

Circular Innovation

Consultancy project with Loro Parque, EAVE and Wootpix



Cooperation between the University of Applied Sciences Kempten, Universidad de La Laguna and
Amsterdam University of Applied Sciences

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Acknowledgement

(Authorship: Christina Menhart)

We would like to extend our deepest gratitude to the companies Loro Parque, EAVE and Wootpix for the incredible collaboration throughout our Circular Innovation Bootcamp. Working together with companies in the fields of tourism, solar energy and development was an enriching experience for all students. We are very grateful that we were able to enlarge our knowledge, especially in the areas of sustainability and consultancy. However, it was not only an enriching experience on the professional but also personal level.

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Summary

(Authorship: Dario Van der Laan Chong, Yuri Schenker)

This report provides an overview of the "Circular Innovation Consultancy" project, an effort involving the companies Loro Parque, EAVE and Wootpix, along with students from the University of Applied Sciences Kempten, Universidad de La Laguna, and Amsterdam University of Applied Sciences. The main focus of the project was on circular innovation within the realms of development, tourism and solar energy. The theoretical research delves into each stage of the economy; Conventional, Green, Sustainable, Restorative and Regenerative. It systematically examines these stages to gain insights.

In the practical application, i.e. the consulting part of the project Loro Parque, EAVE and Wootpix are analyzed extensively.

It sheds light on Loro Parque's sustainability initiatives as a park in Tenerife. These initiatives include practices like reducing plastic usage, sourcing products locally (Kilometre 0), and making use of sources for energy.

EAVE is thoroughly examined as an energy company. The report provides an insight in the state of sustainability of its business model while also offering sustainability improvement advice. It dives into topics such as panels, batteries and implementation challenges to provide guidance for a more sustainable future.

Wootpix is evaluated based on its specialization, in wavefront phase imaging. The report assesses its foundation, capabilities and long-term viability.

The report provides suggestions and details the companies dedication to promoting sustainability.

The document emphasizes the connection, between sustainability and circularity underscoring the importance of an economy in achieving long term development goals. It outlines stages of the economy moving towards regeneration, which sets the foundation for implementing strategies.

With a special acknowledgement, gratitude is expressed to the companies and individuals who played a role in organizing the project and enabling the experience gained during the Circular Innovation Bootcamp. The report concludes with a list of references and sources that supported the projects creation.

Lastly this study provides an analysis of innovation, sustainability and consulting. It offers information, for companies and stakeholders who are navigating the challenges of a circular economy.

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List of abbreviations

CE	<i>Circular Economy</i>
CEO	<i>Chief Executive Officer</i>
EMAS	<i>Eco-Management and Audit Scheme</i>
EMF	<i>Ellen MacArthur Foundation</i>
IFRS	<i>International Financial Reporting Standards</i>
ITER	<i>Intituto Tecnológico de Energías Renovables</i>
PV	<i>Photovoltaic</i>
SDG	<i>Sustainable Development Goals</i>
UCLA	<i>University of California Los Angeles</i>
USP	<i>Unique Selling Proposition</i>
WFPI	<i>WaveFront Phase Imaging</i>

1. Introduction - The five stages of the circular economy

1.1 The Conventional stage

(Authorship: Suzalina Shifat)

Conventional economic framework is a system of human activities related to the activities of production, distribution, exchange and acquisition and consumption of goods and services. Conventional economy matters emphatically maintains the presumption that personal activities are sound (Green Party of Canada, 2007). This implies that judiciousness is defined as human activity in assembling desires of life, i.e. expanding fulfilment and benefit continuously based on common sense-driven needs and wants and will not act intentionally to form decisions that hurt their fulfilment and benefit. Economic framework that is broadly utilized by different nations within the world. The Conventional financial framework, too known as the classical or traditional economic system, started with the distribution of Adam Smith's *The Riches of Country* in 1776. Adam Smith's thinking motivated and had an extraordinary impact on the consideration of financial analysts a short time later as well as state arrangement creators. This Conventional economic system gives full opportunity to everybody to carry out economic exercises. Convention financial framework states that the government can take part to guarantee the smooth and supportability of financial exercises that run, but the government can too not interfere within the economy. In a Conventional economy, a citizen can oversee his claim fate agreeing to his/her capacity. Everybody's free to compete within the trade to gain the foremost benefit, as well as conduct competitions to win free races in different ways. And in the event that there are a hundred of you, they will have a place of wealth and children, and they will have no aid for the destitute. The wealthy will get wealthier and the poor will get poorer. (Tarimizi, 2020)

The flaw is that the System completely rejects the selfishness, individual authority that inhibits it in obtaining freedom of thought and action, it shows indirectly that the system is tied to the dictator's economic system. Labour was made a slave to society that forced him to work like a machine. (Tarimizi, 2020)

1.2 The Green stage

(Authorship: Sara Arbelo)

The green economy aims to balance economic prosperity with environmental responsibility and social well-being. Governments, businesses, communities, and individuals all play essential roles in driving this transformation toward a more sustainable and equitable future. In this interpretation, it represents

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a visionary approach to global prosperity that harmonizes economic progress with ecological sustainability (United Nations Environment Programme, n.d.). It's a departure from conventional models that prioritize growth at the expense of environmental degradation. Instead, it champions a holistic paradigm where economic activities integrate seamlessly with environmental stewardship and social equity (Enel X, n.d.).

At its core, the green economy redefines success by recognizing the interdependence between economic development, environmental health, and social welfare (Enel X, n.d.). It fosters innovation and encourages investments in clean technologies, renewable energy, and sustainable practices across industries.

Central to the green economy concept are initiatives that minimize carbon footprints, conserve resources, and protect biodiversity. It encourages responsible consumption and production patterns, emphasizing the reduction, reuse, and recycling of materials (United Nations Environment Programme, n.d.). This approach not only mitigates environmental risks but also drives economic competitiveness and resilience. In this sense, the green economy is a pathway towards a more balanced and sustainable future, where economic growth aligns harmoniously with environmental preservation and social well-being.

1.3 The Sustainable stage

(Authorship: Lena Winter)

There is no denying of the need for sustainable business practices any longer. Even those who only cared about the profitability of the business recognize that the existence of companies is highly dependent on healthy ecosystems as well as the stability of societies (Harvard Business Review, 2011). Sustainability, initially defined in 1987 by the World Commission on Environment and Development, describes “the balance point where the [human beings] give [the planet] back as much as they take” (Martin Brown, 2018, p.8). Beyond that, Dyllick and Hockerts state that sustainability is the ability to meet the needs of the current stakeholders of a company without compromising the needs of future stakeholders (SpringerLink, 2023). In the business context, the term “corporate sustainability” is gaining importance. It is a corporate approach creating long-term value for shareholders by including the economic, environmental and social dimensions. These three dimensions are being understood as the “Triple Bottom Line” and are also referred to as “3 P’s”, describing the People, Planet and Profit (SpringerLink, 2023).

Since sustainability is of great importance globally, the United Nations conference defined so-called Sustainable Development Goals back in 2012, which 193 countries agreed to pursue. The seventeen Sustainable Development Goals, short SDGs, take into account the “3 P’s” and are intended to share,

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compare and measure the development. The United Nations set their goal for reaching certain sustainable development indicators by 2030 (UNDP, 2023).

Sustainability is closely linked to circularity, the approach of keeping products and materials in a circle as long as possible and giving them a second life. There is no doubt that circular economy is crucial to realize the three dimensions of sustainable development, achieve the defined SDG objectives, and corporate sustainability. Hence, it can be stated that “the transition to a circular economy is a step towards sustainability” (SpringerLink, 2023).

1.4 The Restorative stage

(Authorship: Carlos Taysen Cabrera Plata)

Continuing with the explanation of the concepts that could be differentiated within the broad term of sustainability, the following is a brief introduction to the term restoration linked to the circular economy. Restoration, elementally, embodies the transformative process of returning a system, object, or environment to its former state or the state it held in its origin. This concept is deeply rooted in the fundamental principles of renewal, regeneration, and the preservation of the inherent qualities that define the entity in question. The notion of restoration is characterized by a deliberate effort to reverse or mitigate the impacts of degradation, decay, or alteration, with the ultimate goal of re-establishing the integrity, functionality, and value that the entity possessed in its initial state (Morseletto P. , 2020, pp. 763-773). Aligned with Circular Economy literature, restoration becomes pivotal for sustainable resource management and waste reduction. This holistic approach recognizes interconnectedness, fostering a regenerative balance between human activities and the natural world. It embodies a conscious effort to extend product and material lifespans, minimizing environmental impact and promoting a shift towards more sustainable practices. In essence, restoration represents a transformative paradigm that transcends past resource-depleting patterns, contributing to a harmonious coexistence between humanity and its surroundings (Perring, et al., 2015, p. 131).

1.5 The Regenerative stage

(Authorship: Vsevolod Kononov)

The final phase in achieving sustainability is characterized by regeneration. In 2012, the Ellen MacArthur Foundation (EMF) presented the idea of a circular economy (CE) the concept which involves an industrial system intentionally designed to be restorative or regenerative. It moves away from the notion of end-of-life and emphasizes restoration, transitioning to the utilization of renewable energy, and excluding toxic chemicals that hinder reuse and reintegration into the biosphere. The ultimate goal

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is to eliminate waste by enhancing the design of materials, products, systems, and business models (Ellen MacArthur Foundation, 2014).

Differentiating regeneration from restoration within the context of a CE can be challenging. According to Restore Working Group One (2018), regeneration is defined as 'enabling social and ecological systems to maintain a healthy state and to evolve,' while restoration means 'restoring social and ecological systems to a healthy state' (Brown, et al., 2018).

P. Morseletto (2020) proposes defining regeneration as the enhancement of the self-renewal capacity of natural systems to reactivate ecological processes damaged or over-exploited by human activities (Morseletto P. , 2020). The concept of regeneration finds particular relevance in agriculture, where it has evolved as a field of research and for developing practical solutions (Pretty, 1995). However, within the CE, especially in addressing biological cycles, regenerative agriculture intersects with other agricultural frameworks like organic, biodynamic, low-input, resource-conserving, permaculture, and agroecology (Pretty, 1995).

Regenerative design principles present a viable solution to address the environmental concerns in agriculture such as air and water pollution from the use of harmful chemicals, along with a substantial 39% share of energy and process-related carbon dioxide emissions (Ecolec, 2023). By emulating natural systems and processes within the built environment—comprising human-made structures and facilities—regenerative design enhances resource efficiency, minimizes waste, and bolsters resilience against the impacts of climate change (Manulife, 2023). For instance, the implementation of green roofs and bioswales proves effective in mitigating pollution runoff in urban settings, while the utilization of recycled and sustainable building materials curtails waste and mitigates adverse effects on natural habitats. Furthermore, regenerative design advocates for the adoption of renewable energy sources like wind and solar power to diminish greenhouse gas emissions (Aksamija, 2015). Embracing eco-friendly building materials and designing structures with a minimal environmental footprint, while maximizing their positive contribution to natural systems, is an integral aspect of the regenerative design concept. This involves the use of sustainable, non-toxic, locally sourced materials, and the incorporation of energy-efficient features such as rainwater harvesting systems (Ecolec, 2023).

Circular Innovation

Consultancy project with Loro Parque



By Christoph Meyer, Sara Arbelo, Jorrit Goossens,
Vsevolod Konovalov

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2. The company - Loro Parque

2.1 Intro to the Loro Parque

(Authorship: Sara Arbelo)

Loro Parque is a renowned zoological park located in Puerto de la Cruz, Tenerife, Spain. It was founded in 1972 by Wolfgang Kiessling (Davis, 2017). It's celebrated for its diverse collection of animals, conservation efforts, and engaging educational experiences. Initially established as a paradise for parrots, Loro Parque has evolved into a comprehensive wildlife park housing many species.

The park's attractions span from stunning exhibitions featuring dolphins, orcas, sea lions, and parrots to immersive habitats for tigers, gorillas, penguins, and more. Visitors can enjoy a mix of thrilling shows, interactive experiences, and educational presentations aimed at fostering appreciation and understanding of the animal kingdom. With beautifully landscaped grounds, it offers a blend of entertainment and conservation while promoting awareness about environmental issues. Loro Parque places a strong emphasis on conservation, dedicating resources to breeding endangered species, researching animal behavior, and supporting preservation initiatives worldwide (Loro Parque, n.d.).

Loro Parque has garnered global recognition for its commitment to animal welfare, environmental education, and its status as a leading wildlife destination. It has been awarded as the first zoo in the world by Tripadvisor (2017 & 2018) and the most sustainable zoo in the world by WAZA (Spain Travel News, 2023).

2.2 Current Status of the Company

(Authorship: Christoph Meyer, Sara Arbelo)

In this sense, Loro Parque is recognized for its efforts in wildlife conservation, responsibility, optimization of resources and protection of species and the environment. While it might not be directly associated with the concept of a "regenerative economy," it does contribute to several positive actions and practices related to environmental conservation and sustainability (Loro Parque, 2022).

Plastic free

They have implemented a policy of eliminating single-use plastic. For example: their restaurants use compostable tableware, they have eliminated single-dose options, their transparent packaging is made from corn and beet polymers, and they have installed water fountains in staff areas. Also, their plastic-

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free initiative extends to all departments and processes. For products from external suppliers, they have incorporated a policy of return and reuse of items containing plastic (Loro Parque, n.d.).

