Circular Economy and Aesthetics of Care

Yoana P. Pavlova, Santiago Perez, Iskra S. Simova, Alisa Korolova, Camino M. Ramón, Antonio J. Briones, Sara Bouslama

***Abstract*— There are many concerns about how fast technology affects the environment and ethical questions. Ethics in technology education is underexamined, particularly regarding sustainable innovation. The objective is to explore the 'Aesthetics of care' as a means of exploring the ethical responsibilities of technology. Can the 'Aesthetics of Care' in technological education address the issues of sustainable development and corporate social responsibility, or should the framework be focused on ethical factors? This is based on the AesThiCo project aiming to integrate ethical considerations into technological education; in order to address the importance of understanding the impact of new technologies on the environment and society. This article provides an overview of the Circular Economy (CE) and UN's Sustainable Development Goals and its role in sustainable growth, as highlighted by the European Commission's 2020 Circular Economy Action Plan. It also discusses Corporate Social Responsibility (CSR) as an essential part in aligning business practices with sustainability goals. Regarding the integration of CE, CSR, a number of practices reflecting the Aesthetics of Care that can lead to more sustainable technological development are presented. This study indicates that academic institutions and corporations should adopt this approach to improve their investment in technology for SDGs.**

***Keywords*— aesthetics of care, circular economy, UN's Sustainable Development Goals (UNSDGs), Corporate Social Responsibility (CSR)**

I. INTRODUCTION

Technological developments in recent years provide many opportunities to make people's lives easier, but they also raise many questions from a social and moral perspective. The creation of new technologies, inventions, and applications needs to be considered not only in terms of engineering thought but also in terms of the consequences that these inventions may have on the environment and the social environment.

The successful functioning of technological development and its impact on people and their environment requires a rethinking of how new technologies are learned, conceived, designed, and produced. This is the aim of the Aesthetics and Ecology in Technological Education (AesThiCo) project funded by the EU Erasmus+ program.

From the perspective of the concept of "Aesthetics of Care". Aesthetics of Care in Technological Education is a process, Its aim is ethically responsible action. The process is informed/activated by sensory experience, and shaped by knowledge and aesthetic consciousness. This entails caring for ourselves, others and the planet. We have analysed the principles of the Circular Economy and the UN Sustainable Development Goals. In addition, we have analyzed examples that highlight the link between the creation of technologies and their use with "care" for the environment and people.

More precisely, to better define what "aesthetics of care" is, and what is its role in this research, it needs to be put into context: how technologies can be designed and developed on the same wave length with the ethical principles, environmental sustainability, and social responsibility. By adding aesthetics into technological education, we might claim that future contributors will create technologies that are sensitive not only to functional or focused on business income but also to ethical concerns, environmental care, and societal care. The Circular Economy (CE) and the UN's Sustainable Development Goals (SDGs) emphasize that technology solutions must be sustainable and ethically responsible; aesthetics, therefore, stands as is a leading principle. In this paper/article, aesthetics does not lie in the philosophical aspect but in the way, technology is developed with a reflection of ethics and care.

A. Circular Economy

1) Circular Economy

The Circular Economy (CE) proposes a system in which the value of goods, materials, and resources is kept in the economy for as long as possible to break the linear take-make-dispose pattern of production and consumption. There have been a lot of academic publications on the subject in recent years and yet no consensus on a singular definition [1]. Over a hundred definitions of circularity have been compiled, resulting in the term having a variety of meanings for various people [2]. This could be due to the fact that practitioners, such as policymakers, and businesses have almost exclusively developed and driven the concept and its application [3].

