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Reflections on Sustainability Concepts: Aloha ‘Āina and the Circular Economy

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Abstract: The Circular Economy is gaining traction in the European Union and all over the world as a transition away from the extractive and exploitative linear economy. In Hawai‘i, the cultural value of aloha ‘āina is a philosophy describing a set of values grounded in a relationship of kinship between people and the environment. Aloha ‘Āina structured centuries of sustainability and it has evolved over generations to frame community responses to crucial issues today, such as climate change, oligopolistic markets, and contemporary land management. This paper sits at the intersection of cross-disciplinary collaboration, sustainability, and sustainable development. Participative moderate observations and intentional cross-cultural exchanges of knowledge over five years between scholars and experts in the major fields of indigenous Hawaiian knowledge and industrial ecology inspired the concepts explored in this paper, which address the question of how aloha ‘āina and the Circular Economy can engage with each other in the collective effort to combat climate change, guide sustainable development efforts, and transition societies toward sustainability. Extensive literature reviews and insight gained through site visits to sustainability projects inform the discussion of best practices from opposite parts of the globe—Hawai‘i and Germany—to put into conversation two worldviews and present resulting implications and lessons learned. Essential findings describe the benefits of knowledge exchange between members of global practitioner networks. By shifting expert and participant roles according to which projects are being observed, cross-cultural characteristics can be explored at a deeper level, which allow participants to employ best practices to their respective theories. The Circular Economy’s engagement with indigenous knowledge systems is an opportunity to ally and produce solutions to the challenges associated with changing the linear economy while addressing both environmental and social justice issues.

Keywords: sustainability; indigenous knowledge; circular economy; aloha ‘āina; sustainable development; natural resource management

1. Introduction

Transforming existing social and economic systems to better sustain the earth and its natural systems is necessary to combat human-induced climate change. Addressing the complex issues and challenges of sustainability is arguably one of the most important problems humanity must solve. Solutions require a multidisciplinary approach across three

pillars: environment, economy, and society [1]. Sustainability is more than its technical factors; it extends beyond concerns for carrying capacity, and solutions must include economic and social factors. Reaching solutions that balance the three dimensions of sustainability (environmental, economic, social) is difficult. This requires bridging disciplinary gaps to link diverse fields in order to propose solutions toward achieving sustainability [2]. It is also essential to ensure the pervasive and comprehensive incorporation of sustainable development into all sectors—industry, government, and community. The UN Sustainable Development Goals, adopted as part of the 2030 Agenda for Sustainable Development in 2015, set an example, and in broad strokes, they address climate change, inequality, and injustice. With sustainability as a state in which to strive for and sustainable development as the course of action to achieve, this paper sits at the intersection of cross-disciplinary collaboration, sustainability, and sustainable development [3,4]. The Circular Economy (CE), as a new business and economic model, is demonstrating significant, positive impacts in environmental, human health, and social spheres leading toward more sustainable development and an overall harmonious society [5]. The goal of the Circular Economy is to decouple economic growth from environmental degradation to increase economic output and job growth while decreasing harmful impact on the environment and natural resources. Contrasted with the present linear economy, where goods and services are produced through a linear process often described as take–make–use–waste, a Circular Economy would shift our present state to a model where we design durable products, reduce resource consumption, recapture resource materials from products, and then repurpose wasted materials into new products [6,7]. The business, economic, and scientific incentives of initiating the CE have been established in guidelines produced by the European Union. However, there is much work to be done to help develop the underlying values and ethics required to shift societies away from short-term wealth production at the expense of natural resources and toward the prioritization of economic growth that also enhances the environment. The relationship between culture and sustainable development is undeniably relevant [8,9], and this relationship has been recognized. Sustainable Development Goal 11 describes culture as a crucial role in building inclusive, safe, resilient, and sustainable cities and human settlements. More specifically, Target 11.4 calls for the protection of the world’s cultural and natural heritage [10]. Much has been written recently about culture in the sustainable development context, but there is minimal research on what indigenous knowledge can contribute in navigating challenges of achieving sustainability [11]. Much more exploration of the purposeful integration of indigenous knowledge systems and the Circular Economy needs to be conducted. This paper focuses on this gap in the academic conversation and literature.

Klein identifies bridging gaps between colonial and local indigenous traditions in particular as a requirement to achieve sustainability [12]. Indigenous knowledge systems and their wealth of information could help inform the ways in which societies can persist in closer union with the natural world [13]. Science, defined as a “systematic approach to understanding natural and physical phenomena,” values observation and interpretation. Based on this definition, Kānaka ‘Ōiwi (Native Hawaiians), along with all indigenous peoples, lived science by observing and interpreting natural phenomena systematically [14]. Seeing natural systems and resources as genealogically connected to people enabled the development of philosophies such as *aloha ‘āina*, which focused on the relationships humans must maintain to live in balance with the natural world. *Aloha ‘āina* is a philosophy in Hawai‘i grounded in an ancestral worldview that considers the environment as kin, and it is a system of values perpetuated over generations. It has inspired a historical economy of abundance, supported by closed-loop aqua- and agricultural structures that were sustainable for centuries. It has evolved over time to frame social, economic, and natural resource challenges, as well as put into practice sustainability efforts utilizing those same structures. The CE is a response to the climate emergency to address the environmental, social, and economic issues that we face today. CE aims to model economic activities after ecosystems to be resource-efficient, sustainable, and competitive by closing loops in

economic structures. Both concepts share similarities, such as considering the environment as a model for economic activity. There are also contrasts; CE is a recently developed technical approach to address issues caused by climate change, rooted in ecological and environmental economics as well as industrial ecology [15], while aloha ‘āina is actualized as a multi-generational cultural framework perpetuated by community members through intimate, place-based relationships.