Kilometre 0

Loro Parque's purchasing and acquisition policy is based on the selection of Kilometre 0 products certified by eco-labels. At present, Loro Parque has its own agricultural production, which is certified by the Canary Islands Institute of Agri-Food Quality. External suppliers are only chosen when there is insufficient supply in Tenerife or the Canary Islands (Loro Parque, n.d.).

Energy and water

They optimize the use of energy and water minimizing consumption and choosing suppliers that use renewable energy sources. The fleet of vehicles in the park is being renewed with electric models with zero emissions. Machinery and systems are rigorously maintained to avoid energy leaks. 80% of the park's electricity comes from their solar plants and wind turbines. At present, Loro Parque Group generates:

4Mw of wind energy in Telde + 2Mw of solar energy in Arico + 140Kw from Poema del Mar + 2Mw generated at ITER. A total of more than 8Mw.

They continue to move towards a more sustainable future by investing in renewable energy. One of their prominent projects is the Photovoltaic Park "LORO PARQUE II," located in Arico, covering 13 hectares and with an installed capacity of 11.4 Mwp.

This park's main objective is to generate electrical energy from renewable sources and transmit it to SET ICOR through an underground interconnection line of 20 kV that stretches over 4,450 meters. The generation system is based on solar modules mounted on aluminum structures, which convert solar energy into direct current (Loro Parque, 2022).

It's essential to highlight that this project has the support of the European Union through the European Regional Development Fund (ERDF) within the framework of the Sustainable Growth Operational Program 2014-2020 and under Thematic Objective 4: "Promoting the transition to a low-carbon economy in all sectors." This reflects their commitment to a cleaner and more sustainable economy (Loro Parque, 2022).

Carbon Footprint

Loro Parque Group is a benchmark company in environmental care and responsibility. Since its inception, an intensive strategy has been developed to create sustainability-based energy policies and systems. Loro Parque achieved the recognition, after the corresponding audits, of achieving a negative

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carbon footprint in its activity, following the official criteria in force until 5 July 2023 (This has been confirmed by EMAS, TÜV Rheinland Ibérica and Biosfere) (Loro Parque, n.d.).

Currently, a regulation that does not take into account the clean energy generated by Loro Parque's wind and photovoltaic plants when calculating the carbon footprint has been implemented. This means that they no longer achieve the negative carbon footprint that the previous calculation used to determine. According to this regulation, the Loro Parque Group shall undertake other measures to comply with the required regulations, following their path of environmental commitment and business excellence and further reducing their carbon footprint (Loro Parque, n.d.).

Waste management

The waste management process is continuously optimized. All waste generated by the park and its visitors is responsibly managed by the relevant departments and removed by authorized waste managers. There are bins and containers in the facilities for the correct separation of waste and its subsequent recycling (Loro Parque, n.d.).

Composting

Loro Parque, throughout its history, has been a champion of sustainability, the rational use of resources and the minimisation of its environmental impact as the main tools to support a circular economy.

In their organization, composting is a natural step towards achieving the group's sustainability goals. This composting translates into a reduction in expenditure on phytosanitary fertilizers, thus closing the cycle of bio-waste generated by the group's activities and caring for their soils by improving the fertility and growth of plants in all their green areas and agricultural holdings (Loro Parque, n.d.).

Organic and biodegradable solutions

As part of their informative and educational work on biodiversity of the park and the planet, they opt for the use of organic and environmentally friendly phytosanitary products and fertilizers. They seek and implement as many alternatives to the use of conventional chemical products as the market offers (Loro Parque, n.d.).

Environmental Statement

Loro Parque prepares an annual environmental declaration with the aim of providing the public and other interested parties with information regarding the environmental impact and performance of the organization. This Environmental Statement is the vehicle that allows the granting of the EMAS

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standard and shows Loro Parque's commitment to achieving the Sustainable Development Goals set out in the 2030 Agenda (Loro Parque, n.d.).

For Loro Parque with millions of visitors per year details really make the difference. The results clearly speak for themselves. In 2022 Loro Parque achieved a negative carbon footprint of 13,16 gr/visitor (Interview, 2023).

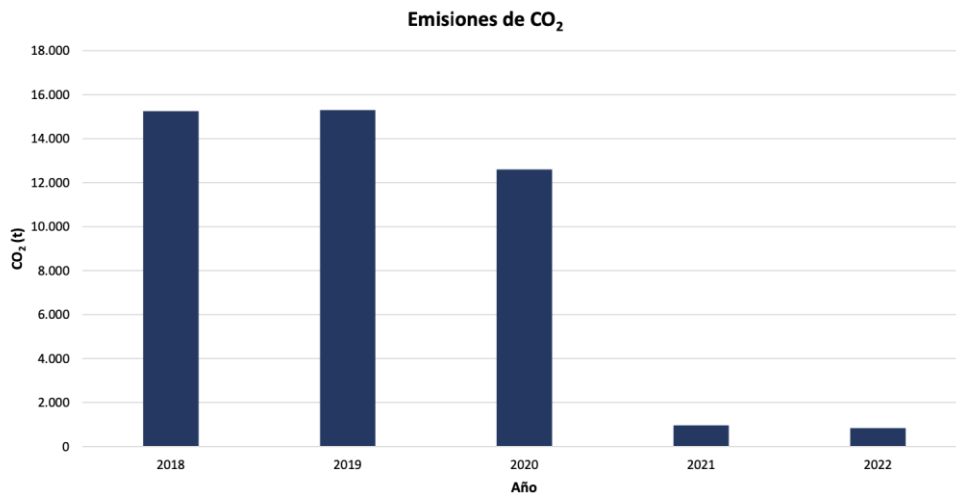


Figure 1: CO2 Emissions over the years (Environmental Declaration, 2022)

2.3 Consultancy Advice

2.3.1 General Quick Wins

(Authorship: Christoph Meyer, Vsevolod Konovalov)

Paperless Processes

During our visit to the Loro Parque, a lot of paper based processes came to our sight. Not only in the office but also in the daily count of animals. Specifically for the parrots where a stack of papers is used to be administered later on. This brings obviously a lot of disadvantages to the table and that is why a consultancy advice from our side would be the replacement of the paper based processes with digital tools like a tablet. This quick win could be realized quickly and brings a lot of benefits with it. First to mention is the digitalization aspect which would contribute with a quick and connected availability of the data for everyone in real time. This enables the administration department to easier access the data, extract the statistics and monitor everything digitally in one place. With this the employee attractiveness could be increased by handing out state of the art equipment to the employees like Apple iPads. This would then be supported by modern software products which could be purchased individually to the Zoos needs and make the daily administration workflows a piece of cake. Furthermore, not to mention the saving of countless papers in daily operations which are not needed

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anymore and the carbon footprint is reduced once more. Last but not least by carrying a tablet this can be used for documenting damages or deficiencies which are detected and they can be taken care of faster and more efficiently.

New Ticketing System

Another quick win could be realized in the ticketing process of the park and the improvement of the online ticketing services to speed up processes and add to customer satisfaction.

The status quo is that most of the people buy their ticket by queuing at one of the 2 available counters where they can buy their physical ticket and also get their invoice (2 printing processes). As the park is really famous, oftentimes the queues get really long that is why at the moment self-check-in machines are built next to the counters. A fast line is only available for the so-called “twin ticket” which is also widely promoted and grants access to both parks at a cheaper price. (Interview, 2023)

Here our suggestions would be to promote online ticketing more actively to have faster internal processes and increase the customer satisfaction by not queuing at all. We would like to propose on the one hand a new “skip the queue” process which can easily be installed. For example a simple QR Code which brings the customers directly to the fast check out in the online store could be placed more prominently at the shuttle bus, the cashiers or at visible locations all over the island. Additionally we recommend adding PayPal as well as Apple Pay to the cash out options for a quicker and easier purchasing experience.

Another idea which needs to be calculated in more detail from an economical point of view is the launch of a so-called “ECO Ticket” which is slightly cheaper than the on-site ticket (ECOTicket, n.d.). This ticket would allow an option to donate the saved amount to an animal of their choice (in a playful way/Gamification). We assume that many people would choose this option so the financial impact would not be as big and still the park would save on paper for tickets and for printing the bill at the counter.

Kinetic Panels

One of the future's most promising inventions for the park to decrease the carbon footprint and at the same time not impact the visual experience of the Loro Parque could be the innovation of Kinetic Panels. These panels installed for example in the ground or pathways generate energy solely by stepping on it and charging a battery through kinetic energy (Energy Floors, 2022).

In the Zoo we could imagine this technology in many places such as:

- Use it on the main paths where a lot of people walk
- Use it on the kids playground

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- Use it in the gorilla cage as a toy
- Use it at the counter where people queue

Still the technology is really expensive (around £80 per square foot) and in its starting points but a small kinetic area to be a pioneer in this technology could be a game changer (Switch Plan, 2022).

To be more concrete, companies like PaveGen try to bring this technology to bigger companies, events and public places (Hawkins, 2022). As a reference also Coldplay used this technology on the floor of the spectators room to make their world tour more eco-friendly and regenerative (Kennedy, 2022).

Offset Program

In the Sustainability Report for 2021-2022, an increase in duty travels was observed (Loro Parque, 2022). According to the interview, Loro Parque sponsors approximately 20 management duty travels monthly (Interview, 2023). When the management chooses air travel instead of alternatives such as ferry, the proposal is to participate in the Offset Program. This program serves as an incentive to counterbalance CO2 produced by the company by compensating it through sustainable practices or supporting environmental associations focused on wild forests. The aim is to not only reduce CO2 emissions but also increase accumulated donations (IATA, 2022).

Loro Parque has three potential avenues for obtaining donations through the offset program. Firstly, the zoo has saved at least 12 types of parrots from the endangered risk of disappearing, continuing their efforts to save animals and birds (Loro Parque Foundation, 2022). Secondly, the Loro Parque Foundation focuses on caring for newcomers to the world. Thirdly, Loro Parque already produces approximately 60-65% of its electricity from renewable sources, primarily generated by solar panels (Interview, 2023).

As a national flag carrier, Iberia began an offsetting program last year (Iberia, 2022). They closely collaborate with CHOOOSE, a Norwegian non-profit organization. CHOOOSE focuses on nature-based solutions, enhancement of sustainable aviation fuels, community projects, and carbon removals (CHOOOSE, n.d.).

In May 2021, Vueling, a Spanish low-cost carrier, launched a new carbon offset program in collaboration with the non-profit organization ClimateTrade (BAA Training, 2023). The program allows passengers to offset the carbon emissions from their flights by supporting renewable energy and reforestation projects (ClimateTrade, n.d.). On the other hand, Binter, a regional airline in the Canary Islands, directly partners with various environmental projects, including the conservation of endangered animals, healing animals, and the conservation and maintenance of wildlife forests in Tenerife (Binter, n.d.).

The ideal solution here is to partner directly with Binter, which involves less bureaucratic work and is easier to implement. However, the other two options seem more beneficial due to their extensive network and the number of passengers they serve yearly. In the end, all options will compensate Loro Parque for CO2 emissions and potentially bring additional investment.

2.3.2 Solar Panels without visual impact

(Authorship: Sara Arbelo, Vsevolod Konovalov)

Solar Windows

In the current landscape of sustainable technology, a groundbreaking innovation is taking shape—the development of solar windows. These windows seamlessly integrate renewable energy with aesthetic appeal, making them particularly well-suited for incorporation into commercial and public spaces.

The solar windows feature electricity-generating liquid coatings, representing a significant advancement in sustainability. Transparent and ultra-lightweight, these coatings efficiently capture energy from both natural and artificial light sources. Notably, they possess a self-charging capability, applicable to various surfaces such as glass, flexible plastics, and films (SolarWindow Technologies, Inc., n.d.).

Looking ahead, the anticipated commercial launch of these solar windows is set within the next three years (Pickerel, 2023). This timeline reflects the confidence in their potential to provide an unmatched solution for businesses seeking to increase photovoltaic production while minimizing the visual impact on their customers (Masterson, 2023).

This innovation holds particular significance for companies committed to enhancing their sustainability practices. By seamlessly integrating renewable energy production into the very architecture of their spaces, businesses can contribute to a greener future while respecting the aesthetic preferences of their customers. The transparent and flexible nature of these solar windows ensures that the visual harmony of commercial and public spaces remains uncompromised.

Solar Panels

Solar panels are devices that convert sunlight into electricity using photovoltaic cells. They're made up of multiple solar cells, typically composed of silicon, that absorb photons from sunlight. When photons

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hit these cells, they knock electrons loose from their atoms, allowing them to flow and create an electric current (SolarPower Europe, 2023).

Some of our ideas in solar panels, in order of reducing the visual impact are:

Transparent panels

Transparent solar panels are a groundbreaking technology that aims to integrate photovoltaic capabilities into transparent surfaces, such as windows or glass facades, while allowing light to pass through. Research and development in this area were quite promising, but large-scale commercial availability might still be in the developmental phase rather than widespread use (Smith, Johnson, & Davis, 2023).

