Resources Institute (WRI), and Ellen MacArthur Foundation, are some examples. These institutions can create guidelines to help with social order. An example is the UN's Sustainable Development Goals, specifically in Goal 12.3: "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.". A joint collaboration from UNEP and FAO also produced the Milan Urban Food Policy Pact (MUFPP), worldwide, inter-city international agreement for a better food policy. These include frameworks and working tools for cities (MUFPP, 2023).

Each institution possibly has its team (think-tank) to make reports on food waste, such as the Food Waste Index by the UN that is published annually since 2016. These institutions can give political influence on the government to make basic policies for the circular economy or even ones that focus on waste. These institutions use infographics, videos, or other scientific work that discuss food waste and circular economy.

Making Discourse

Food waste had different values in the past. Since this has become a global issue, food waste formed a new meaning. The term 'food waste' remains, but its definition has become more complex and diverse. Currently, 'food waste' refers to waste that impacts the environment, society, and economy globally. The FAO mentions three new terms on food waste: 'food waste,' 'food loss,' and 'food wastage' (FAO, 2013). These new terminologies are scientifically proven (based on field facts) to solidify the existence of food waste.

Making Representations

Food waste representations are produced by the epistemic and other communities to gain the attention of the experts on food waste. As a result, research focus on food waste by every sector (social, economy, environment) complete each other by filling gaps in knowledge. This may be done by the government, independent research bodies, or epistemic community networking on food waste.

Food Waste as an Object for Circular Economy (CE)

This contemporary perspective of economy and environment serves as an alternative to its traditional counterpart. The circular economy perspective provides solutions for both the environment and economy. In this case, this perspective no longer considers food waste simply as landfill, but as an object of the economic target. The cyclical process that produces all waste (including food) has the potential to bring new benefits for the economy. According to the Ellen MacArthur Foundation, CE is a framework for global issues such as climate change, extinguishing of biodiversity, wastes, and pollution (Ellen MacArthur Foundation, 2021). There are three principles included: reducing waste and pollution, circular products, and materials, and nature regeneration (Ellen MacArthur Foundation, 2021). This approach pushes every actor to shift to the circular economy and renewable energy. In addition to plastic waste, food waste can be beneficial if processed through the circular economic method. This issue harms the environmental, economic, and social sectors and makes the circular economy a heavenly solution to

manage this issue. Every food waste that is still in good condition can be useful for nature and the economy with the help of advanced technology. Lacy and Rutqvist in their publication (2015) explains that the benefits of the circular economy in agricultural and F&B sectors were⁷: reducing and recycling food waste in the value chain; producing circular energy through anaerobic digestion process; aeroponic farming with reusable and allocated harvesting; eco-friendly/recyclable packaging; and direct retail to consumers (dematerialized store) (Lacy & Rutqvist, 2015).

Western industries, such as at in the United States, have already implemented this. For example, the Kroger Company has turned its food waste into renewable energy⁸. Walmart has also turned its food waste oils into biodiesel, soap, and supplement for animal fodder (Lacy & Rutqvist, 2015). This concept is also implemented by other actors such as governments to mitigate environmental issues due to economic activities. Countries that have started transitioning to the CE in industries are still dominated by the Global Norths, especially the United States and Europe. Lehtokunnas et al. argue that this transition to the circular economy is challenging for nations because not only are they investing in advanced technology but they are also transitioning in their behaviors, infrastructures, and innovations (Lehtokunnas et al., 2020).

In the circular economy, a closed loop for the material and resources are implemented without neglect towards the environment (Jurgilevich et al., 2016). According to Jurgilevich, food waste in a circular economy focuses on the food system by 'reducing numbers of waste, reuse food, utilization of by-product and food waste, nutrient recycling, and changes in diet toward more diverse, more efficient food patterns, consumer issues on food waste and food surplus' (Jurgilevich et al., 2016). Moreover, their research argues that every actor has an important role in the circular economy. This transition from a linear to a closed loop model includes social, technological, and policy changes. At the individual level, participation can come in the form of separating organic and non-organic waste. Food can be separated from other waste, especially in its packaging. In addition to that, green movements introduce many new lifestyle choices, such as freegans, vegan, zero waste, minimalism, first in, first out, leftover taste the best, making an eco-enzyme, or home composting, can help to maintain the numbers on food waste in households. As it has become a global trend for nations to transition from a linear to a circular economy, many local and national-level governments are focusing on implementing this model. In the next section, this article will show data collected on institutions that implement a circular economic model in their business processes.