The concept of circular economy is founded on a diverse set of concepts coming from different disciplines like ecological economics, industrial ecology, cradle-to-cradle design, performance economy, biomimicry, eco-efficiency, resilience science, natural capitalism, and cleaner

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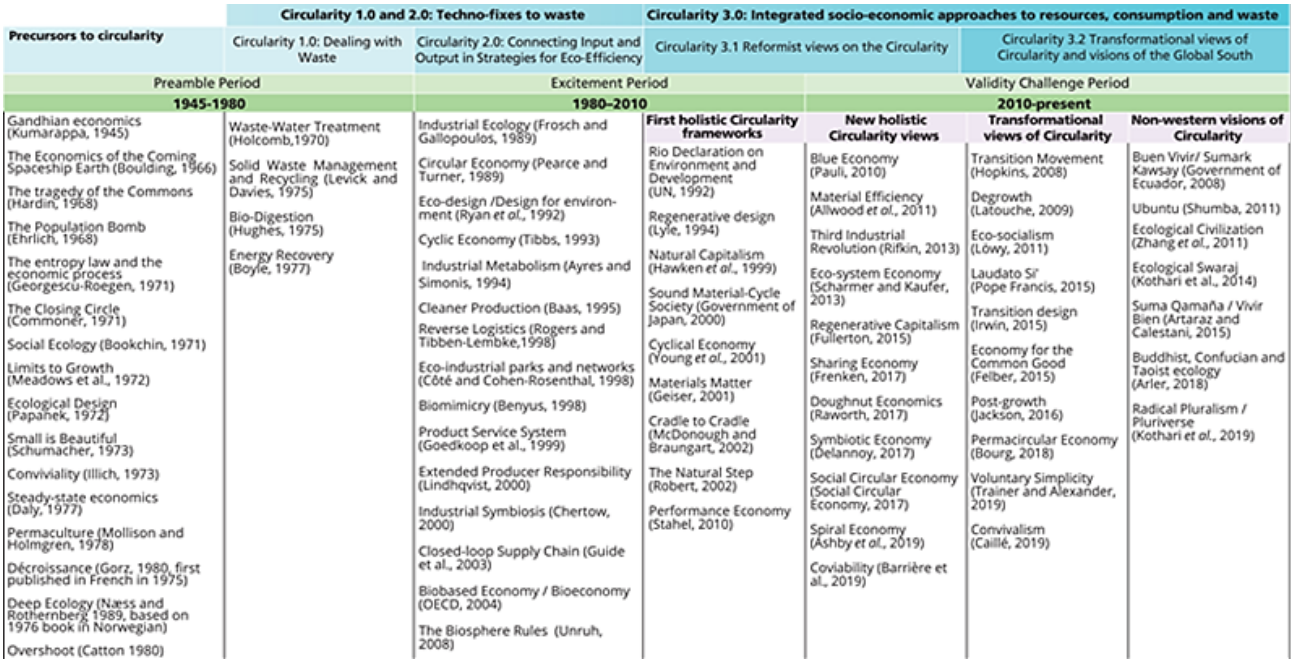

Fig. 1 Timeline of Circularity Concepts and Ideas [5].

production" [4]. However, the practice of Circular Economy has been around for more than 50 years.

Back in 1966, for example, Boulding introduced the idea of the planet Earth as a closed system with a limited number of natural resources available for human activities; then in the 1990s, the practice of Industrial Ecology became a somewhat common practice in industrial parks where waste from one industry becomes the raw material for another. Today those examples make part of the tool-set of the Circular Economy that encompasses a more holistic perspective of the circular economy, one that goes beyond the production and consumption system. Fig. 1 describes a timeline of the development of the central concepts of the Circular Economy.

2) Defining Circular Economy and Aesthetic of Care

The definition of Circular Economy is used by the European Parliament as a model of production and consumption where the life cycle of products is extended. This involves strategies such as sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible.

This idea of caring for the life cycle of products can be encompassed by our definition of Aesthetic of Care as we defined this latter as "an educational process aiming to promote ethically responsible actions. It is informed/activated by sensory experience and knowledge(s) in a relational world. It entails caring for ourselves, others, and the planet (by attending to sustainable forms of creative practice and attitudes of caring). »

Objects, through their life cycle, interact with people and other objects that assign them different values (they belong to a relational world), and depending on that value, they receive more or less care. The life cycle of an object can be extended only for its sentimental value (someone repairing it multiple times, for example), or can be shortened because of its economic value (cheaper objects are easily replaceable even when they could be reparable). Objects become subjects of care. Within the Circular Economy, and purely from a resource and economic efficiency point of view, that care is distributed according to the Resource Value Retention, that is how much economic and material value it carries depending on its life cycle stage. In 2018 a Resource Value Retention Options framework was published based on the practice and theory of the Circular Economy (Reike, 2018). Such a model is the base of the United Nations Environment Programme's (UNEP, 2019) circular economy strategy. The 9Rs or 9 Value Retention Options are subdivided into 4 categories corresponding to their impact and stakeholders (Table 1).