2. Methods

The author team comprises indigenous Hawaiian knowledge scholars at the University of Hawai‘i, industrial ecology scholars from the University of Augsburg, and expert practitioners from community projects. We come from different academia sectors and carry differing worldviews, areas of expertise, and tools of inquiry. However, in this paper, we come together in conversation to reflect on the knowledge exchanged over a five-year international partnership. This partnership included presentations to demonstrate commonalities between aloha ‘āina and the CE, visits to community sites practicing sustainability projects, and literature exchange. Through this experiential, empirical process, we strive to explore how aloha ‘āina and the CE, as two major fields, can engage with and learn from each other to achieve a common goal of transitioning to sustainable societies. Discussions around the concepts presented in this paper began during a presentation in 2016. Bound by a shared commitment to sustainability and resource management, an indigenous knowledge scholar from Hawai‘i and industrial ecology scholars specializing in the Circular Economy in Germany established a partnership to embark on emancipatory research that bridges Western and non-Western approaches to sustainability studies. This paper represents findings after the successful development of partnerships and joint research projects that are of mutual benefit. The authors were drawn initially to similarities of aloha ‘āina and the Circular Economy in modeling processes of nature in economic systems. Their continued partnership is guided by the question of how aloha ‘āina, as an indigenous philosophy, and the Circular Economy as a modern economic approach can inform each other. Over the course of five years, the author team conducted multiple site visits to community projects, held discussions with community experts in Germany and Hawai‘i, and organized community symposiums at the University of Hawai‘i at Mānoa and the University of Augsburg. These intentional exchanges of knowledge at local sites across continents inspired the concepts and ultimate findings outlined in this paper.

As an alternative to participant observation, moderate participant observation describes the methods employed in this research. Moderate participation constitutes the researcher maintaining a balance between insider and outsider roles, which accounts for a combination of both involvement and objectivity [16,17]. In this case, the observations are done by local expert researchers. The observing units are sustainability and projects taking place in differing cultural contexts influenced by different theoretical backgrounds; the Circular Economy informs the project in Germany, and Aloha ‘Āina informs the projects in Hawai‘i. However, these observations were conducted between representatives of different cultures, who therefore shifted the expert and participant’s role depending on which projects were being observed. Therefore, due to the shifting roles in this cross-cultural exchange, the author team is positioned to employ a comparative analysis in order to gain a deeper understanding of cross-cultural characteristics. In this paper, cross-cultural observation with moderate participation and expert/participant exchange [18] is utilized in order to answer the following research questions: (1) Under which conditions are sustainable projects successful? (2) What can we learn from each other? To begin considering the research question, the authors completed methodical literature reviews most familiar with their respected major fields. Insight gained through visits to community sites and conversations with grassroots community members inform the discussion of and case studies from differing cultural diverse contexts. The qualitative representations that result are useful in putting into conversation and engaging two worldviews with the ultimate

goal of allyship to guide communities and governmental policy all over the world toward sustainability.

3. Historical Background

3.1. *The Origins of Aloha ‘Āina and Contemporary Hawai‘i*

‘Ōiwi (Native Hawaiian) scholar Noelani Goodyear-Ka‘ōpua describes that “The philosophy and practice of aloha ‘āina have been a root of well-being and sustainability in Hawai‘i for generations, and I believe that we need it now more than ever. When I talk about aloha ‘āina from an ‘Ōiwi perspective, we mean not only a love for the land, but a real deep and personal sense of connection to place, an unswerving commitment to the health of our natural world” [19]. From a Hawaiian worldview, the environment is not merely an entity to be prioritized because of the ecosystem services it provides for man, but it articulates instead a familial and genealogical relationship between ‘āina (land), akua (gods), and kānaka (people) [20]. This relationship is embodied by the term aloha ‘āina, which is translated to “love for land”. Practicing aloha ‘āina means to be active in mind, spirit, and policy to achieve a deep love for, and be committed to act as protector of, land. It considers the relationship between humans and land as one of kinship and as something that should be seen as inseparable and integral for our existence [21].

One account that demonstrates the origins of the kinship between Kānaka ‘Ōiwi (indigenous Hawaiians) and the natural world is the birth of Hāloa. ‘Ōiwi scholar David Malo discusses this significance, as it marks a point where the lineages of land and people are intertwined:

“... the first-born son of Wakea was of premature birth (keiki alualu) and was given the name of Haloa-naka. The little thing died, however, and its body was buried in the ground at one corner of the house. After a while, from the child’s body, shot up a taro plant. After that, another child was born to them whom they called Haloa, from the stalk of the taro. He is the progenitor of all the peoples of the earth.” [22] (p. 244)

In this account, the relationship between ‘āina (land, or literally, that which feeds us) and kānaka (humanity) is defined as one of reciprocity between an elder and younger sibling; the kuleana (responsibility) of the elder is to sustain, love, and protect the younger, who in turn loves, serves, and honors the elder. More specifically, as the younger sibling, Kānaka ‘Ōiwi incorporated our kuleana to love, serve, and honor land in this reciprocal relationship into every strata of society, from religious, to political, to social, and to economic practices [23].