These transparent panels use innovative materials and technologies to harness solar energy without significantly compromising visibility. They often employ transparent conductive coatings or organic photovoltaic materials that can absorb light in the invisible spectrum (like ultraviolet and infrared) while allowing visible light to pass through (García-López, Montano, & Melgarejo, 2023).

Some companies and research institutions have been working on these technologies. For instance, Ubiquitous Energy is a company that has been focusing on transparent solar technologies, developing clear photovoltaic coatings that can be applied to glass surfaces (Ubiquitous Energy, n.d.). Additionally, research groups in various universities, such as Michigan State University and the University of California, Los Angeles (UCLA), have been actively exploring and advancing transparent solar cell technologies.

The goal behind these transparent solar panels is to enable their integration into everyday infrastructure like windows, buildings, and even mobile devices, thereby allowing these surfaces to generate electricity from sunlight without obstructing the view or functionality of the surface they cover (García-López, Montano, & Melgarejo, 2023).

Palm tree shaped panels

“Palm tree panels” refer to an innovative concept of integrating solar technology into artificial palm trees, allowing them to harness solar energy while maintaining their aesthetic appeal (GreenTech Solutions, 2023). This specific concept might be more of a creative idea or a design concept rather than an established technology widely available in the market.

The idea behind integrating solar technology into palm trees or similar structures could involve incorporating solar panels into the design of artificial tree structures. These panels would mimic the shape or surface of palm leaves or branches, effectively camouflaging the solar cells within the tree's

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design. This integration could serve dual purposes of providing an attractive landscaping element while generating renewable energy.

However, it's important to note that while there are many innovative concepts in the realm of solar energy, not all ideas or designs become commercially available products. Ongoing advancements in solar technology may lead to creative and aesthetically pleasing ways of integrating solar panels into various structures and designs in the future.

Camouflaged panels

Camouflaged solar panels are a creative approach to integrating solar technology into various surfaces and structures in a way that blends with their surroundings, making the panels less noticeable or even indistinguishable from the environment. These panels are designed to match the appearance of the surface they cover, whether it's a building facade, a roof, etc. (Clean Energy Innovations, 2023).

There are a few ways this can be achieved:

Color Matching: Solar panels can be manufactured in different colors and shades to match the color of the surface they're installed on. For instance, panels can be made in earth tones to blend with rooftops or designed with patterns to mimic the appearance of certain materials.

Custom Designs: Customizing the shape and design of solar panels to fit seamlessly into the structure can make them less conspicuous. For example, panels can be made in irregular shapes or cut to fit specific architectural elements.

Invisible Mounting Systems: Mounting systems that hide the edges and hardware of solar panels contribute to their camouflage. Flush or integrated mounting minimizes the visual impact of the panels. Camouflaged solar panels offer an aesthetic advantage, especially in settings where the appearance of traditional solar installations might be less desirable. They can be particularly useful in historical areas, urban landscapes, or places with strict aesthetic regulations, allowing renewable energy integration without compromising visual appeal. While this concept holds promise, widespread adoption might depend on further advancements in technology to improve efficiency and reduce costs.

Parking solar panels

Solar panels in parking lots serve a dual purpose: providing shade for parked vehicles while generating renewable energy. These installations often involve canopies or structures topped with solar panels that are strategically placed over parking spaces (Vickib, 2023). These solar carports offer several advantages:

Renewable Energy Generation: Solar carports generate electricity from sunlight, which can be used to power the facilities nearby or fed back into the grid, contributing to renewable energy production.

Shading and Protection: They provide shade for parked vehicles, reducing - interior temperatures during hot weather and protecting cars from the elements, such as rain, hail, or snow.

Space Optimization: Parking lots are typically expansive, and utilizing the space - above parking spaces for solar panels maximizes energy generation without using additional land.

Electric Vehicle (EV) Charging Integration: Some solar carport installations include charging stations for electric vehicles, encouraging the use of clean energy for transportation.

These installations vary in design, size, and capacity based on the location, available space, and energy needs. They're increasingly popular in commercial settings, universities, and public facilities as part of efforts to promote sustainability and reduce carbon footprints. Additionally, government incentives and policies supporting renewable energy adoption have encouraged the installation of solar carports in various regions.

2.3.3 Composting

(Authorship: Jorrit Goossens)

Loro Parque generates a lot of organic waste in its park. The biggest part of the waste comes from the foods the animals eat in the park that are leftover. The consumables of visitors of the parks and the restaurant of Loro Parque generate a considerable amount of food waste as well.

Open air composting

Currently Loro Parque composts using an open air composter, an effective motive of composting for vegetables and fruits. However, open air composting comes with negative effects as well (Direct Compost Solutions, 2022).

Insects, pests and bad odors

Bad odors are generally generated at open air composters, this is due to the rotting process that takes place in composting and it being open air, it easily spreads the bad odors and attracts insects and pests. This smell was profound when we were shown the open air composter, whose garage door quickly closed due to the smell that would spread. Around the open air composter are a lot of flies, which again indicates the attraction of insects and how unhygienic it is (Harris, 2022)

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Compost process

The process of composting using an open air composter takes around 5 months according to Loro Parque and is dependent on the weather conditions. The colder it gets, the slower the process will be, due to the necessity of heat.

The process of composting demands an employee or multiple employees to monitor, water, turn and spread the compost. This must be done to lower the chances of mammals, insects or pests away from the compost. Keeping them away is the most important, because some of these mammals, insects or pests could carry illnesses that would be dangerous to the animals in the zoo. The nitrogen and carbon levels must be checked to keep the balance between dryness and wetness. All these processes must be done for a good quality of compost.

Separating

Open air composting requires the park to separate its organic wastes, due to the limitations of the composting method. Open air composting is only able to compost vegetables and fruits and is unable to process meats, dairy and processed foods. Part of the animals Loro Parque holds eat meat, where the leftovers have to be thrown away because it cannot be composted in the current situation. Another part of the waste is created by humans, the visitors and the employees of Loro Parque who throw away processed leftover food waste, which is unable to compost in the current method Loro Parque uses to compost.

Mechanical composting

Mechanical composting is a very efficient method of composting organic waste. To compost large amounts of waste quickly, mechanical composting is preferable, especially when you need it to compost all organic waste (Vickib, 2023).

Compost process

A mechanical composter encases compost which benefits the compost process and the odors compost creates. The odors are kept within the machine and should not attract insects or pests in the vicinity.

How mechanical composters generally work is that the organic material is placed in the composter and after that there is nothing in terms of monitoring, turning, watering or spreading an employee has to do. The composter itself will heat up the compost to kill all pathogens and weed seeds (Deziel, 2023).

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To speed up the process, mechanical composters could have machinery to tumble the compost, to dry the compost quicker which is more efficient in terms of time.

One drawback is the space it will need, the machine itself and the semi-composted soil need space. Because the mechanical composter creates semi-composted soil, the semi-composted soil needs to be stored to further compost. This will require extra storage space for the semi-composted soil.

Having all these accelerating effects on the composting will make the process take around one week of processing time for the compost to be ready.

Separating

The mechanical composters are able to make compost from any organic waste (wood or high fiber organic waste is recommended to be made in small pieces). Because it can make compost from every type of organic waste, you won't have to separate any organic waste. This eliminates the time consuming process of separating all these types of organic waste and enables you to easily get rid of your waste yourself.

Energy consumption

One of the only negative effects of a mechanical composter is the energy it will need for the composting. The heating process and the turning process within the mechanical composter will need energy.

Maintenance

The mechanical composter will need maintenance, the machine must be kept in great shape by engineers to keep the machine running. The cost of buying the machine is already expensive, with poor maintenance it will be more costly than keeping it maintained.

Conclusion

Mechanical composters will be better than open air composters and enable Loro Parque to compost every type of organic waste, which is good for all the parks and the restaurant. The mechanical composters will not attract any rodents, insects and pests, which would be safer for the zoo animals who could bring illnesses. The biggest upgrade to the open air composter will be the fact you will need less regular work for the process of creating compost, where the mechanical composter will only need regular maintenance checks for the machinery and the state of its components.

Going to the mechanical composter is recommended to make composting more efficient and cleaner. The only reason that could hold Loro Parque back is the amount of money it will cost to buy the new mechanical composter. To fund this, there should be a look at how much Loro Parque could save per year in costs of separating and the lesser amount of time needed for workers to manage the mechanical composter compared to the open air composter.

2.3.4 How to become a regenerative business

(Authorship: Vsevolod Kononov)

In the landscape of sustainability, businesses are increasingly turning to a transformative approach known as regenerative business. This philosophy goes beyond conventional sustainability measures, aspiring to actively restore and revitalize natural and social systems while generating long-term value for all stakeholders involved. As we delve into the realm of regenerative business principles, we will explore how Loro Parque can further align itself with these transformative ideals. Below are five regenerative business principles that we will study in detail, applying them to Loro Parque's practices and providing suggestions for improvement (Awardaroo! , 2023).

Systems Thinking:

In embracing regenerative business practices, Loro Parque demonstrates a profound commitment to systems thinking. The institution recognizes its integral role within a larger interconnected system that extends beyond its immediate boundaries. This awareness is reflected in various aspects of Loro Parque's operations.

Loro Parque approaches its operations with a holistic understanding of their impact on various interconnected systems. This includes considerations for the well-being of the animals in their care, environmental sustainability, and the broader social context.

The institution actively participates in and supports conservation projects globally, acknowledging that the health of natural ecosystems is intricately linked to the well-being of the species they care for. Loro Parque's conservation efforts extend beyond its immediate surroundings, emphasizing the importance of a comprehensive and interconnected approach to wildlife preservation.

Educational initiatives at Loro Parque Foundation play a crucial role in fostering systems thinking. By highlighting the interconnectedness of species, habitats, and human actions, the institution aims to

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cultivate a broader understanding of the intricate relationships that sustain life on Earth among its visitors, staff, and the wider community (Loro Parque Fundacion, n.d.).

Loro Parque engages in collaborative partnerships with other conservation organizations, researchers, and experts. These partnerships exemplify a systems-oriented approach, recognizing that solving complex issues requires collective efforts and a comprehensive understanding of the interconnected challenges facing wildlife and the environment.

The institution's commitment to long-term sustainability is another manifestation of its systems thinking perspective. Loro Parque understands that its actions and decisions have far-reaching consequences, and therefore, it aims to design practices that contribute positively to the overall well-being of the ecosystems it interacts with.

Holistic Approach:

The company recognizes that value creation extends beyond financial capital. Loro Parque considers natural capital by emphasizing environmental sustainability in its operations, acknowledging the critical role of ecosystems in the well-being of the species it cares for.

Social capital is a critical point, as Loro Parque actively engages with local communities and global conservation organizations. By fostering positive relationships and collaboration, the institution contributes to the social fabric and shared value creation.

Human capital is acknowledged through educational initiatives that not only enhance visitor experiences but also promote a deeper understanding of the interconnectedness of species, habitats, and conservation efforts. This investment in human capital aligns with Loro Parque's commitment to creating informed and environmentally conscious citizens.

Loro Parque's commitment to long-term sustainability reflects its holistic approach. The institution recognizes the interdependence of economic, social, and environmental factors, designing practices that contribute positively to the overall well-being of the ecosystems it interacts with.

Loro Parque can further enhance its holistic approach by broadening the scope of capital considerations. Beyond financial, natural, social, and human capital, the institution might explore additional dimensions, such as cultural capital. This could involve recognizing and preserving the cultural heritage of the communities it operates in. The zoo can actively seek partnerships with local communities, collaborating with artisans and cultural practitioners to infuse traditional art, crafts, and performances within the park.

Cultural events and celebrations can become vibrant expressions within the park, showcasing local traditions, music, dance, and culinary arts. These events are thoughtfully aligned with significant

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cultural celebrations or milestones in the local community, creating a dynamic and immersive experience for visitors.

Exhibits within Loro Parque serve as showcases that intertwine cultural history and biodiversity. Cultural narratives are seamlessly integrated into signage and information displays, offering visitors a more profound and educational understanding of the interconnectedness between cultural heritage and wildlife.

Positive Impact:

As aforementioned, Loro Parque plays a significant role in global conservation initiatives, contributing to the preservation of endangered species. The positive impact extends beyond its immediate surroundings, actively participating in global efforts to protect and rehabilitate threatened wildlife. The park incorporates sustainable practices, such as waste reduction and resource conservation, to minimize its environmental footprint. Efforts like energy efficiency and waste recycling contribute to a positive impact on the local ecosystem and promote responsible resource management. Loro Parque's commitment to biodiversity conservation goes hand in hand with positive environmental impact. The institution actively engages in projects that support the conservation of various species, contributing to the overall health and resilience of ecosystems (Loro Parque, n.d.).

On the social front, Loro Parque fosters positive relationships with local communities. The institution engages in initiatives that benefit the community, ranging from educational programs to supporting global conservation and wildlife projects, thereby contributing to social well-being. The park's educational programs have a positive impact on visitors by fostering awareness and understanding of wildlife conservation. By providing information on the importance of biodiversity and conservation, Loro Parque contributes to shaping environmentally conscious individuals. Loro Parque generates positive social impact by providing employment opportunities for local residents. This not only supports the local economy but also enhances the livelihoods of individuals within the community.