TABLE I
THE UNEP RESOURCE VALUE RETENTION OPTIONS

Guiding principle	User to user	User to business	Business to business [a]
R1-Reduce by design	R2-Refuse	R5-Repair	R8-Repurpose
	R3-Reuse R4-Reduce	R6-Refurbish R7-Remanufacture	R9-Recycle

Those 9R are part of the UNEP circularity approach that would guide the sustainable consumption and production strategies in order to meet the UN Sustainable Development Goals (SDG). Figure 2 shows the Circular Economy process by the UNEP.

To put into practice such strategy, technological innovations, social transitions, and new business models have been adopted. In theory, they improve together the the resources and energy efficiency, mitigating the lifecycle emission, creating more benefits, and enhancing the resources/energy security [6].

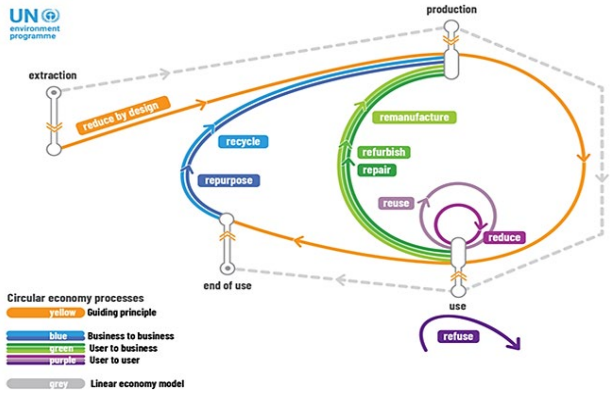

Fig. 2 The UNEP Circularity approach using the 9-RS

The lens of Aesthetics of Care specifically focused on technological education, brings a new path of reflection of the Circular Economy, one that can help generate more sustainable technological innovations, more just social transition and more adaptative business models.

3) Recent Developments in the Circular Economy

In March 2020, the European Commission presented the new Circular Economy Action Plan (CEAP), which is one of the building blocks of the EU new agenda for sustainable growth, better known as the European Green Deal. The goal is to transition to an economy that will reduce pressure on natural resources while generating sustainable growth.

In February 2021, the Parliament adopted a resolution of the CEAP demanding additional measures to achieve a carbon-neutral, environmentally sustainable, toxic-free and fully circular economy by 2050, including tighter recycling rules and binding targets for materials use and consumption by 2030. All that constitutes a prerequisite to achieving the EU's 2050 climate neutrality target and to halt biodiversity loss.

In March 2022, the Commission released the first package of measures to speed up the transition towards a circular economy, as part of the CEAP. The proposals include boosting sustainable products, empowering consumers for the green transition, reviewing construction product regulations, and creating a strategy for sustainable textiles.

The new action plan announces initiatives along the entire life cycle of products. It targets how products are designed, promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is prevented, and the resources used are kept in the EU economy for as long as possible.

Measures introduced under the new CEAP aim to:

- make sustainable products the norm in the EU
- empower consumers and public buyers
- focus on the sectors that use the most resources and where the potential for circularity is high such as: electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water and nutrients
- ensure less waste
- make circularity work for people, regions and citieslead global efforts on circular economy

For detailed information on each one of the key actions please go to https://data.europa.eu/doi/10.2779/05068, [7].

II. Circular Economy and UN Sustainable Development Goals

The 2030 Agenda for Sustainable Development, approved in 2015 by every nation that is a member of the United Nations, offers a common strategy for peace and prosperity for both people and the planet now and in the future. The strategy is divided into 17 Sustainable Development Goals (SDGs), which work altogether to address climate change, work to preserve the oceans and forests, improve health and education, reduce inequality, and encourage economic growth (see Fig. 3).