In 1971, the “Modern Hawaiian Movement” began with the non-violent protest of community members in Kalama Valley against suburban development [24]. Aloha ‘āina was identified by Haunani-Kay Trask as the cultural value that characterized the series of land struggles that would follow in the 1970s and 1980s [25], in which communities across the archipelago effectively advocated for the protection of their places through activism. George Helm of Moloka‘i is an honored leader in aloha ‘āina; his multi-faceted activism in the protection of Kaho‘olawe against live fire training by the United States military led to his status as a cultural hero that rose out of the Modern Hawaiian Movement [26]. His steadfast dedication to aloha ‘āina ended in his ultimate sacrifice when he, along with fellow activist Kimo Mitchell, disappeared at sea as part of a rescue attempt; they would become one of numerous historical figures that sacrifice their lives for aloha ‘āina, who remained fearless and unwavering when their values and land are threatened [27]. During his time, Helm articulated aloha ‘āina as follows in the trenches of the struggle for the sovereignty of Kaho‘olawe:

“The truth is, there is man and there is environment one does not supersede the other. The breath in man is the breath of Papa (the earth). Man is merely the caretaker of the land that maintains his life and nourishes his soul. Therefore, ‘āina is sacred. The church of life is not in a building, it is the open sky, the surrounding

ocean, the beautiful soil. My duty is to protect Mother Earth, who gives me life. And to give thanks with humility as well as ask for forgiveness for the arrogance and insensitivity of man.” [28]

The battle continues against the oppressive structures that attempt to dismiss aloha ‘āina in Hawai‘i. Today, aloha ‘āina is a movement toward the unification of culture and the environment to achieve social, cultural, and ecological justice in Hawai‘i in an effort to integrate the knowledge and practices of traditional systems into the contemporary management of land and people [27]. Aloha ‘āina remains at the core of Hawaiian society; it helps to ground our being while guiding our strategy in addressing the social, economic, and natural resource challenges of our time.

Historically, economic industries in Hawaii grounded in aloha ‘āina led to generations of productivity, abundance, and growth [29]. A highly complex and sophisticated society emerged in Hawai‘i that centered around an abundant agricultural economy [30], without a market and the need for surplus production. The economy of traditional Hawai‘i was dependent on the balanced use of products from land and sea, accounting for an ingenious land division system [31]. Kānaka Maoli scholar Mary Kawena Puku‘i identifies ‘ohana, or extended families, as the core economic unit in Hawaiian society:

“Between households within the ‘ohana there was constant sharing and exchange of foods and of utilitarian articles and also of services, not in barter but as voluntary (though decidedly obligatory) giving. ‘Ohana living inland, raising taro, bananas, wauke and olona, and needing guards, coconuts and marine foods, would take a gift to some ‘ohana living near the shore and in return would receive fish or whatever was needed. The fisherman needing poi or ‘awa would take fish, squid or lobster upland to a household known to have taro, and would return with his kalo or pa‘i‘ai . . . it was the ‘ohana that constituted the community within which the economic life moved.” [32] (pp. 5–6)

There is also evidence that residents of particular communities engaged in exchange among wider community circles. Hommon identifies “exchange” as a form of gift-giving and barter, but significant evidence shows exchange of “pure gifts”, with no return expected, which is found to be characteristic of Polynesian character. Regions tended to offer surplus goods, or items of unique or superior quality, in return for items more readily available in other areas [33]. There was no currency because of the absence of economic concepts on which such a medium could be based, such as surplus appropriation, value storing, or payment deferral. Since there was no idea of financial profit from exchange, there was also no concept of economic exploitation [34]. However, entities that could not be given or held for the exclusive use of a single person were land and water. The idea of exclusive private ownership of land and resources was not a part of ancestral society. Precious resources such as water, as the source of life to land and man, was not the possession of a single individual but rather held in trust by the Ali‘i (chiefly class) for future generations [35]. Careful management of natural resources and a “pure gift” economy driven by aloha ‘āina established a sustainable society in Hawai‘i with similar underlying values to the Circular Economy. With the use of locally sourced material, the economy was based on human communities’ health and well-being, and the surrounding environment, rather than the accumulation of material wealth, and it supported a flourishing population comprised of 800,000 to 1,000,000 people [36].

Indigenous Hawaiian leaders developed a complex system of resource management as well as a social system rooted in aloha ‘āina that was hybridized during the period of the Hawaiian Kingdom when Hawai‘i became recognized as an independent and sovereign state in 1843 [37]. The introduction of industrial agriculture through the plantation economy from the mid-eighteenth to mid-nineteenth century marked a significant transition to market capitalism in Hawai‘i. Precious water resources were diverted away from streams and lo‘i (terraced agricultural pondfield) systems and used for sugar production. The industrial consumption of environment and communities set the stage for the modern economic landscape dependent on tourism and the military [38]. The illegal

overthrow of the Hawaiian Kingdom by an oligarchy with the aid of the United States troops, and the rapid transition to a linear economy in Hawai‘i, caused the debilitation of land and communities across the islands [39–41]. When the United States claimed Hawaii as the 50th State in 1959, it set the stage for an economic transition from the plantation to a tourist-based economy. Although visitor expenditures make up a majority percent of the State’s tax revenue, the existing extractive tourist industry is tied to multinational corporate interests, causing much revenue to leave the local economy and be returned to foreign companies [42]. Additionally, the industry poses a significant threat to cultural and community identity due to the development of precious lands and resources, yet the economic well-being of Hawai‘i continues to be heavily dependent on it. The US military is the second biggest industry in Hawai‘i. Despite years of aloha ‘āina resistance against its presence, the military continues to play a primary role in the United States’ forcible occupation of Hawai‘i’s lands and waters. The industry’s numerous investments in the economy have led to economic dependence to the point where the development of other economic initiatives is avoided, despite multiple devastating costs that accompany these various military investments in the economy [43].