Economically, as a popular tourist destination, Loro Parque positively impacts the local economy by attracting visitors from around the world. This influx of tourism contributes to the economic development of the region, creating business opportunities and supporting local services. Loro Parque allocates financial resources to conservation projects globally. This economic contribution directly supports initiatives focused on protecting endangered species and their habitats, fostering positive change on a broader scale.

To further amplify its positive impact, Loro Parque could strategically leverage visitor engagement and global participation through innovative approaches. By incorporating gamification and interactive

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initiatives, the institution can create a more stimulating and engaging platform for individuals to contribute to conservation efforts. Here are formal proposals for such ideas:

Interactive Animal Naming Campaign:

Launch an engaging initiative allowing visitors and online supporters to propose and vote on names for animals within the park. Encourage contributions with a donation component, and prominently display the chosen names on informational plaques near the respective enclosures. This not only personalizes the visitor experience but also recognizes the donors who contribute to the campaign.

Donor Recognition Boards:

Introduce a comprehensive donor recognition program, prominently displaying the names of contributors who make significant donations to support specific species or conservation projects. These recognition boards, strategically placed near relevant animal habitats, serve as a lasting acknowledgment of the collective efforts made by the global community.

Circular Economy:

In its commitment to circular economy principles, Loro Parque has implemented a comprehensive policy to eliminate single-use plastic, extending the plastic-free initiative to all departments and processes. The park's commitment includes the use of compostable tableware in restaurants, the elimination of single-dose options, and the adoption of transparent packaging made from corn and beet polymers. Additionally, water fountains have been installed in staff areas to further minimize plastic usage. The plastic-free approach extends to external suppliers, where a policy of returning and reusing plastic-containing items has been incorporated. Loro Parque's purchasing policy prioritizes Kilometre 0 products certified by eco-labels, and the park has its own certified agricultural production (Loro Parque, n.d.).

Furthermore, Loro Parque emphasizes sustainability in its energy and water usage. The park optimizes consumption and selects suppliers that utilize renewable energy sources. The park is gradually renewing its vehicle fleet with zero-emission electric models, and machinery and systems are meticulously maintained to prevent energy leaks. A significant portion of the park's electricity, 80%, is generated from solar plants and wind turbines. The commitment to renewable energy is showcased through projects like the Photovoltaic Park "LORO PARQUE II," covering 13 hectares and boasting an installed capacity of 11.4 Mwp. This project, supported by the European Union, exemplifies Loro Parque's dedication to a cleaner and more sustainable economy (Loro Parque, n.d.).

However, despite the success of these initiatives, there is room for improvement in waste management, particularly in bio waste. Loro Parque recognizes the need for a composter, especially in light of the new law (Law 7/2022 on April 8) emphasizing a circular economy (Ferriz & Cuervo, 2023). A composter with a bioreactor, as discussed in the appendix, would not only contribute significantly to sustainability but also position Loro Parque as a strong leader in environmental stewardship within the industry.

Stakeholder Engagement:

The park collaborates with external suppliers, prioritizing those within Tenerife or the Canary Islands whenever possible. This approach supports local businesses and minimizes the environmental impact associated with transportation. The engagement with suppliers includes policies encouraging the return and reuse of items containing plastic, promoting a circular economy (Loro Parque, n.d.).

It is also important to note that we did not have the opportunity to observe the extent of involvement and engagement in certain areas, such as employee engagement and local community involvement. Due to limitations in time and focus on specific tasks, the depth of engagement in these areas was not fully assessed.

Regarding visitor interaction, all relevant information has been previously discussed in the previous sections. The acknowledgment of existing educational programs for visitors and the proposed solution for enhancement has been duly addressed.

2.4 Summary and Conclusion

(Authorship: Jorrit Goossens)

Summary

The waste of paper could be reduced significantly by digitalization. Currently the ticketing process and counting the animals at the least could be digitized by creating an app or website that is easy to use. To get people to buy digitally, we would like Loro Parque to urge visitors by placing signs or posters where people can easily scan a QR code or show the website in their advertisements.

Currently Loro Parque's employees travel by air to go to business meetings. We understand there are limited options to travel to these meetings, to which you could participate in an offset program. The offset program ensures the carbon impact of their flights to be non-existent.

Conclusion

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Loro Parque has been striving for ecological improvements by using green energy, helping animals in need or from extinction and composting. On our visit to our park, we have seen and heard a couple things that could be improved and named them accordingly in this document.

Short-term improvements

We would ask Loro Parque to seriously consider our proposals in the document, especially the ones that could be done short-term, like the ticketing system improvements, less paper waste and the offset program. The QR codes could easily be added to advertisements with the slogan to save paper and help the environment. The animal counting and possibly other systems could be digitized to reduce paper waste.

The offset program could be done quickly as well. Making the first contact with the airlines Iberia and Vueling and asking them about their program would be a good first step to more environmentally friendly flying.

Long-term improvements

The rest of the improvements will take longer to implement and would cost more than the last paragraph. The solar windows and panels suggested are still upcoming or custom, which will set a higher price to buying these panels. But definitely keep them in mind after a couple of years, since generating more energy in the park with a fitting style of solar panels would make Loro Parque even less dependent on other energy suppliers.

The mechanical composter would improve the food waste efficiency of the park, where every type of food of the restaurants in the parks and the restaurant from Loro Parque itself, will be able to compost its leftover foods using the mechanical composter. This would also mean you will not have to separate any organic foods and the park will not be dependent on other external parties to collect their waste. At last, the kinetic panels. Right now they are upcoming and are very expensive to buy for the park just now. However, it will be worth keeping an eye on the products because the prices can only go down and the efficiency of them can only go up. If the durability goes up for these panels, it would possibly be worth buying them for busy paths within the parks to generate energy. If the kinetic panels are still new to the market, it could also be very interesting to show visitors and make a special area for it to play with.

All in all, it was very interesting to get Loro Parque as a company to consult for, especially on the topic of becoming a more regenerative company as a whole. There are improvements that can be made, some easier implemented than the other. We would like to see Loro Parque make these improvements for the next generations to come.

Circular Innovation

Consultancy project with EAVE – The way to a more sustainable business model



By Elisa Brunner, Caroline Libertad, Christina Menhart,
Dario Van der Laan Chong, Lena Winter

Circular Innovation Bootcamp
Winter Semester 2023

3. The company – EAVE

3.1 Introduction to the company

3.1.1 Business model & activities

(Authorship: Lena Winter)

The Spanish company EAVE operates in the energy industry as its corporate name “EAVE”, an abbreviation of Electric Avenue, already suggests. Its foundation only lays back three and a half years, which is why EAVE still be classified as a start-up company (Linares Soto, 2023). Nevertheless, the start-up has been able to grow since its foundation in 2019 and meanwhile consists of five locations across Spain and the Canary Islands. It is based on Tenerife, Gran Canaria, Palma de Mallorca as well as Madrid and Bilbao (Neobrand, 2023). EAVE’s *raison d’être* lays in enabling their customers to reduce their carbon footprint by using the Sun as a Service (SaaS). In the bigger picture, EAVE’s goal therefore is to contribute to make the Canary Islands a paradise for the next generations by preventing the destruction of the environment (Linares Soto, 2023). The business model of EAVE is based on both, offering products as well as services. However, there needs to be stated that EAVE is not a manufacturer itself but sources its products from external suppliers to later sell and install them to the end consumer. So the start-up belongs rather to the service industry (San Román, 2023). Its key activities lay in the selling, installation and maintenance of solar panels, batteries and charging stations for e-vehicles (Neobrand, 2023). What EAVE offers in the photovoltaic sector is a tailored bundle: they ask for the exact need of the customer and based on these needs, the team recommends a suitable photovoltaic system with the demanded capacity including the installation and maintenance. Furthermore, they provide the customer with a monitoring system in order to observe the performance of the solar panels (García Díaz, 2023). Regarding the charging stations for electric vehicles, EAVE prepares the customers' homes accordingly. The company installs charging stations for e-vehicles not only in private households, but beyond that in community garages, company premises or public spaces. The key activities, the installation of solar panels, batteries and the charging stations, can be combined if requested (Neobrand, 2023). As the components for a renewable energy system are costly, EAVE’s goal is to lower the barrier for its customers by offering a special payment method. After agreeing with the customer on a tailored service package, EAVE draws a monthly fee. The customer has the option of choosing a payment method of either five or ten years (San Román, 2023). Investments in renewable energies are being subsidized by the Spanish government. EAVE therefore offers its support to their clients with filling in the paperwork for permits, subsidies or financing. In the end, EAVE wants to create value for its customers by supporting them in saving money on the energy bill (García Díaz, 2023). The business

model of EAVE is based on both, offering products as well as services. However, there needs to be stated that EAVE is not a manufacturer itself but sources its products from external suppliers to later sell and install them to the end consumer. So the start-up belongs rather to the service industry (San Román, 2023). Its key activities lay in the selling, installation and maintenance of solar panels, batteries and charging stations for e-vehicles (Neobrand, 2023). What EAVE offers in the photovoltaic sector is a tailored bundle: they ask for the exact need of the customer and based on these needs, the team recommends a suitable photovoltaic system with the demanded capacity including the installation and maintenance. Furthermore, they provide the customer with a monitoring system in order to observe the performance of the solar panels (Linares Soto, 2023). Regarding the charging stations for electric vehicles, EAVE prepares the customers' homes accordingly. The company installs charging stations for e-vehicles not only in private households, but beyond that in community garages, company premises or public spaces. The key activities, the installation of solar panels, batteries and the charging stations, can be combined if requested (Neobrand, 2023). As the components for a renewable energy system are costly, EAVE's goal is to lower the barrier for its customers by offering a special payment method. After agreeing with the customer on a tailored service package, EAVE draws a monthly fee. The customer has the option of choosing a payment method of either five or ten years (San Román, 2023). Investments in renewable energies are being subsidized by the Spanish government. EAVE therefore offers its support to their clients with filling in the paperwork for permits, subsidies or financing. In the end, EAVE wants to create value for its customers by supporting them saving money on the energy bill (García Díaz, 2023).

What differentiates this company from its competition, according to the founders of the corporation, is its customer service and satisfaction. The customer is in the center of EAVE's business model. Another key competitive advantage of EAVE is the company size. As it still has the start-up character, the communication and decision-making channels are shorter and make EAVE therefore more flexible on the market. Beyond that, EAVE is known for its quality, reliability and good reputation (García Díaz, 2023).

3.1.2 Current status of the company

(Authorship: Lena Winter)

Positioning EAVE in terms of sustainability is not easy. There is no "black-and-white" thinking when it comes to sustainability. What needs to be stated right at the beginning: just because a corporation is active in a sustainable field like the renewable energy industry, doesn't automatically make the company itself sustainable. A demarcation and a precise assessment of the company's actions are necessary.

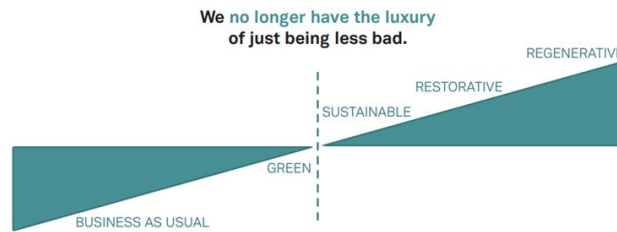


Figure 2: From Conventional to Regenerative (Working Group One)

“Conventional”, very simplified, describes the exploitation of the resources without considering the consequences in the bigger picture. In other words, conventional businesses are based on linearity (Microsoft Office User). Even though the product life cycle of EAVE is linear at the moment due to missing options of giving their products a “second life”, EAVE itself is not a conventional company. After analyzing the company’s actions, it can rather be placed in the green area. In the literature, green economy frameworks are being described as “highly relevant [...] to achieve environmental sustainability, emissions reductions, social justice, and stable economies” (Georgeson, Maslin, & Poessinouw, 2017). “Green” companies adopt environmentally friendly policies and practices and make sustainable decisions in their operations. So does EAVE. The company has its own solar panels on the roof of its offices and therefore the possibility to produce most of the energy needed in the building itself. Within the company, the EAVE team furthermore uses reusable cups and bottles and separates its trash in order to recycle. Regarding their transportation method, EAVE has switched to e-mobility, charging its cars at its very own e-vehicle charging stations, using the energy generated by its solar panels on the roof (San Román, 2023).

“A balanced framework for green economy actions must be complemented by comprehensive, relevant frameworks for measuring progress” (Georgeson, Maslin, & Poessinouw, 2017). For now, EAVE has no such thing as a sustainability policy or strategy (García Díaz, 2023). There is no way of measurement of the company’s sustainability, which is why EAVE should not be positioned in the sustainable area yet.

3.1.3 Project scope

(Authorship: Lena Winter)

As EAVE is constantly growing, so are its challenges. Due to the legal regulation that installers are obliged to take back the materials of their installations at the end of their lifetime, EAVE will be facing a big problem within the next ten to twenty years. While the lifetime of a solar panel is estimated at twenty to twenty-five years, the one of a battery is only half as long (San Román, 2023). So the main question, EAVE is searching an answer for is: What happens with the solar panels and the batteries after the end of their lifetime? For now, there is no such thing as a strategy in place. Currently, EAVE

would get in touch with the local waste government and let them dispose the products. In order to prevent large quantities of solar panel and battery waste in the upcoming decade, EAVE wishes for ideas to give its products a second life (Salesa Miguel, 2023).