Fig. 3 The 17 Sustainable Development Goals

Each one of the SDGs carries a list of targets and indicators to assess and follow its development and implementation. In total there are 169 targets across the 17 SDGs, they are evaluated annually (SDG Progress reports) and there is a larger report called the Global Sustainable Development Report (GSDR) produced every 4 years (GSDR). The last GSDR was produced in 2019, the next will be produced in 2023.

The connection between SDG goals and Circular Economy (CE) practices demonstrates that CE practices can directly contribute to the achievement of many SDG goals. SDGs 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 8 (Decent Work and Economic Growth), 12 (Responsible Consumption and Production), and 15 (Life on Land) have the strongest ties to CE practices [8].

Circular economy uses renewable resources and renewable energy could have significant environmental benefits in the whole life cycle of products. By adopting this strategy, it will strongly contribute to environmental goals in SDGs (goals 6, 7, 12, 13, 14, 15), but moderate contributions to social aspects.

The idea of Reuse in a circular economy benefits not only environmental goals in SDGs, but also helps to generate a new market for waste collection, recycling, and remanufacturing, hence contributing to economic and social goals as well. Positive contribution is identified to goals 1, 11, 12, and 17 in social and economic dimensions.

A key aspect of the Circular economy is education. Education could promote pro-environmental behaviours that are fundamental to achieving the SDGs, and by combining technologies innovation, design for the future, and knowledge creation will lay the foundation for social transition (related to goals: 4,5,9. 10, 11, 12, 16, 17).

Some work has already been done on the relationship between the Circular Economy and the Sustainable Development Goals. Figure 4 illustrates the work done by Patrick Schroeder, Kartika Anggraeni and Use Weber, who have done one of the most comprehensive results on such relationships [8].