Dependence on tourism and military industries in Hawai‘i’s current economic environment are examples of oligopolistic market structures carried out by the US in Hawai‘i for generations. These economic regimes have created a society that is dependent on global markets for its survival. Roughly 85 to 90% of Hawai‘i’s food is being imported, as well as a majority of energy [44]. Considering the vast amount of imported resources, be it tourist and military dollars, or food and energy, their misappropriation results in high waste generation. In 2008, Hawai‘i produced more waste per person than any other state in the United States, which as a nation, produces more garbage than most countries [45].

Many people in Hawai‘i recognize that an alternative economic model is needed for our islands to survive the pending crisis of climate change. There have been some efforts to look toward aloha ‘āina as a historical model before unfettered capitalism, which offers the possibility to be sustainable by returning to an economy based on using local resources in a way that does not require exploitation. The Aloha+ Challenge is one creative effort to address Hawai‘i’s resource, waste, and consumption challenges. Aloha+ identifies targets for Hawai‘i to achieve global Sustainable Development Goals (SDGs); objectives for sustainability are integrated, including clean energy, local food, and waste reduction, with a commitment to achieve these objectives by 2030 [46].

3.2. Sustainable Development and Circular Economy in Europe

The Circular Economy offers an alternative to the profit-driven linear economy. As such, it could be a model that aids in addressing the complex set of environmental, social, and economic problems that come with the climate crisis. One key insight toward a circular economy is the rethinking of “waste”. Nature’s biological metabolism works in loops [47], resulting in waste being non-existent naturally as material is effectively recycled. The approach of a Circular Economy takes ecosystems as a role model and aims to make our economic activities more regenerative, resource-efficient, sustainable, yet still competitive by closing the loops within our economic model.

A range of scholarly literature analyzes different definitions of Circular Economy [48,49] and its opportunities and barriers [50–52]. A commonly agreed aim of the Circular Economy is maximizing resource efficiency by keeping materials at their highest value at all times [7]. Further key aspects are the minimization of waste as well as a decoupling of economic growth from resource use [53], or even one step further, the “double” decoupling of economic activity from resource use and from environmental impacts.

The concept of a Circular Economy is not a new business model, but it has been evolving since the 1970s, based on different schools of thought. The first idea of Circular Economy can be traced back to the American economist Kenneth E. Boulding [5], who introduced an “open economy” and “closed economy”. An “open economy” would have an unlimited capacity of the outside to supply or receive energy and material, while a “closed

economy” would have no exchanges of matter with the outside environment; resources would remain as long as possible a part of the economy [54]. A closed economic system would be characterized as a circular relationship, where everything is input into everything else [47]. According to extensive literature by Wautelet (2018), the origins of Circular Economy are mainly rooted in ecological and environmental economics as well as industrial ecology. Additionally, more recent schools of thought, such as performance economy, cradle to cradle, biomimicry, natural capitalism, and blue economy have contributed to the emergence of the concept of Circular Economy [53].

A common perspective on CE is based on “the principle *waste equals food*, which implies that all products and industrial processes should be designed to enable the perpetual flow of resources within one of two distinct metabolisms (cycles): the biological metabolism and the technical metabolism” [47]. The two cycles distinguish two types of products depending on their use: products of consumption and products of service [55]. This distinction is illustrated by the butterfly diagram below (Figure 1).