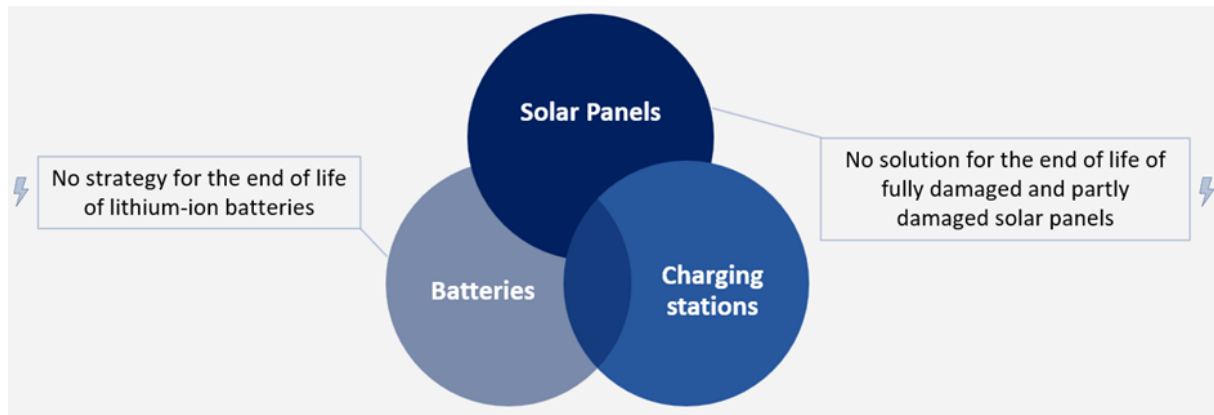


Figure 3: Project Scope

3.2 Sustainability recommendations to EAVE

(Authorship: Christina Menhart)

In the following chapter, proposals regarding the further development of the company in the context of sustainability are exhibited. Special focus will be allocated to the end-of-life management of the solar panels and batteries as requested by EAVE. In order to create a foundation for the subsequent content, the relevant fundamentals are outlined first.

It has already been stated in 1. that in order to achieve the objective of operating more sustainably, the Sustainable Development Goals have been established. They form the framework for the countries that have agreed to the conditions. Thereby, the targets can be divided into three sections: the environmental, economic and social aspects. (Strezov, Evans, & Evans, 2016, p. 242f)

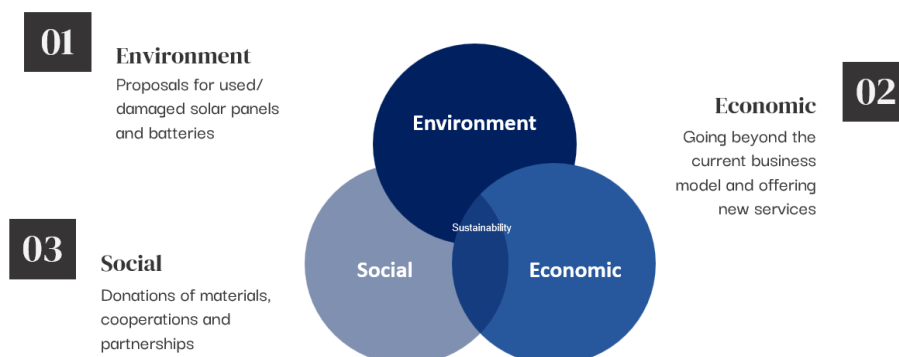


Figure 4: The three areas of sustainability (Own illustration based on (SpringerLink, 2023))

As shown in figure 4, the mentioned framework is used to divide the proposals for the company in terms of sustainable development.

Nowadays, renewable energy solutions, such as solar panels and batteries, are increasingly used to store generated energy (BP, 2022; Lehtola & Zahedi, 2019, p. 11). However, especially for installers such as the company EAVE, the challenge arises regarding the utilization of the solar system after they have reached the end of their lifetime (San Román, 2023). In order to overcome the challenges, the company is facing, several recommendations for solutions are documented in the following chapters. Thereby, the established proposals in respect to the end of the lifetime of solar panels and batteries will be considered as environmental proposals, the first sub-section of the sustainability framework. The second part, the economic aspect, focuses on proposing improvements that go beyond the current business model of EAVE. Lastly, recommendations regarding the social area will be pointed out. This includes for instance donations as well as cooperations and partnerships with other companies.

3.2.1 Solar panels

3.2.1.1 Fully damaged

(Authorship: Caroline Libertad)

The world's transition in recent years towards more environmentally friendly energy sources has resulted in a notable rise in solar panel installations. As these photovoltaic (PV) systems approach the end of their usage period, handling their end-of-life management has emerged as a major issue.

Recycling shows promise to mitigate the environmental issues surrounding the disposal of solar panels. This chapter investigates the effects of solar panel recycling, looking at the social, economic, and environmental aspects of this sustainable activity.

Considering an average panel lifetime of 25 years, the worldwide PV waste is anticipated to reach between 4%-14% of total generation capacity by 2030 and rise to over 80%, which amounts to approximately 78 million tons by 2050 (Md. Shahariar Chowdhury, 2020).

According to research done by the International Renewable Energy Agency (Weckend, 2016), cumulative waste projections will rise far sooner and more extensively than most analysts expect, as figure 5 shows.

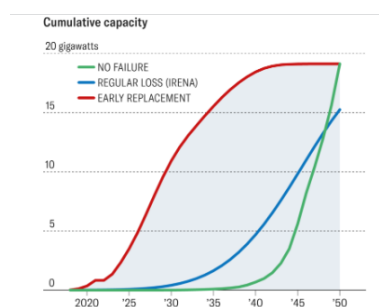


Figure 5: Cumulative waste of solar panels

3 The company – EAVE

This is the reason why finding a second life usage for their redundant solar panels is the first option that EAVE will need to consider.

Below figure 6 shows the current situation of EAVE and displays the expenses of the current process of recycling at the local waste facility.

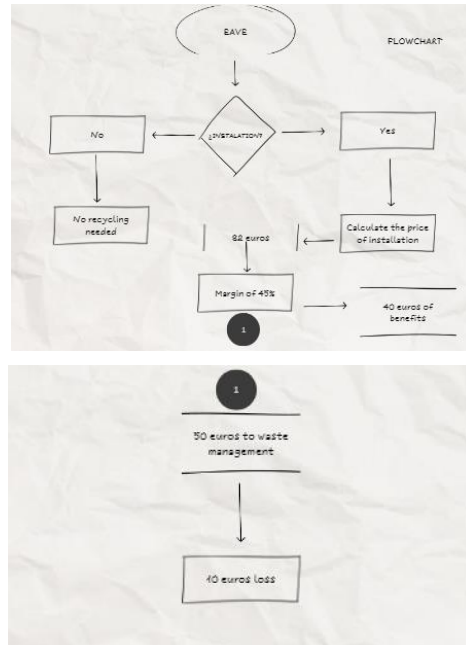


Figure 6: Expenses of solar panel recycling process at EAVE

It does not seem like a big issue now, since currently only a small number of solar modules needs to be disposed of, but in the future EAVE should be considering alternatives and firm proposals, such as donations, working with start-ups and other well-established organizations.

Fully damaged solar panels are difficult to get rid of and donating them can present several challenges, primarily due to safety concerns, environmental considerations, and practical limitations.

Nevertheless, after a dense research we found ACER which accepts donations of non-functional solar panels to use them for their initiatives and research investigations (Asociación Canaria de Energías Recovables, 2020).

ACER is a suitable proposal because it includes and represents the producers and promoters of renewable energy from the Spanish autonomous communities. Besides, the organization is responsible for developing projects to identify and spread best practice. For instance, ACER and ECORYS were awarded, together with 14 other organizations from European countries led by the Freie Universität Berlin, for the H2020 project “Community Energy for the uptake of RES in the electricity sector”. In where The Canary Islands was selected as a target region within the framework of COME RES.

In this project, they wanted to identify and study the existing potential and barriers for the development of energy communities as defined in the new EU Renewable Energy Directive (Asociación Canaria de Energías Recovables, 2020).

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Due to the increase in solar panel installations – when the life cycle comes to an end – information and preparation will be needed to know what to do with those fully damaged solar panels. This is where projects such as these will positively influence the anticipated research into proposals for this situation, which will harm the environment.

Before considering the donation of damaged solar panels, it's crucial for companies to assess the extent of the damage, potential repair costs, and the overall feasibility of making the panels safe and operational. Even though it may sound counterintuitive, in some cases, recycling or proper disposal of damaged panels may be a more responsible and environmentally friendly option.

Which led us to our second proposal for fully damaged solar panels, which is establishing a partnership with a specialized company in solar panel recycling.

Solucciona Energía is a Spanish pioneer in offering PV module recycling services through Solrecycle technology, developed by the company itself. For EAVE, it could be a suitable partner due to its service for associations, manufacturers, developers and installers.

Unfortunately, there are no local companies engaging in solar panel recycling on the Canary Islands due to the geographical source's limitations. This is the reason why we focused our research on the nearest place, mainland Spain, where also no regulatory issues are subject to rise.

The main reason why we have chosen this company is because they are willing to make photovoltaic energy a sustainable and environmentally friendly energy option, by linking with public research and technological development institutions that are constantly checking the improvement, functionality, and results of Solucciona Energía's projects.

The Solrecycle project includes both the repowering of photovoltaic panels, i.e. their repair and reuse, and their recycling or disassembly. The process begins with a visual and electrical inspection of 100% of the modules that arrive at the facilities, so that they are classified to be repowered or recycled depending on the cost of repowering and their technical feasibility (Solucciona, 2023).

During intensive research on how to give the solar panels a second life, it turned out that the first solutions – donations and recycling cooperations – can only be realized by interacting with institutions outside of the Canary Islands. The challenge is how to solve the problem without the need to leave Tenerife. One answer is local artists.

To give some context, the following is the main idea of “Solar punk”, which is an ideology that motivates modern artists to create futuristic art, bringing solar panels from our roofs into our homes.

One of the trademarks of Solarpunk is its obvious aesthetic, which combines art, technology, and nature to create new cities where gardens and solar panels are the main protagonists. Inspired by the Art Nouveau and Arts and Crafts movements, the Solar Punk aesthetic places a strong emphasis on

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"manual labor" and believes that fertile soil and vegetation are integral elements of the "New Eden" that we can create together (Solucciona, 2023).

Why put solar panels into waste when you can help local artists to get into the solar panel art movement? This niche is by no means new, so artists, architects, and designers around the world have already been implementing this vision in their art. For instance, the Dutch artist Marjan van Aubel has a studio that is building a positive future by combining the fields of sustainability, design, and technology, as displayed in figure 7. (Hahn, 2022)



Figure 7: The glow-in-the-dark tapestry (M. van Aubel), made from transparent photovoltaic cells.

There are local artists who are willing to take this step and give a renewable look to their art by accepting donations of entire solar panels or just some of the parts they need to complete their work. As the donation process can be very complex nowadays, there have been special online platforms created which will facilitate and speed up this process. For instance, Trash Nothing is an online platform that facilitates free sharing of items between people within local communities (Trashnothing, n.d.) . This platform operates through local groups where users can offer items they no longer need or make requests for items they are looking for.

In summary, the adoption of online donation platforms empowers organizations and donors alike by providing a seamless, secure, and efficient channel for supporting meaningful causes.

However, we do not rule out that EAVE may encounter some problems when finding local artists to accept fully damaged solar panels due to the associated challenges to manage them. Nevertheless, local artists often thrive on creative challenges. Fully damaged solar panels can serve as unique and unconventional artistic materials, inspiring the surroundings to explore innovative ways of repurposing and transforming them into aesthetically pleasing artworks.

Furthermore, it helps raise awareness about environmental issues in public.

It is worth noting that the success of such donations depends on the willingness and interest of local artists, as well as the extent of damage to the solar panels. Clear communication and collaboration

between donor companies and artists can help maximize the positive impact of donations. In addition, it is important to ensure that all environmental and safety issues are addressed.

3.2.1.2 Partly damaged

(Authorship: Christina Menhart)

Despite considering the arising challenges related to fully damaged solar panels, the occurrence of partially damaged panels must be taken into account as well. Partially damaged solar modules can be caused by internal failures due to installation errors. This can result in low efficiency and performance in generating renewable electricity (Badescu, Lazaroiu, & Barelli, 2019, p. 65; Tur, Colak, & Bayindir, 2018, p. 1). Furthermore, when the lifetime of the solar panels has been exceeded, the possibility for damaged solar panels increases and their performance may be reduced (Alves dos Santos, Torres, Fernandes, & Marques Lameirinhas, 2021, p. 1). For this reason, EAVE must keep the predetermined end of the lifetime of 25 years under review and reflect on possible utilization options for solar modules that can be classified in the category of the exceeded lifetime.

Therefore, this chapter contains suggestions for the possible further use of partially damaged as well as used solar panels. The solar panels that exceeded their lifetime but are still functioning to a certain extent will be considered under the partially damaged aspect. The following content will be divided into three parts: the donating, selling and repairing of damaged solar panels.