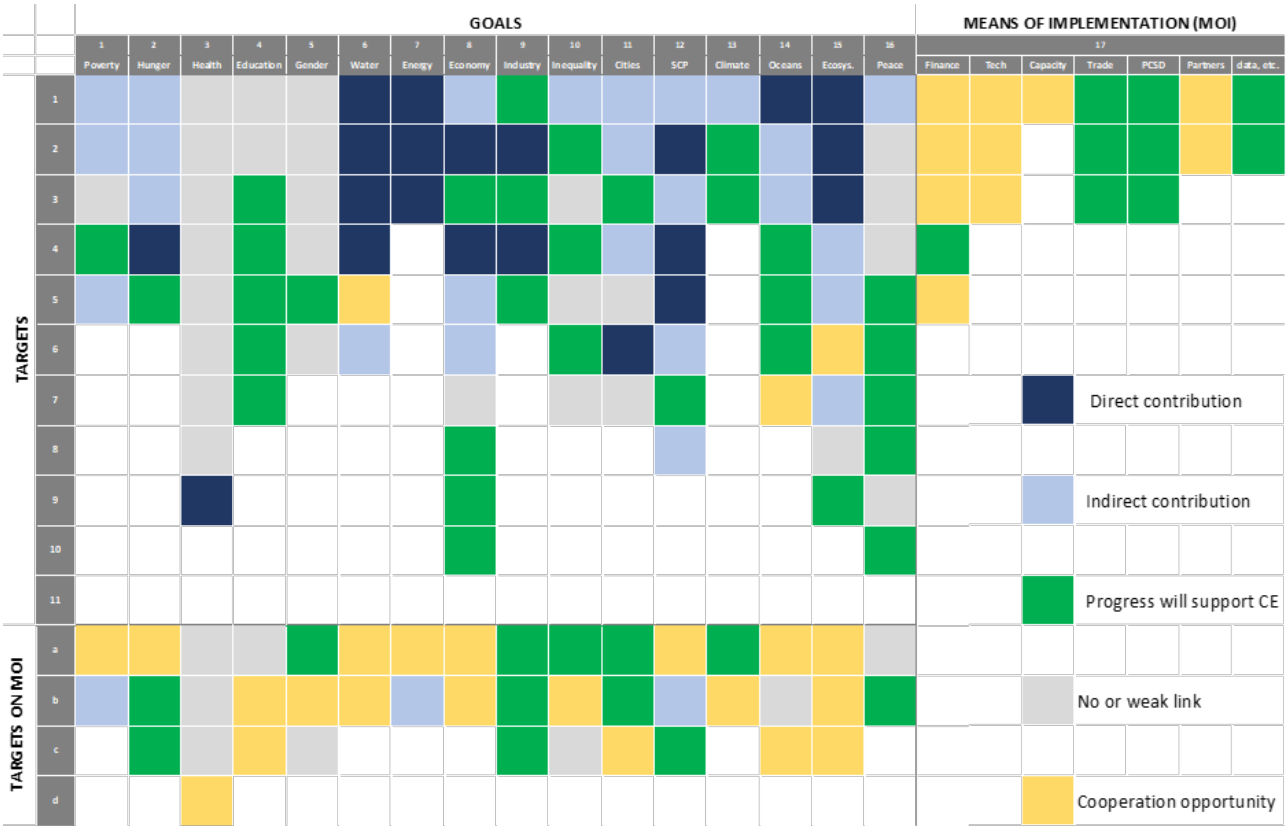

Fig. 4 Circular Economy practices for the SDGs [8].

III. Corporate Social Responsibility

Over the past few decades, the transformation of business activities has gone beyond the mere pursuit of economic and financial gains [9]. Companies now actively engage in ethical considerations and assess the economic impact of their activities on the surrounding environment, emphasizing the concept of Corporate Social Responsibility (CSR) [10]. This shift reflects a heightened awareness of CSR as a means to mitigate adverse effects on human rights and the environment resulting from business operations [11]. However, CSR is becoming more and more widespread although we can consider that in the last two decades, the debate on the strategic potential of CSR and competitiveness has increased [12], being in the last century when CSR started to be mentioned [13].

The evolution of CSR has led to the creation of indicators and standards to assess the economic, social, and environmental performance of companies, informing stakeholders and strengthening the internal culture of sustainability [14]. The approved SDGs in the Agenda 2030 have played a significant role in bringing CSR to the forefront of many companies' priorities [15].

An important challenge faced by organisations responding to the policies of CSR and its relationship with the SDGs, reflecting the importance that this entails in terms of strategic business and institutional capacities and its derivatives in terms of administration, management and the commitment that must be acquired, CSR mainly involves activities of excellence in companies, by focusing attention on those developed by individuals in working conditions and production processes with the addition of three facets or dimensions of sustainability for economic, social and environmental development [16], as well as other more recent aspects of sustainability and the agents involved, for their impact on citizenship and the environment [12].

Although CSR is key to obtaining sustainability [17], both concepts are intricately intertwined [18], promoting CSR as an autonomous contribution to Sustainable Development [19], in addition to being part of general corporate strategies [20]. Other more contemporary authors relate it to the governance of the company before the markets and stakeholders based on CSR strategic policy behaviour, ethical and responsible behaviour plus its economic and business implication in the implementation of the SDGs [21], [22]. CSR therefore manifests itself as a way of guiding business management, being an instrument or decision-making model available to companies to incorporate the correspondence between the organisation and the stakeholders linked to it, maintaining a common interest for mutual benefit. Therefore, business development measures, CSR initiatives and the SDGs lead to serious planning for responsible business management [23], [24], [25] in different areas including responsible management of education [26].

The convergence between SDGs and CSR practices acts as an essential bridge to address global challenges [27]. Companies committed to CSR contribute to eradicating poverty (SDG 1) [28] through programs promoting social inclusion, sustainable employment, and support for disadvantaged communities. In the pursuit of Zero Hunger (SDG 2) [29], CSR initiatives align with sustainable agricultural practices, reduction of food waste, and support for local farmers. CSR translates into the development of educational programs, student scholarships, and support for local educational projects in the realm of Quality Education (SDG 4) [30]. Gender Equality (SDG 5) is strengthened by CSR through internal policies, support for women's empowerment, and promoting diversity in workplaces [31]. Regarding access to Clean Water and Sanitation (SDG 6) [32], committed companies adopt practices optimizing water resource use and support community projects for universal access, demonstrating that CSR is not only compatible with SDGs but is also an effective strategy for positive global sustainability impact.