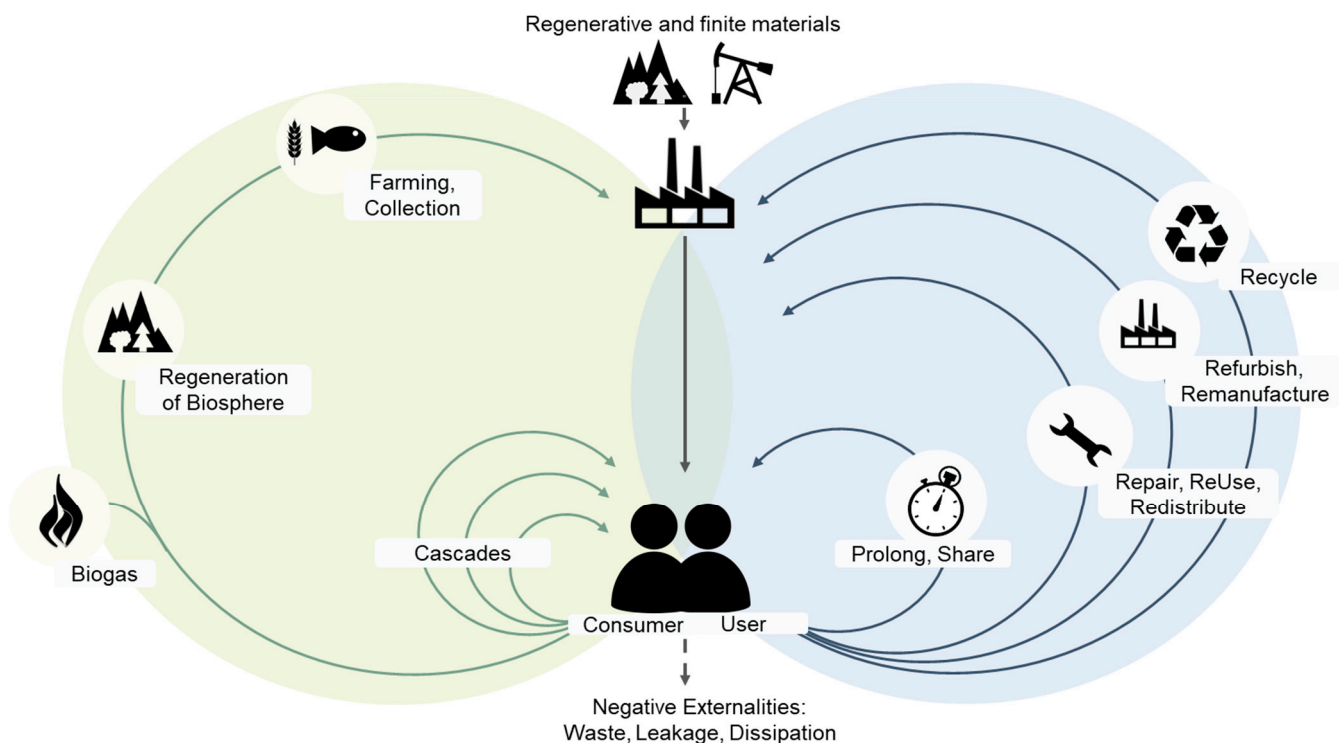


Figure 1. A circular economy seeks to rebuild capital, whether this is financial, manufactured, human, social, or natural. This ensures enhanced flows of goods and services. The system diagram illustrates the continuous flow of technical and biological materials through the “value circle” (illustration based on Hutner, 2017 and Ellen MacArthur Foundation, 2019) [56,57].

The green cycle illustrates the flow of products of consumption (i.e., food or biodegradable shampoo). These products are consumed during the use phase and are supposed to be biodegradable, so they can serve as nutrients and feed back into biological processes at the end of their lifespan. The blue cycle describes products of service, for example smartphones or laptops that are of synthetic or mineral nature and are therefore not biodegradable. The manufacturing of these products is resource and energy-intensive [58]. Therefore, the products should remain in the use phase for as long as possible. A lifetime extension can be achieved through repair, share, reuse, or refurbishing. At the end of their life span, products should be recycled, so materials can feed back into the production phase as secondary materials [55].

The EU’s adoption of the SDGs is a part of implementing change in society. The Sustainable Development Goals address the global challenges we face, including those related

to poverty, inequality, climate, environmental degradation, prosperity, peace, and justice; they are the blueprint for achieving a better and more sustainable future for all. Their key aspects include fostering economic growth, reducing disparities in living standards, ensuring the same chances for everyone, sustainable resource management, and ensuring the preservation of ecosystems while strengthening their resilience. Today, the Division for Sustainable Development Goals plays a key role in the implementation of the 2030 Agenda for Sustainable Development, which all United Nations Member States adopted in 2015. In order to make the 2030 Agenda a reality, broad ownership of the SDGs must translate into a strong commitment by all stakeholders to implement the global goals. These SDGs, at the heart of the 2030 Agenda, are behind the European Commission's adoption of an ambitious Circular Economy Package in 2018 to stimulate Europe's transition toward a circular economy while continuing to boost global competitiveness, foster sustainable economic growth, and generate new jobs [59]. The Circular Economy is a model leading toward more sustainable development approaches, and therefore, a harmonious society is ultimately based on closed-loop systems that mimic natural processes. By considering economic, environmental, technological, and social aspects as well as their interaction across sectors and industries, the Circular Economy strives to implement a greener economy by contextualizing entire life cycles of processes [5]. Then, it is beneficial to investigate the sustainable economies developed by indigenous nations that supported thriving populations, who initially integrated closed-loop systems of production. In Hawai'i, the value of aloha 'āina was the driver behind the following examples of closed-loop, circular economic systems.

4. Closing the Loop: Case Studies of Best Practices in Germany and Hawai'i

Recent years have seen Germany pioneer an energy revolution called the "Energie-wende" (energy transition), which is advocated by scientists as a model all nations should strive for to avoid climate disaster. The "Energiewende" is influenced by a grassroots campaign planned by Germany to replace nuclear energy and fossil fuels with renewable energy, and it is a commitment to slash the country's carbon emissions in comparison to 1990 by 55% in 2030, and by at least 80% by 2050. A bill boosting this transformation incorporated a crucial principle in 1990: producers of renewable energy were allowed the right to feed into the grid, and utilities have to pay them [60]. The small village of Wildpoldsried in southern Germany has invested in renewable energy projects for the past two decades to become a powerhouse in the country's renewable energy transformation through the nation's "pay back" policy on renewable energy investments and its community-driven vision of environmental and economic stewardship [61].

The modest farming community of Wildpoldsried in the State of Bavaria has gone beyond energy independence by producing a significant energy surplus, which is sold back to the grid for millions in annual revenue. The Village Council produced "Wildpoldsried Innovativ Richtungsweisend" in 1999 (Wildpoldsried Innovative Leadership, WIR-2020), which is a mission statement that outlined three focus areas: renewable energy and saving energy, the ecological construction of buildings using ecological building materials, and the protection of water including ecological disposal of wastewater. Through these focus areas, the town committed to producing 100% of its electricity from renewable energy by 2020 [61]. Today, the town boasts a diverse list of projects: five biogas plants, eleven wind turbines, a natural wastewater and hydropower system, along with photovoltaic installation, several municipal and residential biomass heating systems, solar thermal systems, and geothermal systems produce a holistic portfolio of renewable energy production managed by a smart grid operated by the town [62]. The small but engaged community bypassed their original goal of generating 100% of their electricity through renewable energy by 2020; they were already producing 321% of its electricity by 2011 and received 5.7 million Euro (6.4 million USD) in revenue from the surplus [61]. By 2017, Wildpoldsried produced 500% more energy than it needs [62].