On the one hand, partially damaged or used solar panels can be donated. This has already been carried out by the solar manufacturer *LONGi* that donated solar panels to a rural village school in Spain. This has enabled the company to achieve a high level of recognition (*LONGi*, 2022). Even though the company *LONGi* donated fully functional solar panels, EAVE has the opportunity to do the same with partially damaged solar panels. This can be done through a cooperation with the company *Twende Solar* which focuses on improving reliable source of energy in developing countries (*TwendeSolar*, n.d.). The lack of energy can limit communities in their daily lives. Being able to even use partly efficient solar panels can already support the access to electricity in developing countries (*TwendeSolar*, n.d.).

Another option is to donate to regional institutions for research purposes. One example for this is the Spanish institution of solar energy at the Universidad Politécnica de Madrid. Among other aspects, this institution is investigating solutions to the challenges faced by solar panels – from the source material to the solar system installation in the scale of utility (Universidad Politécnica de Madrid, 2023). This information can also be useful for EAVE in order to obtain knowledge and insights about possible future developments of solar panel systems.

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Conducting donations may involve a lot of effort. However, it offers several benefits, because in addition to the possible greater publicity, donations of solar panels can be tax deductible. Nevertheless, this depends on the location of the business and the organization which the company wants to donate to. For this reason, EAVE must personally contact the respective organization and clarify the legal framework of such a donation (Solaria, 2022; Europe Transnational Giving, 2016, p. 1f).

By implementing the mentioned proposals, damaged solar panels do not have to be disposed at local waste dumps. This can improve the company's environmental and social situation, as waste can be reduced by reusing the product.

On the other hand, EAVE could use the online selling markets for solar panels. Hereby, used and damaged solar panels can be sold through online market platforms. One example is the Spanish resell platform *SoloStocks*. This organization was founded in the year 2000 and has an international offer in over ten countries, including Spain. To be able to sell solar panels through *SoloStocks*, a registration on the platform is required. The registration cost for the basic use packages is approximately 75€ (SoloStocks(A), 2023; SoloStocks(B), 2023).

Another online selling market for solar panels is the German resell platform *SecondSol* (SecondSol(A), 2023). Like *SoloStocks*, *SecondSol* consists of suppliers from more than ten countries, including Spain. The costs for the registration depend on the chosen package. For the company EAVE, the free package or basic package, which amounts to roughly 20€ per month, is recommended for the start. As EAVE has until today on average less than five damaged solar panels a year (San Román, 2023), the costlier packages with the opportunity to list more than five products are neither necessary nor profitable for the company at this point (SecondSol(B), 2023).

Furthermore, the opportunity to repair the partially damaged solar panels should not be neglected. This can be done by a cooperation with the repair service company *Iberdrola*, which has several office locations in Spain as well as in Santa Cruz and Las Palmas (Iberdrola(A), 2023). In general, Iberdrola offers three different repair service packages that can be chosen from. Depending on the service, the costs range from 5,99€ up to 8,41€ per month (Iberdrola(B), 2023).

It should be mentioned that not many repair services exist on the Canary Islands and Spain apart from Iberdrola. It may be an opportunity for EAVE to fill the gap in the market by establishing a repair service business. As this would be an entire new business model for EAVE, a *Sustainable Global Business Model Canvas* was created as a proposal for the establishment of a repair service for partially damaged solar panels. It should be noted that the following *Sustainable Global Business Model Canvas* is intended to serve as a guideline. The detailed planning must be carried out by the company itself on the basis of internal and selected relevant information.

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Key Partners  - Solar panel installers - Repair equipment manufacturers	Key Activities  - Repairing broken solar panels Key Resources  - Equipment/ tools for repairing solar panels - Service team/ employees (knowledge)	Value Propositions  - Closing the lack of repair service of solar panels - Increased number of customers due to the offer of repair service - Increase in sustainability	Customer Relationships  - Personal and friendly partnership - Giving the customer the opportunity to repair their solar panels and become more sustainable Channels  - Website - Social media (LinkedIn, etc.) - Face-to-face (WOM)	Customer Segments  - Solar panel owners located in Tenerife or Spain - Already existing customers of EAVE - Solar panels owner that require repairment for their solar panel installation
Cost Structure  - Transportation costs (if repair on site not possible) - Purchasing costs (Equipment/ tools) - Staff costs - Energy costs for way to customer (Charging electric vehicles)		Revenue Streams  - Monthly/yearly fee for repair service - Fee per service		
Eco-Social Costs  - Ecological: equipment costs + costs for recycling (in case it will break) - Social: salary costs (repair experts), training costs		Eco-Social Benefits  - Ecological: increasing lifetime of solar panel, reducing waste - Social: increasing staff jobs, changing mindset of customers towards sustainability		

Figure 8: Figure 8: The Sustainable Global Business Model Canvas for the repair service of solar panels (Own illustration based on (Cardeal, Höse, Ribeiro, & Götze, 2020), see appendix 1)

The *Sustainable Global Business Model Canvas* is created to show how the company to be developed operates and what value it proposes (Cardeal, Höse, Ribeiro, & Götze, 2020, p. 1). Therefore, the model comprises eleven key elements, as shown in figure 8.

Firstly, the *value proposition* of the repair service of solar panels must be defined. This includes closing the shortage of solar panel repair services in Spain and the Canary Islands. Therefore, more solar panel customers have the opportunity to repair their damaged solar systems instead of sending them back to the manufacturer or to landfills. Due to the reduced waste, the degree of sustainability can be increased.

The *customer segment* of the service can be solar panel owners who require repairs for their solar panel installation settled close to EAVE's current locations - in Spain and on the Canary Islands. In addition, the customer segment also includes the company's existing customers, as they may need this service in the future, especially after the solar panels have reached the end of their service life. As the customer segment consists of existing clients as well, the *channels* through which the potential customers can be reached should also include the existing channels. This will ensure that, in addition to the new customers, the current ones who may be using EAVE's channels will be aware of the new service offering as well. Therefore, the new business model can be published on the company's website (EAVE(A), 2023) and on social media channels, for instance on LinkedIn (EAVE(B), 2023) and Instagram (EAVE(C), 2023). To reach a new segment, the principle of word-of-mouth can be applied (Bughin, Doogan, & Vetvik, 2010). This means that the company can talk face-to-face with people living in Spain and on Tenerife and recommend its new repair service offer to them.

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The *customer relationship* involves a personal and friendly interaction between the buyer and the service provider. As EAVE is still a start-up company and in the process of building up its customer base, a closer relationship with the clients is mutually beneficial. Moreover, the repair service offers solar panel owners the opportunity to reduce waste generation and thus act more sustainably. This can lead to customer satisfaction and may increase the appreciation of the company.

As it has already been stated, the *key activity* of the new business model is the repair of damaged solar panels. In order to execute this service, certain *key resources* are required. Firstly, a service team with the required expertise and knowledge for repairing the solar system is needed. Secondly, the necessary equipment must be acquired. This can be done through a partnership with manufacturers of repair equipment, who will then be one of the *key partners*. Another possible key partner is solar panel installers. Since there are not enough repair service offers, other solar panel installers can recommend the new service to their customers when the challenge of damaged solar panels arises.

The model explained can be used to generate an additional *revenue stream* to the existing ones. This can be done by introducing either a monthly or annual fee or a fee per service, depending on the damage of the solar panels. Besides investigating the revenue stream, the arising *cost structure* must also be considered. The new equipment and the required expertise of the employees result in acquisition and personnel costs. The staff costs can consist out of the salaries for new employees as well as training costs for existing ones. However, this can generate additional expertise and extend the knowledge base of the company. As the people responsible for repairing the solar panels have to travel to the customers to inspect the solar system, travel costs will occur. Nevertheless, as EAVE uses electric vehicles which are powered by the regenerated energy from solar panels on the roof of the company's office building, travel costs can be kept low. Electricity costs for the cars only arise if the solar system cannot provide the company with sufficient energy, for instance, due to bad weather conditions. There may also emerge situations where the solar panel system cannot be repaired at the customers' location. Costs may therefore be incurred for transporting the product to the company.

As the model is a sustainable framework, the *eco-social costs* and *eco-social benefits* must be mentioned. By opening up the new business, certain eco-social costs can occur. On one hand, it is required to purchase additional equipment which may be made out of non-renewable resources. Hence, before the purchasing the company has to ensure and invest in the recycling process in case a tool will break. On the other hand, as new jobs are created, social costs will occur. It is required to train existing staff in order to acquire additional expertise and knowledge about repairing a solar system. The final element of the business model is the *eco-social benefits*. On the ecological side, these include extending the lifetime of the solar panels and reducing the amount of waste. On the social side, there

is the creating of jobs for employees and the opportunity to change customer attitudes towards sustainability as less waste is generated.

In summary, by introducing the repair service as a new business model, EAVE is not only acting positively regarding the environmental aspect of sustainability but is also taking economic and social aspects into account.

3.2.2 Batteries

(Authorship: Dario Van der Laan Chong)

Modern life would not be possible without batteries, which power everything from electric cars to cellphones. However, batteries can present a serious environmental risk when their useful lives are coming to an end. As EAVE is installing many batteries with their solar systems, it is essential to understand what happens when they reach the end of their life span and how the sustainability of this process can be improved.

Battery recycling has two primary issues. First off, compared to solar panels, the field of battery recycling has received considerably less attention. Second, the hazardous components in batteries make the recycling process more difficult, which is even worse for research.

We will look at two ways to make the battery recycling process more sustainable in this chapter. Working with businesses that specialize in battery recycling is the first solution. Spain's mainland is home to several businesses, and the sector is expanding. Donating to nearby research centers or universities is the second option. Contributions to two organizations that concentrate on sustainable energy research, ACER and SELF, may enhance the sustainability of the battery recycling process.

Recycling in Mainland Spain

Novolitio is a company that specializes in the recovery and recycling of lithium batteries for electric vehicles in the Iberian Peninsula. As part of Endesa's Futur-e Plan, which intends to create new, long-lasting economic activity in the area, the company was created in 2018. About 50 jobs will be created by the new facility, whose construction is scheduled to start in the second half of 2023 and be situated in the El Bayo Industrial Estate in Cubillos del Sil. The installation, which is a component of Endesa's Futur-e Plan aimed at fostering new, enduring industrial activity in the region, will cost €14 million. The facility will determine which batteries still have a further purpose and to which it will be possible to give a second life. The others will be subjected to a process to extract the elements of which they are composed, recovering value from about 90% of them (Endesa, 2022).

Recyclia is a waste management company that specializes in the recycling of electronics and batteries. They emphasize the importance of improving Spain's recycling capacity in order to recover valuable

materials such as silicon and maintain the long-term survival of the solar business. They have collected and recycled over 415,727 tons of rubbish since they began operations, thanks to the largest electrical and electronic trash collection network in Spain (Recyclia, 2018).

Recycling in Tenerife

Ecoasimelec is a non-profit organization based in Madrid, Spain. They work towards proper electronic and electrical waste management and environmental protection. They provide battery recycling services, particularly those used in solar panels. They also provide additional services such as electronic waste collection and treatment, hazardous waste management, and vehicle disposal (RAEE andalucia, 2017).

Ecolec is a non-profit organization that collaborates with manufacturers, distributors, and trash management companies to guarantee that electronic waste is disposed in an eco-friendly way. They provide a variety of services, including as hazardous waste management, end-of-life vehicle management as well as the collection and treatment of electronic waste. Additionally, they strive to increase public knowledge of the significance of appropriate waste management and the environmental effects of electronic trash (Ecolec, 2023).

End of Life

The end of the guarantee period for batteries is a critical issue that needs to be addressed. After the warranty period, the risk of facing a lot of disposals increases, which can lead to environmental pollution and other hazards. To avoid this, it is essential to find alternatives to local waste facilities. It is also important to note that the European Union has recently adopted new regulations that strengthen sustainability rules for batteries and redundant batteries. The regulation will control the entire life cycle of batteries – from production to reuse and recycling – and ensure that they are safe, sustainable, and competitive. The new rules aim to promote a circular economy by regulating batteries throughout their life cycle. The directive therefore establishes end-of-life requirements, including collection targets and obligations, targets for the recovery of materials, and extended producer responsibility. The regulation sets a target for lithium recovery from waste batteries of 50% by the end of 2027 and 80% by the end of 2031, which can be amended through delegated acts depending on market and technological developments and the availability of lithium (European Council, 2023).

Focus Areas for Eave

Partnerships with Recycling Companies: To guarantee a seamless and efficient recycling process, form alliances with reputable recycling businesses like Novolitio and Recyclia. Working together can strengthen Eave's dedication to sustainability.

Compliance with Regulations: Remain aware of and abide by changing laws, particularly those pertaining to battery recycling. This could entail fulfilling recovery goals, modifying reporting procedures, and operating procedures.

Community Outreach: Interact with the communities in which EAVE operates, highlighting the company's dedication to ecologically friendly operations. This can entail giving resources for safe battery disposal, taking part in community events, and supporting regional recycling programs.