Beyond the aforementioned points, the CE can be seen as a practical sustainability tool or a starting point for achieving CSR, with both becoming increasingly interconnected concepts [33]. In other words, the concept of a circular economy contributes positively to the attainment of the SDGs [8], fostering employment, stimulating innovation, establishing a competitive advantage for companies, or preserving the environment. Moreover, CE serves as a crucial foundation, demonstrating how CSR contributes to sustainable development [33].

Approaches rooted in the circular economy can integrate into the realization, design, and development of effective CSR strategies. Companies have the opportunity to present comprehensive information on both CSR and CE in a unified report, articulating their strategies for circular CSR [34].

IV. Aesthetics of Care in Practice

Aesthetics of care can take a variety of forms and scales. Participatory actions such as co-design, participatory art, and participatory planning are often related to social justice [35]. Initiatives around the world show practices where caring for ourselves, others, and the planet overlap, thus allowing the educational process to cover various aspects of the aesthetics of care. For example, in Riga, there are various groups, initiatives and events, that promote education in aesthetics of care by using several circular economy principles, and at the same time being connected to SDGs. For instance, the Zero Waste Brothers is an organisation focused on the reuse of old materials and furniture, giving a new life to wooden pallets, wooden doors or window frames, fences, textiles, etc. in this way reducing waste. On a larger scale, there are organisations aiming for urban regeneration and adaptation of unused buildings and sites, to host new functions and thus continue the life of the building.

A combination of these principles: community engagement and co-design, reuse of old materials and regeneration of the territory, giving a new place for neighbours to meet, communicate and spend their free time, formed a basis for the initiative that took place in Imanta neighbourhood in Riga in August 2019. The event called “Imantas svētki” took place in two locations: a public park and a territory next to the Anniņmuiža (the building hosts an NGO).

Engagement of the local community in the process of regeneration of the area included: participatory art while painting the façade, creation of benches and flower beds by reusing old wooden pallets and other wooden materials, planting the flower beds, as well as other activities. The event aimed at the engagement of various stakeholders and user groups, promoting the participation of families with small children, dog owners, seniors, and people living in social housing next to the territory (fig. 5).

Fig. 5 Creation of a new flower bed and participatory art on the building facade (photo: A.Korolova).

In recent years, "senior playgrounds" have become increasingly popular [36]. These outdoor facilities are designed and constructed specifically to meet the needs of elderly people. They aim to promote physical exercise among this age group through easy and convenient design (fig. 6). Senior playgrounds attempt to address two main issues. The first is to improve the health of elderly people through physical activity, and the second is to enhance their emotional well-being by facilitating social interactions.

Fig. 6 Examples of senior playgrounds [36].

The fashion industry is one of the sectors with the most negative impact on the environment, so any initiative aimed at reusing and repurposing clothes that are no longer used has a positive impact on people and the environment. The initiative “Together in class” (Bulgaria)" links the reuse of clothes with charity and the promotion of education. Other good practices are related to remaking old clothes. Breathing new life into old clothes and unwanted materials is one of the basic principles of the Circular Economy and consumer behavior. Involving children and young people in organizing fashion shows with clothes made from old clothes is a positive step. In this way, the principles of personal responsibility and sustainability are promoted.

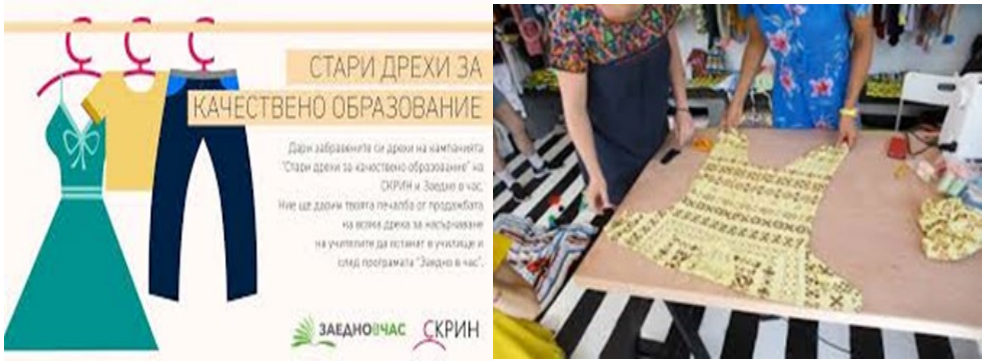

Fig. 7 The initiative “Together in class” (Bulgaria)