It is worth noting the role of the community in the development of renewable energy infrastructure. Inspired by WIR-2020, a civic society formed in 1999 established a company

to build two community windmills through investor-contributed funds, along with a small grant from the State of Bavaria. The successful construction of more windmills, a biogas plant, and a natural wastewater system over the next seven years were all funded through investors and government grants [58]. The economic incentive provided by the German government is also notable; the original “feed-in tariff” passed in 1990 introduced the potential for citizens to receive revenue from surplus energy, but the original payment was relatively low. Economic viability was not achieved until the Renewable Energy Source Act of 2000, when a new feed-in tariff was introduced that led to significant profits and increased investment in renewable energy, especially solar, leading to the expansion of renewable infrastructure [60,61]. As a part of the nation-wide transformation to renewable energy, Wildpoldsried models community sustainability through numerous initiatives. This example provides insight into the emergence of a Circular Economy at the local level through the collective engagement of farmers and citizens taking the lead to invest in renewable infrastructure and their economic growth from a transformation supported by government initiatives.

A prevalent view among archaeological scholarship suggests Polynesian settlement of Hawai‘i occurring sometime after 500 CE (Common Era) [63]. Numerous environmental resources of the archipelago would attract early Pacific settlers: fertile soils in broad valleys to plant crops, freshwater streams flowing from the mountains for irrigation, and extensive, well-developed coral reef systems [30]. Exponential population growth thereafter led to the implementation of strategic agri- and aquacultural systems [64] to develop a sophisticated, entirely sustainable economy based on circular systems of intensive farming and aquacultural methods. Lo‘i kalo are stone-faced, terraced, irrigated pondfield complexes used to cultivate wetland taro varieties, and they were developed at a larger scale in Hawai‘i compared to anywhere else in Polynesia. An investment of high initial labor inputs was required in the construction of lo‘i and its irrigation canals [65], resulting in agronomic modification of existing soil to create an artificial ecosystem within the environment geared specifically to growing kalo [66]. Kalo cultivation in Hawai‘i reached engineering sophistication of a unique level because of lo‘i [67] and led to the development of systems among the largest in Polynesia. Despite their size and complexity, lo‘i did not require painstaking management to produce high yields [66]; at the peak of production, cultivation is estimated to have covered more than 80,937,128 m² over six islands to cultivate kalo as a principal food source [39,67]. Loko i‘a (fishponds) are an aquacultural technology developed in Hawai‘i to cultivate fish in specialized fresh- and brackish-water ponds. Loko i‘a kuapā (walled fishponds) specifically are walled, brackish-water fishponds constructed along the shore with sluice gates, and they are a technological innovation found nowhere else in Oceania [68–70]. The kuapā (walls) and mākāhā (sluice gates) of loko i‘a kuapā created estuary environments ideal for marine aquaculture through their development in natural embayments, where freshwater streams flowed into the ocean to create brackish ecosystems [71]. Another famed ‘Ōiwi scholar, Samuel Manaiakalani Kamakau, describes fishponds as a marker of abundance in a place: “. . . a land with many fishponds was called an abundant land (‘āina momona). They date from very ancient times . . . The making of the walls of the shore ponds was heavy work and required the labor of more than ten thousand men. Some of these fishponds covered an area of sixty or seventy acres, more or less . . . ” [72] (p. 47). Similar to lo‘i kalo, an investment of high initial labor inputs was required in the construction of loko i‘a kuapā and their key components: permeable seawalls, channels for water flushing or inflow, and grate-structured wooden sluice gates. As a result, they became extensive operating systems with significant production outputs of 44,4834 to 67,251 kg/km² every year [70]. In other words, the systematic cultivation and propagation of herbivorous fish in loko i‘a provided protein to the Hawaiian population 100 times more efficiently than the natural food chain, and it could continue a cycle of efficient protein production indefinitely if managed and maintained correctly [69]. Lo‘i kalo and loko i‘a are two technological innovations among many historically driven by aloha ‘āina that supported a thriving, self-sustaining civilization in Hawai‘i.

5. Results and Discussion: Aloha ‘Āina and the Circular Economy

The philosophy of aloha ‘āina in Hawai‘i emerged from a relationship of kinship between the earth and people that drives indigenous Hawaiian identity and existence, and it is a philosophy that can be employed to guide the emotional, socio-psychological changes necessary to institute systemic change and a paradigm shift toward rethinking and reorganizing global economic processes. The conflicts over natural resources between indigenous and Eurocentric cultures reflect systematic differences between them. The indigenous worldview is evidently eco-centric; it is marked by values that prioritize group welfare. Furthermore, the assignment of sanctity to natural resources is a representation of the spiritual connection between people and nature, which situates the environment as a life source and “a kind of extended self”. On the other hand, the European worldview is often characterized as homocentric, which prioritizes the accumulation of individual wealth and/or property [73]. The strict binary that sets nature apart from culture is arguably the most important gap between Eurocentric and indigenous views of sustainability; there is a need to address that gap to institute the systemic change needed for a successful transition to circular economies.

The two case studies outlined above in Germany and Hawai‘i provide vignettes into alternate economic possibilities. The case of Wildspoldried illuminates the structural change possible through community commitment to change. The rural village models the top-down, policy-driven approach of the Circular Economy in Germany. The multiscalar character of change is important to consider in this case; grassroots community engagement and decision-making is a crucial factor in which change is inspired, while tangible systems are upheld by governments.