3.2.3 Further proposals

(Authorship: Elisa Brunner)

Besides investigating solutions for the end of the batteries' and solar panels' lifecycle, the student consultant team analyzed the entire business model and operations of EAVE. In order to improve sustainable operating and have a positive social, economic and environmental impact in the future, there are several areas of action recommendable for EAVE. First and foremost, as a modern and growing company, it is essential to offer customers, partners, and all stakeholders transparent communication in terms of corporate sustainability. The team has learned that the company is very keen on using electric vehicles, producing their own energy from regenerative sources for all office buildings, and paying attention to correct recycling. However, these aspects are not mentioned on the website, nor is there an internal report existent to collect, analyze and improve all the data related to these activities. It is highly important to translate these efforts into measurable figures. A measurement system and open communication would improve transparency and credibility and could ultimately create a new USP, differentiating EAVE from the local competition. Many firms for instance are analyzing their corporate sustainability by using indexes, standards and ratings, such as ESG ratings, sustainability reports and IFRS Sustainability Disclosure Standards (Tenuta & Cambrea, 2022). Furthermore, the team has deeply researched the upstream supply chain of EAVE. With full awareness that in a young industry such as producing regenerative energy and storing energy, an installing company is highly dependent on the suppliers' offer, there are still some recommendations for EAVE's future. We advise to investigate the presence of more local suppliers i.e. from mainland Spain to avoid the extensive shipment routes. In consideration of the economic and environmental aspect, it is also advisable to monitor the development of more sustainable alternatives for the future, such as saltwater batteries or "second-hand" batteries. Seawater batteries are a newly developed energy storage option, which is able to convert chemical energy into electricity. Due to the fully natural resource utilized in this type of battery, they might be the sustainable replacement of the lithium-ion batteries in the future. However, they are still in the development and validation phase and cannot be considered an option for EAVE yet (Youngsik & Wang-geun, 2022). As for the second-use batteries, scientific literature proposes that

batteries from electric vehicles can be disassembled, regrouped and used in lower safety requirement areas like in energy storages (Kailong, Wang, & Lai, 2022). For EAVE, it would be recommendable to consider these re-utilized batteries for their solar installations to support a cyclic economy in the future. Even though there is no specific supplying company covering this field in Spain yet, it is without doubt that new companies will be established as the market grows, and it is definitely worth for EAVE to monitor this development.

In addition, EAVE must be aware that the competition on the Canary Islands is steadily increasing and there will be a saturation of the market at some point, especially due to its geographically limited location. Hence, it makes sense to think about innovating the business model to outperform competitors in the future. For example, a solar panel renting system could be introduced, in which EAVE would hold the ownership of the solar installations, while the private customers would pay a certain fee for the consumption of the renewable energy from their roofs. The system would require an IT setup which calculates the prices dynamically, based on the energy created and the current demand. The offer would be especially beneficial for those people who live in apartment buildings and are not eager to finance a solar system as they are not the house owners, but nevertheless interested in using energy from renewable sources. Also, this unique offer would lower the barrier to consume regenerative energy for the individual customer, since he would not be forced to make a big investment in a solar system installation. A similar subscription system called “Community Solar” with ground-mounted solar installations has been introduced in the United States, providing renters access to solar energy (Heller, 2019). Without doubt, EAVE would be able to target a distinct customer segment and make a contribution to the social and economic dimension of sustainability. A similar subscription system called “Community Solar” with ground-mounted solar installations has been introduced in the United States, providing renters access to solar energy (Heller, 2019). Without doubt, EAVE would be able to target a distinct customer segment and contribute to the social and economic dimension of sustainability. Finally, speaking about the social responsibility, we encourage EAVE to get in touch with public facilities and offer them donations of the redundant solar panels and batteries to do research and use the materials for education.

3.3 Challenges and opportunities regarding implementation

(Authorship: Elisa Brunner, Caroline Libertad, Christina Menhart, Dario Van der Laan Chong, Lena Winter)

Despite the short time frame of the project, several risks and challenges, but also opportunities in relation to the proposed actions to EAVE were identified.

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It was found to be very challenging to offer solutions within a reasonable geographical area. Due to the distance to the mainland, one risk of cooperating with the proposed entities could be the transfer of the affected materials to the mainland. It is imaginable that the cost of the transfer could be higher for EAVE than disposal to the local waste facility and therefore economically less desirable.

In addition, challenges in implementing the proposals for partially damaged solar panels exist. This can be seen in relation with the repair service. Setting up the new business can involve high costs such as the salaries and training costs for the new employees as well as the purchase of the necessary equipment. Moreover, it could be challenging to convince colleagues and managers internally about the business model, especially since the need for a repair concept did not seem to be considerably large yet in the eyes of EAVE. As a young company, they did not encounter many damages in solar panels yet. However, as the market is growing, we strongly believe that this could be a good niche to focus on. Consequently, considerable initial investment and effective communication of the new business model are required.

Regarding batteries, the largest challenge is the state of the industry as such. Since it is still a fairly young market, the challenges generated by production and disposal of the batteries have not grown to a global scale yet. Surely the number of lithium-ion batteries for electric vehicles and energy storages has grown at rapid speed during the last years. However, the regulatory framework and the solution to the massive waste challenges are still lacking behind. There might not be enough infrastructure in some places to recycle batteries. This covers recycling facilities, transit networks, and collection centers. Recycling projects cannot succeed unless the requisite infrastructure is invested in, and this seems to be a big challenge on the Canary Islands. Research has proven that it is costly to recycle batteries, particularly ones that contain potentially dangerous materials. Businesses such as EAVE have to balance the environmental advantages of recycling against the costs. It is also challenging, that there is no second-use option for those large modular batteries from energy storages at the moment (Kailong, Wang, & Lai, 2022). Therefore, it is extremely difficult to come up with a valid proposal for EAVE, besides partnering with local specialized recycling companies as suggested in chapter 3.2.2. of this report.

Contrary to the challenges, there is a great amount of opportunities for EAVE which will be pointed out in the following paragraph.

The donation of partly damaged and used solar modules is an important opportunity for the company. Donations to developing countries or research institutions may increase publicity for EAVE. In addition, it has to be mentioned that opening up a repair service for damaged solar panels can be highly beneficial for the company as it would close the market gap in Spain and on the Canary Islands and

EAVE could be the first mover in this segment. The advantage for EAVE would be an increasing customer base and the generation of a new revenue stream.

Another opportunity for EAVE arises from the cooperation with local businesses on recycling and second-use options of batteries and solar panels. The interaction, knowledge-sharing and communication may establish a reputation as a conscious business, socially as well as economically. This may encourage future stakeholders to engage with EAVE and improve the company's standing.

The biggest opportunity for EAVE is the innovation of the business model beyond installations of solar systems and charging stations. With new technology-driven innovative ideas such as the smart rental system proposed, the company can outperform the competition. EAVE should not hesitate to take the opportunity of offering additional value to the customer and the entire island community and by that, clearly show the future-oriented mindset to the public which is existing inside the company.

3.4 Conclusion & Outlook

(Authorship: Elisa Brunner)

In summary, there are several next steps that EAVE can take to go towards a more sustainable future. Regarding the end-of life challenge for the solar panels and batteries, several options were proposed, including extension of lifetime and some solutions for the management at the end of life to avoid pure waste. Generally, lifetime extension by offering repair services or cooperating with a specialized repair company would be the most favorable. For fully damaged, unrepairable materials, it is of the utmost importance to establish cooperations in the near future. There are several firms specializing in recycling of solar panels and lithium-ion batteries. Instead of disposing the materials at the local electronic waste facility, as it is currently the policy, we recommend establishing partnerships with the proposed organizations early on. Especially, since the challenge will be growing to scale, not just for EAVE but for the entire industry on the archipelago within the upcoming years. It is worth making investments now to be able to deal with the challenges of the future. For a certain smaller amount of materials, more inventive solutions should be considered, such as donations for research and re-use or sale for artistic purposes. Additionally, the creative and innovative mindset that the company has at present will be the key for future development. We recommend analyzing the market niches and thinking of how to create value beyond the current business model, i.e. with a repair service or rental model. With its employees as the greatest resource, EAVE will be able to develop innovative ideas to become a sustainable leader. Lastly, we would like to point out the importance of sustainability indicators, their measurement and the transparent communication related to such measurements. It will be crucial in the future to attract investors and partners.

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With regards to the theoretical framework of the conventional, the green, the sustainable, the restorative, and the regenerative economy, there are certain additional proposals to be mentioned on how the company can improve and move from their current “green” stage towards a regenerative way of operating. First of all, EAVE is producing renewable energy with solar panels on the roof of their office buildings which are unfortunately not covering the total energy consumption of the company. We propose EAVE to extend the solar installations and to add energy storage solutions to guarantee energy efficiency. The company can even think beyond their own energy use. There is a policy established on the Canary Islands, which allows solar system owners, to feed their energy surplus back into the grid and receive a deduction for it on the subsequent energy bill. Spanish law also allows to pass on the excess energy to neighbors at a lower rate (Macke, 2022). Hence, the company would be making an economic benefit and at the same time contribute to social sustainability by sharing their green energy with the public. This policy has a positive impact on the environment and society and is therefore a textbook example for the regenerative economy, since scientific theory proposes that regeneration is defined by positive contribution to any system, as stated in the introductory chapter. Furthermore, as stated in literature review, regenerative economy incorporates a focus on natural, non-toxic materials. With getting away from lithium-ion batteries and installing seawater batteries, that are not available on the market yet, but will very likely be in the future, EAVE could take a big step towards regenerative economy.

For the immediate future, we recommend the company to focus on establishing cooperations with the firms proposed. We are convinced that successful partnerships will be the key to the end-of-life management of the relevant materials. EAVE will benefit from the additional knowledge and will be able to find a suitable solution to their core challenge. In addition, we highly recommend considering the launch of a repair service to fill the market gap and be a leader in that field.

Circular Innovation

Consultancy project with Wootpix



By Karianne Huynh, Suzalina Shifat, Yuri Schenker,
Carlos Taysen Cabrera Plata

Circular Innovation Bootcamp
Winter Semester 2023

4. The company – Wootpix

4.1 Introduction to Wootpix

(Authorship: Yuri Schenker)



Wootpix is a company situated in Tenerife. It emerges as a pioneering force in the realm of imaging. Specializing in cutting-edge light field and wavefront phase technologies, Wootpix's mission is to revolutionize the acquisition of visual data.

4.1.1 Foundation and Expertise

(Authorship: Yuri Schenker)

Founded on a legacy of direct star imaging with adaptive optics, Wootpix possesses an intrinsic understanding of the complexities inherent in capturing beautiful images through varying atmospheres. It is this foundation that Wootpix uses to develop innovative solutions capable of handling propagations of the light to its full extent.

4.1.2 Core Competencies

(Authorship: Yuri Schenker)

Wootpix's capabilities lie in the mastery of manipulating light across diverse applications. With proprietary formulas and patents stemming from their expertise in the light field and wavefront phase technologies, Wootpix wants to provide solutions to distribute the power of image and data.

4.1.2.1 Key Offerings

(Authorship: Yuri Schenker)

The company offers a wide range of products and services regarding advanced technology and further development and innovation, giving them a competitive edge. Wootpix's key offerings are volumetric images, high resolution, real-time results and high accuracy measurements.

4.1.2.2 Volumetric Images

(Authorship: Yuri Schenker)

Through advanced WaveFront Phase Imaging (WFPI) and light field techniques, Wootix delivers volumetric information that establish applications across a spectrum of market segments.

4.1.2.3 Highest Resolutions

(Authorship: Yuri Schenker)

The company distinguishes itself from its' competitors by preserving full sensor resolution not needing to compromise through micro lens arrays or camera arrays.

4.1.2.4 Real-Time Results

(Authorship: Yuri Schenker)

Via Wootix's technology, they have the ability to acquire and process live results in less than 1 second.

4.1.2.5 High Accuracy Measurements

(Authorship: Yuri Schenker)

Wootix's techniques set new benchmarks in accuracy, especially in measuring transparent or reflective items compared to current industry standards.

4.1.3 Current focus

(Authorship: Yuri Schenker)

Wootix's current focus lies in the semiconductor metrology industry, as they introduce a groundbreaking technique: WFPI. This approach sets a new standard for measuring wafer geometry, capturing millions of data points in milliseconds with sub-nanometer height accuracy, surpassing the capabilities of existing methods.

Wootix's WFPI is a semiconductor wafer geometry technique that delivers shape uniformity, nanotopography and roughness measurements for the entire 300mm silicon wafer in a non-contact, single-image snapshot. With the capacity to collect over 10 million data points at sub-

nanometer height resolution, WPFI outpaces current industry standards in both speed and resolution.

4.1.4 Other branches of research

(Authorship: Yuri Schenker)

Despite being so heavily involved with semiconductor metrology, they also are researching in different branches of fields, such as ophthalmology, microscopy and application of wavefront technology in everyday cameras (Wootpix, n.d.).

4.2 Sustainability and Wootpix

(Authorship: Suzalina Shifat)

There are three main pillars regarding corporate sustainability: the environmental, the social responsibility, and the economic. Companies attempt to improve their environmental sustainability by, for instance, reducing their carbon footprint or wasteful practices. The social responsibility pillar represents practices that benefit the company's employees, consumers, and the wider community. The economic (or governance) pillar refers to maintaining honest and transparent accounting practices and regulatory compliance (Beattie, 2023).