⁷ Food and agriculture sectors are one of biggest contributor of food waste needs proper waste management. Back to beginning, the circular economy hopefully could be a solution for closing the waste loop. Ellen Macarthur carry the circular economy framework for urban area as the biggest population for big changes.

⁸ Waste are transformed into renewable energy and cheap to give power for buildings by anaerob digestion that changed waste into biogas (as replacement for conventional gas).

Tabel 1. Lists of Actors that Advocate Circular Economy to Manage Food Waste

| No | Name Of Actors | Link Source | Origin | Category |
|----|--|---|---|---------------------------------|
| 1 | EU Platform on Food Losses and Food Waste (FLW) | https://ec.europa.eu/food/safety/food-waste/eu-actions-against-food-waste/eu-platform-food-losses-and-food-waste_en | European Union | Platform |
| 2 | Agrocycle for a circular economy | http://www.agrocycle.eu/ | Dublin, Irelandia (School of Biosystems and Food Engineering University College Dublin) | Research and Innovation Project |
| 3 | Farm to Fork Strategy (European Green Deal) | https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en | European Commission | Project |
| 4 | De Verspillingsfabriek | https://deverspillingsfabriek.nl/nl/home | Netherland | Company |
| 5 | Ellen Macarthur Foundation (EMF) | https://www.ellenmacarthurfoundation.org/explore/food-cities-the-circular-economy | UK | NGO |
| 6 | Fight Food Waste Cooperative Research Centre | https://assets.kpmg/content/dam/kpmg/au/pdf/2019/fighting-food-waste-using-the-circular-economy-report.pdf | Australia | Research Institution |
| 7 | KPMG | https://home.kpmg/au/en/home/insights/2019/12/fighting-food-waste-through-the-circular-economy.html | Australia | Service Firm |
| 8 | Indoensia Green Growth Program (Bappenas and Waste4Change) supported by World Research Institute (WRI) UK, UKFCDO, | http://greengrowth.bappenas.go.id/en/sustainable-food-waste-management-contributes-to-low-carbon-development-in-indonesia/ | Indonesia | Government Program |
| 9 | Walmart | https://corporate.walmart.com/esgreport/esg-issues/waste-circular-economy | USA | Company |
| 10 | Revive Eco | https://revive-eco.com/2018/11/01/press-release-zero-waste-scotland-investment-secured/ | Scotland | Company |
| 11 | Fooditive | https://www.fooditive.nl/copy-of-sustainability | Netherland | Company |
| 12 | Gamuda | https://gamuda.com.my/2020/12/creating-a-circular-economy-through-food-waste/blog/ | Malaysia | Company |

| | | | | |
|-----|--|---|-------------|-------------------------|
| 13 | Slow Food | https://www.slowfood.com/position-paper-the-circular-economy-package-and-european-food-waste-policy/ | Italy | Grass Root Organization |
| 14 | Olleco | https://www.olleco.co.uk/sustainability/circular-economy | UK | Company |
| 15 | Compost Connect | https://www.compostconnect.org/circular-economy/ | Australia | NGO |
| 16 | My Waste | https://www.mywaste.ie/the-circular-economy/ | Ireland | NGO |
| 17 | Guelph-Wellington | https://guelph.ca/wp-content/uploads/SmartCities_Booklet.pdf | Canada | Government Program |
| 18 | Cerealto Siro | https://www.cerealtoSIROfoods.com/sustainability/respect-for-the-environment/ | Spain | Company |
| 19. | Towards Zero Waste | https://www.towardszerowaste.gov.sg/circular-economy/ | Singapore | Government Program |
| 20 | ICLEI East Asia | https://circulars.iclei.org/wp-content/uploads/2021/04/best-practices-circular-food-JP-KR.pdf | South Korea | Global Network |
| 21 | S Group | https://s-ryhma.fi/en/responsibility/the-circular-economy | Finland | Company |
| 22 | GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) GmbH | https://www.giz.de/en/aboutgiz/profile.html | Germany | Company |
| 23 | The Waste and Resources Action Programme (WRAP) | https://wrap.org.uk/about-us/our-vision/wrap-and-circular-economy | UK | NGO |
| 24 | Intesa Sanpaolo | https://www.world.intesasanpaolo.com/circular-economy-food-sour-taste-zero-waste/ | Italy | Bank |
| 25 | Kerry Group | https://www.kerrygroup.com/sustainability/planet/circular-economy/ | Ireland | Company |
| 26 | Amazon | https://sustainability.aboutamazon.com/environment/circular-economy | USA | Company |

Source: Name of actors list was collected by the author by researching on www.google.com with 'circular economy actor' keywords.