The agri- and aquacultural technologies of lo‘i kalo and loko i‘a are founded on similar underlying values as that of the Circular Economy: initial investment in design, manufacturing products of integrity, high value, and long life, low maintenance expectations over time, and innovation. Environments with prime conditions were carefully chosen, and an artificial ecosystem was effectively created geared specifically for taro and fish cultivation. Initial investments of high labor inputs in their construction led to complex, efficient systems unique to Hawai‘i with high production yields over long periods without requirements of painstaking management. The Circular Economy also calls for innovation, which requires imperative vision by predicting future technological changes and environmental impacts of production. Over the last two centuries, devastating factors led to the decline of these systems: massive population collapse, dislocation of Kānaka ‘Ōiwi from land and land-based practices, diversion of water for industrial agriculture, development, pollution, and the introduction of invasive species have left lo‘i kalo and loko i‘a kuapā overgrown, destroyed, or forgotten. Despite a catastrophic decline of production in Hawai‘i and hindered access to ancient structures, steady efforts in cultural revitalization in recent years have led to restoration efforts of traditional lo‘i kalo and loko i‘a projects to revive their production and engage in economic diversification [39,65,70]. As two technological innovations designed through aloha ‘āina, lo‘i kalo and loko i‘a are two of many processes and practices that sustained a thriving society in Hawai‘i. These ancestral technologies serve as examples to drive the necessary transformation contemporary societies need to make toward sustainability. By utilizing aloha ‘āina as a tried-and-true indigenous-centered platform in partnership with the Circular Economy, the possibility of global change becomes tangible. Figure 2 summarizes the main results of this study.

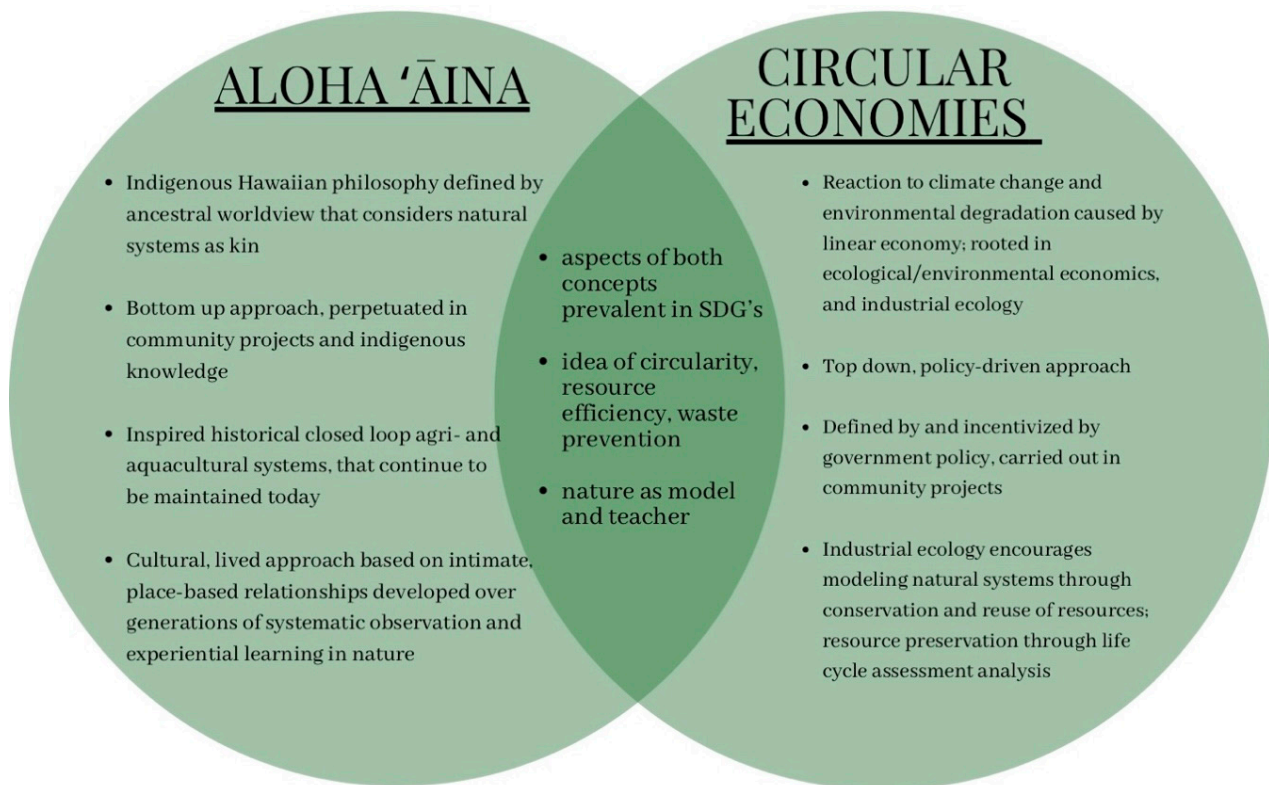


Figure 2. Diagram representation summarizing aloha 'āina and the Circular Economy, and presenting their commonalities.

The seven essential findings are as follows:

- Community sites of aloha 'āina continue to be utilized, adapted, and innovated by community experts; these projects are rich places of knowledge exchange that can inform complex economic and socio-ecological questions;
- Methods and tools of CE can inform aloha 'āina practitioners and initiatives, especially the installment of top-down approaches to implement and institutionalize community projects;
- Immersed experiential knowledge exchange across cultures, and shifting expert and participant roles, allows for exploring at a deeper level cross-cultural characteristics;
- CE engagement with indigenous knowledge systems that model bottom-up approaches produces socially and culturally relevant solutions to the challenges of changing linear systems;
- Aloha 'Āina and other indigenous knowledge systems have struggled with the linear economy in different ways; there is now an opportunity to ally and uplift to change the outcomes of how the system is functioning;
- The goals of a CE to change the status quo of linear economic systems could benefit by also addressing social justice and environmental justice issues of indigenous peoples and other peoples of color;
- Establishing networks of local-global practitioners is beneficial to solving complex sustainability issues and addressing environmental and social justice.