CIRCÚBICA, S.COOP is a Spanish company dedicated to working in the educational field using recycled materials and surplus production. Promote circular economy initiatives related to a portfolio of business services using entrepreneurial practices immersed in culture, art, sustainability, and circularity. It is a firm that seeks waste from other companies in a state of waste or surplus production, to use them again taking advantage of their potential with the transformation of industrial waste to serve in turn as innovative pedagogical tools. Among the things it does: inclusive and environmentally friendly education, incorporating unstructured and recycled materials in its classrooms, sourced from local businesses, Sustainability, education, care for the elderly and disabled in a single space for the enjoyment and benefit of the whole community (fig.8).

Fig. 8 Examples of CIRCÚBICA’s circular economy initiatives

Some examples of designs and construction elements: Play installation for the shopping centre using metal structures that were going to be discarded to build immersive tunnels, as well as cardboard and furniture to

build meeting areas; and, recreation of aesthetically friendly spaces with reusable and recycled materials from natural resources from the Region of Murcia (fig. 9). The projects in which he has recently collaborated: CIRCOTRONIC, a project promoted by the University of Kosice in Slovakia, CARISMED with CEEIM Murcia, on friendly and sustainable spaces, and Science and Water Museum of the City of Murcia (Spain). Circubica has awards for entrepreneurship, sustainability, education and circular economy.

Fig. 9 More examples of CIRCÚBICA's projects.

Building elements integrated in a nature conservation environment should be useful as resources with environmental and circular valorisation. For example, access to beaches is of great difficulty. This image of the stairs for access to Falesia Beach is an example of a construction or access with a high tourist influx in the Algarve in Portugal (fig. 10).

Fig. 10 The Falesia Beach stairs

A new specimen of seahorse captures our attention every time we walk along the Paseo Colón, in Santiago de la Ribera (Spain). The seahorse, together with "La Dorada", have been the fish that identify the coastline of the Mar Menor in the Region of Murcia in Spain, their uniqueness and beauty today as sculptures contribute to improving the tourist image of this Spanish region so devastated in recent years (fig. 11). However, these works have their origin in the Ecopark of the municipality of San Javier, where they were created with circular processes by the municipal official Mr. Teodoro Martínez Gismero, becoming today a point of visual tourist interest, the identifying resources of this coastline and serving as a cultural value to show to the citizens.

This seahorse was made entirely from recycled materials that citizens deposited in the Ecoparque, from table and chair scraps to any other material that could be used in its construction. The different pieces were fastened together with steel from the waste that was taken to the recycling centre. For the last two years, in addition to the artistic value that our eyes have the fortune to contemplate in this privileged environment, such as the Mar Menor, the Caballito de Teo is a clear example of a circular economy. This approach gives a new life to products, promoting reduction, reuse, renovation and repair, allowing the imagination to fly to create an aesthetic, ecological and unique design. Next to this seahorse, on the same promenade, is "La Dorada", which was created a year earlier with materials from the ecopark by the same official. These examples are visited by thousands of people every year and are an obligatory stop for many tourists who take the opportunity to have their photographs taken with them. We hope that this initiative does not stop here, as the new waste that enters the ecopark will surely form part of future projects at Aesthetics of Care.