Importance of Knowledge Co-Production on Circular Economy Projects

The circular economy has become a complex method but is considered a good solution for industrial issues and their damage to the environment. Developing a circular economy strategy not only requires economic, but technical and ecological knowledge. Knowledge co-production can be an important tool for the circular economy where in which the perspective could incorporate multidisciplines to explain the phenomenon and can also illustrate an example to make an efficient policy. As we know, the circular economy has become a path to balance nature and economy by properly utilizing material values with as low cost as possible, especially for reducing food waste.

Creating interdisciplinary guidelines requires cooperation in order for the policy to be generally implemented and objective. Marra explains the benefits of knowledge sharing for the circular economy, showing multidisciplinary communication and varied knowledge, and developing multidisciplinary cooperation under the same framework (Marra et al., 2018). The circular economy at the macro-level includes cities, provinces, regions, and nations that require reorganizing industries, infrastructures, cultural framework, and local to global social actions (Marra et al., 2018). This large scale can be challenging and needs multidisciplinary cooperation to share all perspectives for globally implementing the ideas of the circular economy.

The circular economy is an excellent solution for industry and the environment. Environmental damages and the emergence of institutions advocating for the value of the circular economy to food waste is an emerging discourse drawing attention from economic and environmental experts as a solution for reducing food waste in the perspective of knowledge co-production. Circular economy and food waste can be a beneficial combination to save the global economy, where a closed economic loop can reduce waste, and improve social wellbeing

Conclusion

Food waste has a long historical past in which its visibility has fluctuated depending on level of importance. Currently, this issue has once again become a priority, as it causes social, environmental, and economic damage on a global scale. The role of knowledge co-production explains how food waste and the circular economy have gained an identity as a key issue, establishes agencies to defend and advocate food waste in the circular economy, and create discourse as a means to explain the phenomenon. Political actors such as governments can identify food waste depending on a particular perspective and can in turn participate in designing international agendas for food waste. While the Global Norths still dominate the idea, they face little challenges in transitioning from a linear to a circular economy. In contrast to big challenges in developing countries suffering from tech investment and behavioral transition. This requires further research in viewing the food waste issue on various socio-politic layers to understand the dynamics. As this issue continues to be developed, economic and social transition can become burdensome for some nations. This issue does not simply push us to finish the food on our plate but aim to increase individual awareness of proper waste treatment in order for food waste to not end in landfill. Moreover, they do not have economic value. The government's role is important in controlling food industries because there will be no food waste if there is no food surplus. Food redistribution might even help food distribution, but it cannot solve the problem from the root. It is important to shift our values to believe this issue needs ethical work for every individual to support campaigns and starts practicing a non-food waste lifestyle.

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Authors Biography

Rana Qonita Rofila is a graduate student in the Department of International Relations at Universitas Gadjah Mada (UGM), Yogyakarta, Indonesia. Her academic pursuits center around food waste and knowledge co-production, resulting in continuing to write this to her ongoing thesis project. Her bachelor's degree is in international relations from Universitas Muhammadiyah Yogyakarta (UMY) in 2019, she authored an undergraduate thesis that explains the influence of the American Israel Public Affairs Committee (AIPAC) on the U.S. Embassy's relocation to Jerusalem during Donald Trump's era. Throughout her graduate studies, she actively contributed to the WTO Chairs Programme. She presented a paper addressing the challenges of circular economy and food waste policies at the "International Workshop on Trade, Sustainability, and Circular Economy: Forging Knowledge Co-Production on the International Trade System and Circular Economy in Developing Countries." organized online by the Center of World Trade Studies at Universitas Gadjah Mada, took place on September 21, 2021. Additionally, she shared her research on "Ekonomi Sirkular dalam Praktik" at the Study Group of the Center of World Trade Studies (CWTS) at UGM on May 13, 2022. Since July 2022, Rana has been an active volunteer with Food Bank Bandung, demonstrating her commitment to understanding and addressing food waste issues. This involvement includes collaboration with various industries. Her dedication to the cause was further demonstrated at the U20 International Conference held on August 3, 2022, at Universitas Katolik Parahyangan (UNPAR) in Bandung. Her rich experiences have inspired her to contribute to the discourse on global food waste, emphasizing the importance of knowledge co-production. For inquiries, Rana Qonita Rofila can be reached via email at ranaqonita97@mail.ugm.ac.id or ranaqonita@gmail.com.