Through cross-cultural moderate participant observation, and international knowledge exchange between Germany and Hawai'i, we lay the foundation to put into conversation the case of Wildpoldsried as an example of the Circular Economy, and the development of circular economic production systems in Hawai'i as examples of aloha 'āina. A significant issue in Hawaii's current events is centered around local communities challenging the Thirty Meter Telescope (TMT) construction on Mauna Kea, a sacred site of spiritual-cultural significance and Hawaii's tallest mountain [74]. This event could serve as a modern example in which aloha 'āina and the Circular Economy can be employed together.

After three decades of mismanagement by state entities, thirteen observatory facilities make up the world's largest astronomy observatory complex on Mauna Kea's summit [75]. Despite the already dense concentration of observatory facilities on the mountaintop, documented mismanagement, continuous community outcry against further development, and "significant, substantial and adverse" harm to Mauna Kea caused by astronomy industry development, the controversial Thirty Meter Telescope (TMT) project would constitute an 32,375.32 m² construction footprint and extensive environmental impact as the fourteenth telescope facility. In October 2018, the state Supreme Court ruled in favor of TMT's construction due to the reasoning that despite constitutional and statutory protections, the degradation to the summit of Mauna Kea was already so substantially adverse that the TMT would have little substantial impact. Associate Justice Michael Wilson wrote in his dissent: "Under this new principle of natural resource law, one of the most sacred resources of the Hawaiian culture loses its protection because it has previously undergone substantial adverse impact from prior development of telescopes [. . .] the BLNR applies what can be described as a degradation principle to cast off cultural or environmental protection by establishing that prior degradation of the resource—to a level of damage causing a substantial adverse impact—extinguishes the legal protection afforded to natural resources in the conservation district" [76,77]. Justice Wilson properly calls out the paradox of the operation of the linear economy on the summit of Mauna Kea, that prior degradation is used to justify future degradation at the expense of culture and the environment. What kinds of solutions might the CE and aloha 'āina provide?

On a mountain peak with finite resources and space, the development timeline on the mountain is a small-scale model of a linear economy: observatory facilities were allowed to be constructed—regardless of their harmful environmental and social impacts—without firm plans for their timely deconstruction or removal. In a Circular Economy, the decommissioning process, including accountable entities and dedicated budgeting, would be included in the design and initial management plans submitted for permitting, which are then enacted as soon as a facility is rendered out of commission. Planning ahead of time, holding the producer responsible for waste management, and firm financial commitments for deconstruction are all methods that would be required within a Circular Economy. First efforts toward a circular economic redesign of telescope facilities also exist; mirror segments can be recoated instead of replaced [78], zero-discharge waste systems and chemical storage enclosures can be designed [79], and parts from facility deconstruction can be refurbished or reused to install new telescope structures, rather than enlarging the existing footprint by building entirely new structures [80]. Furthermore, new proposals for future astrophysics missions out of NASA are for space telescopes designed to study the solar system with expected launches in the mid-2030s [81]. Since TMT completion was projected for 2027, the device would already be nearing the end of its relevancy before the launch of the space telescopes less than ten years after that may define the next generation of astrophysics.

Movements by community members and allies, self-identified as *kia'i*, or protectors, have been driven by aloha 'āina to vehemently oppose the way development has been allowed to carve into the summit of Mauna Kea, beginning with the very first facilities constructed on the mountain. Recent years in the movement have gained international recognition as *kia'i* physically put themselves between Mauna Kea and heavy construction equipment hauling material to build the TMT, not because of opposition to science or development but rather in opposition to the methods in which the linear economy has allowed the continuous exploitation of Mauna Kea and the finite resources of its peak. It is on the slopes of Mauna Kea, where up to thousands have taken a stand, that the power of aloha 'āina has proved its might against the juggernaut of a profit-driven economy to the world.

6. Conclusions

In this paper, we explore the ways in which aloha ‘āina and the Circular Economy might come together as catalysts for global change. Lasting change requires creative solutions to deeply complex structural problems. The Circular Economy promotes sustainable development that contributes toward an overall harmonious society, redefining perpetual economic growth while remaining competitive. By modeling ecosystems, an economy can be designed that is more regenerative, resource-efficient, sustainable, and competitive in the marketplace. The Circular Economy is inspired by nature, and it encourages the incorporation of practices such as ensuring product integrity to keep them at their highest utility, keeping materials and resources in the economy while preserving its value, minimizing waste, and decoupling economic growth from resource use. Its genesis in Europe was motivated by not only achieving sustainability and sustainable development; it also includes the goal to eradicate social injustices, such as poverty, inequality, and environmental degradation. However, sustainability is still defined by its three pillars: environment, economy, and society, the cultural dimension is not yet fully integrated. Insights from the concept of Aloha ‘āina demonstrate the relevance of cultural sustainability as a fourth pillar of sustainable development.

Aloha ‘āina is a philosophy that has the ability to strengthen the effectiveness of the Circular Economy. It has an indigenous philosophical base, to inspire deep structural change and transform the social and economic framework of societies all over the globe. It is more than a sense of sustainability and environmentalism; it is a way of life grounded in a familial connection to place that transcends space and time, to relate to the natural world on an emotional and spiritual level. It is what guides communities across Hawai‘i today in resistance, resilience, and justice, for the earth, its resources, and its inhabitants. Together, both aloha ‘āina and the Circular Economy contribute important aspects to strive for balance that is sorely needed to change the trajectory of humanity away from resource depletion and damage, and toward a balanced, sustainable future.

As the natural systems of our world are entering a period of unprecedented change because of the impact of the linear economy, individual communities and global participants of our economy must implement local and regional interventions. We must empower and build upon the diverse knowledge systems, cultural practices, and scientific understandings of our world to rapidly change course. Engaging and uplifting indigenous knowledge systems such as Aloha ‘Āina while participating in current best practices in implementing CE can provide a broader set of solutions and possible futures for our world than either can alone.

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