Fig.11 The seahorse at the coastline of the Mar Menor

Another example of the "Aesthetic of care" practices is "Der Hörweg / The Listening Path" which is an audio trail in the forest of Dieburg, Germany. The audio trail, implemented by the Odenwaldklub Dieburg and Research Center for Digital Communication and Media Innovation (DKMI) at Darmstadt University of Applied Sciences (h_da), was created to engage the listening culture and to raise awareness of the fact that the sonic dimension of the ecological state of the environment is also reflected in a acoustic way. It is a practice that connects technology with

ecological sensitivity and community engagement. This project encourages hikers to use their smartphones to access specific sounds in different sites, which it distributes auditory content to a general public, offering a site-specific, high-quality aesthetic listening experience embedded in the everyday life scenario of a hiking path 8. The aim of the project was to make the local community more aware of their sonic environment and its significance to their regional identity. The process is using a popular hiking trail, where the individual could find eleven audio stations through the audio trail. The project highlights the sonic richness of the environment, promoting awareness and appreciation of local ecological soundscapes.

Fig. 12 The “Hörweg” project.

At the entrance of the forest, near the starting point of the Dieburg Audio Trail, an information board is set up at the beginning of the audio trail (fig. 12). It provides a brief project overview, operational and technical details, and a QR code that allows the users to access the link to download the audio trail app. At each audio station, there are designated signs installed, characterising the station’s title, a symbol and a QR code. By scanning this QR code, visitors can hear the sound associated with each station. Each listening station offers a sound that is unrecognizable and inaudible under normal conditions. These sounds reflect the sonic environment of this site. The aim is to enhance visitors' curiosity and ability to listen to natural sounds. These sounds in this place show how vibrant the environment is, making people think about the changing environment, the climate change, dangers and challenges the ecosystem is facing, and the importance of different sounds.

In this context, the technological choices may have aesthetical and environmental implications. The Audio Trail serves as a practical example of how aesthetics can be applied to its auditory use, in a way it is converted from a simple functional tool into a tool for ecological and auditory experience that can be described as a soundwalk powered by technology 9. We could state that this project serves as a case study showing how technology can be designed with both ethical and practical factors in mind. As Professor Sabine Breitsameter stated, “Another important paradox that had to be solved was the fact that hikers who are close to nature are often older people who sometimes have a skeptical attitude towards digital media and are often not very experienced in using these tools. The audio trail was therefore not only conceived as a project to promote environmental hearing, but also as a contribution to the digital transformation of society in the sense of media aesthetic education. This presented us with the challenge of developing an apparatus whose handling would not overshadow the project goals with technical difficulties” [37]. The project indeed reflects one of the aspects of "aesthetic of care" that involves community engagement with awareness and consideration of aesthetic value. Projects such as the Listening Path do engage culture with the world and mindfully with technology, with a nurture of sustainable practices and an ethical awareness which suggests an approach that draws attention on ideas from acoustic ecology, a field that deals with the relationships between individuals and their sonic environments, that focuses on the ethical necessity creating this connection between technology and nature [38]. The second aspect is tied to building the notion that care in technological education needs to be part of functionality but it also needs to consider the bigger impacts on society and the environment.

Fig.12 The “Hörweg” project information board

V. Conclusion

The age of technology we live in creates many development opportunities, while simultaneously raising numerous questions. Questions regarding the role, function, and interaction of humans with technology.

Some possible answers can be found in the principles embedded in the United Nations Sustainable Development Goals, the Circular Economy, and Corporate Social

Responsibility. What is common among all of them?

The unifying link, in our opinion, is the concept of "Aesthetics of Care." Aesthetics of Care as a principle redefines technologies that are created not only to serve people but to be mindful of them and the environment.

The provided examples show how these principles can and should be implemented in every activity. However, for their sustainability, it is necessary to conduct training, especially in engineering education, to establish the Aesthetics of Care as a fundamental thinking framework when designing and creating technologies, applications, and products.

In addition, 'environmentally responsible companies' are those that not only comply with legal regulations but also adopt an awareness to improve their productive activities, looking for technological alternatives with a lower environmental impact. To conclude, we believe that today we can talk about environmental sustainability strategies, the opportunity to improve the income of companies due to CSR strategies, with a growing interest for the shareholder, the opportunity to carry out circular economy practices, green economy, and a long etc. of terms that help to improve the quality and reliability of the CSR policy and strategy.

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