On the basis of the three main pillars of this concept, Wootpix's sustainable practices will be analyzed, which are mainly within the environmental and social pillar. Being a smaller company, Wootpix has done indirect sustainable actions such as utilizing the traditional technology regarding semiconductors, but they managed to use less resources and increase efficiency. The company is currently working on reducing repetitiveness in the production of chips by implementing more accurate measuring tools and machines. In addition, an example of Wootpix's appropriate waste treatment is their collaboration with waste institutions when their IT equipment can not be further reused. Their machines are more advanced compared with their competitors regarding accuracy, energy consumption and waste production. Wootpix is collaborating for research with professionals in the medical field, specifically in the ophthalmology area.

4.2.1 Wootpix's expectations and core values

(Authorship: Ngoc Karianne Huynh)

In the first physical meeting on 5th of November 2023 with Wootpix, the company's expectations and core values were clarified. Us, the group of students wanted to specifically know Wootpix's expectation of the work that they want us to perform. The expectations that were laid in front of us as a group was to present solutions on how Wootpix could move their business towards a circular economy. During the on-sight week in Tenerife we got to know about the *Agenda Canaria 2030* based on the UN's 17 sustainable development goals. This gave us the framework to develop an action plan for Wootpix to grow towards a circular economy.

The CEO, José Manuel, specifically requested that what we presented would be something new for him to learn or point out different perspectives that were not thought of. To provide more relevant solutions for Wootpix they were asked for the company's core values. Wootpix is a company that performs a lot of research and development. Therefore, their core values are to require more quality knowledge, continue experimenting, testing and innovating so that they can keep developing new and sustainable technology.

4.2.2 Wootpix's future

(Authorship: Ngoc Karianne Huynh)

An important part of developing new action plans for Wootpix was to offer a strategy that illustrates how the business might look in the future. After interviewing multiple people of different backgrounds and positions in the company, the core vision of Wootpix's future was for the company to grow internationally where their products are fully developed and distributed. This vision and the company's core values were taken to account when straining out ideas after brainstorming. Furthermore, the ideas were presented to José Manuel for feedback and to see if the company could successfully implement the action plans.

As a group of students, we got the impression that Wootpix needed an action plan that presents how the company can grow sustainably. In addition, the action plan would also be relevant for the company to implement, aligning with their future vision and core values.

4.3 Suggestions for promoting and improving sustainability in the company

4.3.1 Canary Agenda intro

(Authorship: Carlos Taysen Cabrera Plata)

The main basis on which all our advice was focused was to align current and future company practices with the *Canary Islands Agenda 2030*. To provide better context for the concrete results and the solutions that have been developed, what the Agenda consists of will be addressed and why this tool has been chosen.

The *Canary Islands Agenda 2030* represents the culmination of a collaborative and inclusive effort to tailor the global vision of sustainable development outlined in the UN 2030 Agenda. The UN 2030 Agenda provides a unique context of the sustainable practices in the Canary Islands. This document encapsulates the distinct aspirations and challenges of the archipelago. It was carefully formulated through a consensus-building process that engaged a diverse spectrum of stakeholders. The shared commitment to achieve the 17 SDGs is reflected in the active involvement and input from representatives spanning civil society. Specifically the business sector, academia, research centers, and public administrations across the entirety of the Canary Islands. The participation of the contextualization ensures that the *Canary Islands Agenda 2030* is locally rooted, and provides a comprehensive roadmap that goes beyond a mere adaptation of global goals. Fostering a sense of ownership and collective responsibility among the Canary Islands' varied realities. It stands as a collective strategy to unite individuals, groups, organizations, and institutional sectors. The collective strategy aims to reshape our existing development paradigm and align it with the principles of sustainability and resilience. This framework guides us through the intricate transformations needed in the period from 2021 to 2030, enabling us to confront the formidable challenges that lie ahead. The document acts as a dynamic tool empowering all stakeholders across the Canary Islands, both in public and private sectors. By providing a framework that facilitates the formulation, enhancement, and implementation of the action plans that contributes significantly to the advancement of sustainable development. In essence, the *Canary Islands Agenda 2030* becomes an essential resource, fostering collaboration and ensuring that diverse territorial agents play an active role. (Gobierno de Canarias, n.d.)

It is important to highlight the fact that the *Canary Islands 2030 Agenda* is intricately structured into five distinct dimensions, each meticulously aligned with the 17 sustainable development goals established by the United Nations. These dimensions serve as the foundational pillars guiding the overall strategy for sustainable development in the Canary Islands:

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People: This dimension is intricately tied to social sustainability, emphasizing the well-being and equitable development of the diverse communities across the archipelago.

Planet: It is aligned with environmental sustainability, this dimension focuses on preserving and enhancing the natural resources, biodiversity, and ecosystems vital for the ecological balance of the Canary Islands.

Prosperity: Rooted in economic sustainability, this dimension seeks to foster inclusive economic growth, ensuring that prosperity is shared among all segments of society.

Public Governance: Encompassing elements of peace, justice, strong institutions, and collaborative partnerships, this dimension aims to fortify the foundations of governance and enhance cooperation between various stakeholders.

Cultural: This dimension, intricately connected to heritage and culture, recognizes the significance of preserving and promoting the unique cultural identity and historical legacy of the Canary Islands (Gobierno de Canarias, n.d.).

Each of these dimensions possesses a set of distinct priorities for action. Upon reflecting the initiatives currently undertaken by the technology company *Wootpix*, as well as considering potential future endeavors. It becomes evident that aligning the *Canary Islands Agenda 2030* framework with Wootpix's practices could provide a better source for developing an effective action plan. This framework, with its nuanced approach to social, environmental, economic, governance, and cultural sustainability, has the potential to guide *Wootpix* in elevating its commitment to sustainable practices. The company's existing commendable initiatives in sustainability make it well-positioned to leverage this comprehensive framework, ensuring a systematic and holistic enhancement across all relevant facets. By utilizing the Agenda as a guide, *Wootpix* can further refine and amplify its contributions to sustainability, reinforcing its role as a conscientious corporate entity, deeply committing to advancing the overarching goals of the mentioned framework.

4.3.2 Our focus

(Authorship: Suzalina Shifat)

PEOPLE | Priority action: 3.2 - Health

PROSPERITY | Priority action: 6.3 - Promote labor participation among young people and attract talent

PUBLIC GOVERNANCE | Priority action: 8.8 - Strategic alignment and impact report on the SDGs

CULTURE | Priority action: 9.5 - The cultural system in global commitments and multilateralism

Solutions Based on the Agenda's

Related to Priority Action 3.2 - Health

An extremely smart implementation of Wootpix technology is in the ophthalmology field called **t-eyede**. Wootpix found out that they can use their technology to detect changes in the human eye. With these detections Wootpix can diagnose the eye in an extremely accurate way. Ophthalmologists were surprised by what the data provided them. With this we can sell machines as testers throughout the other the Canary Islands, where Wootpix and both hospitals or clinics could use these machines to test their patients. This could reduce CO₂ emissions, because in order to have medical diagnosis, several instruments are only locally positioned on the capital islands of the archipelago (Tenerife and Gran Canaria). So implementing these new technologies in all the islands, patients from the small islands will not have to travel by plane and CO₂ emissions will be avoided. Moreover, those who have the machines can send the data back to Wootpix to iterate on the technology, and ophthalmologists can have the patient's data for a proper and accurate diagnosis of their eyes. With this, they can completely cut out the middleman which in this case are the opticians. With a successful run of this project, Wootpix can then globally expand their business by selling these machines overseas.

Related to Priority Action 6.3 - Promote labor participation among young people and the attraction of talent.

One of the problems the company is facing from our understanding is that not many local people really know about Wootpix and what the company can offer. And even if people from a non-technical background know about Wootpix, they could have a hard time understanding what they actually do. Here, there is a possibility for the company to provide information about what they offer and what they are working on via organizing seminars that everyone in every field can join in on, having talks and more papers shown in a clear visible way. The company's current sustainable practices could be documented on their website, where a webpage for sustainability can be created. Videos and illustrations can give a better understanding of the technological concepts. By sharing knowledge earlier in the life cycle of students would also help creating and inspiring young minds. With this, the company can gain more eyes and value in the brand that is Wootpix.

Related to Priority Action 8.8: Strategic alignment and impact report on SDGs

Wootpix can build a project to cooperate with the government on the SDGs to develop a sustainable future. It could be something related to what Wootpix is currently doing, or create opportunities for citizens to have well-paid jobs, reducing unemployment. Wootpix can focus the project on the sociocultural part of any project concept. By doing so, Wootpix can undergo changes that could

diversify the economy of the island while attracting investments from abroad, without damaging the resources the islands have.

Priority Action 9.5 - **The cultural system in global commitments and multilateralism**

Wooptix can develop a culture where every employee is coming together to think about the developing sustainable practices they have implemented and delegate their work accordingly. The meetings can take place every 6 months, but more frequent meetings are recommended for faster development, better communication throughout the company and easier access to support. Calling on professionals in the required field will give the company better insights of the practices that have been implemented. For specialized workers that cannot attend the meeting, there can be a possibility to submit a video report or a written one on the current sustainable work.

4.4 Discussion

(Authorship: Carlos Taysen Cabrera Plata)

In the rapidly evolving landscape of technology, the call for sustainability has become more pronounced than ever. Companies, particularly those in the tech sector, are increasingly recognizing the need to align their practices with sustainability goals. However, as we delve into the nuances of regenerative practices, we find that merely being sustainable is no longer sufficient. The nature of our technology company, dedicated to creating tools that enhance optics and visualization, presents a unique challenge in aligning with regenerative techniques. Unlike industries with more tangible connections to ecosystems or natural resources, the abstract nature of our products makes it challenging to directly correlate it with regenerative practices. Recognizing the difficulty in incorporating these regenerative techniques, we have focused on leveraging the sustainable actions already inherent in the company's practices. The company actively engages in several sustainable actions, such as the commendable reuse of work equipment until obsolescence and the proper treatment of equipment when it can no longer be used. These actions, though integral, might not be fully appreciated or communicated effectively.

This was what we mainly did to bridge the gap between our technological focus and regenerative practices, to propose an alignment of the company with the *Canary Islands Agenda 2030*. This strategy allows the company to contribute to broader sustainable development goals, emphasizing the interconnectedness of their actions with the well-being of both the local and global communities. To embark on the path to a regenerative economy, as an imperative for the company, first it has to be an

establishment of a strong foundation in sustainability in *Wootpix*. This *Agenda* provides a comprehensive framework for sustainable development goals, and related to this, several actions, practices and patents of the company could be easily aligned to it. The creation and technological improvement of semiconductor metrology for chip manufacturing contribute to efficiency, leading to lower energy and resource consumption. Simultaneously, advancements in ophthalmology analysis tools contribute to social sustainability by enhancing health outcomes. By aligning technological advancements with the broader goals of the agenda, the company creates a narrative that transcends individual actions, contributing holistically to the sustainable development of the region. Beyond the immediate technological advancements, the company's presence on the Canary Islands, specifically Tenerife, holds significant potential for regional development. The island's high unemployment rates and dependence on tourism create an opportunity for economic diversification. The technology company can play a pivotal role in transforming the economic landscape, fostering innovation, and becoming a catalyst for job creation. This aligns seamlessly with the *Canary Islands Agenda 2030*, contributing to sustainable development on a broader scale.

To amplify the impact of sustainability initiatives, we proposed the creation of a powerful marketing plan dedicated to sustainability. This plan should be more than a superficial gesture, requiring genuine commitment from all employees. A transparent and authentic communication strategy is essential to avoid the pitfalls of greenwashing. By showcasing the company's dedication to sustainability through concrete actions, the marketing plan becomes a catalyst for positive change, both internally and externally. Clear communication of the company's sustainability journey, acknowledging both achievements and challenges, will build trust with stakeholders. External audits and certifications can further validate the company's commitment to genuine sustainability practices.

4.5 Conclusion

(Authorship: Carlos Taysen Cabrera Plata)

The journey toward a regenerative economy for a technology company such as *Wootpix*, specialized in optics and visualization, involves strategic progression through sustainability phases. By aligning with the *Canary Islands Agenda 2030*, with clear priorities for action that can be easily related to the company's practices, *Wootpix* will not only strengthen its commitment to sustainable development but also contribute to regional progress. Through the action plan, *Wootpix* can grow sustainably. The action plan is relevant for the company to implement, aligning with their future vision and core values of quality knowledge, continuation of experimenting, testing and innovating to keep developing new and sustainable technological practices. Furthermore, the inclusion of the proposed marketing plan ensures

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that these efforts are not only substantive but also effectively communicated. Embracing these strategies will not only propel the company towards its regenerative goals but also set a precedent for the entire sector, fostering a collective commitment to a sustainable and regenerative future.

5. Final discussion

5.1 Suggestions for Tenerife

(Authorship: Christoph Meyer)

To conclude this report, we would like to point out one thing specifically which was clearly visible by everyone involved at the last day of the project week: Networking.

The importance of meeting in person and exchanging on topics which really matter like sustainability and circular economy can never be underestimated. In just a rather short gathering in Tenerife where we presented our results, it was already remarkable how the three companies present could benefit from each other. To pick a single example would be the possible symbiosis of Loro Parques ambitions to increase the number of solar panels without visual impact in the facilities and EAVEs goals to invest in this sector. Also to work with the broken panels from the park could be a potential partnership between those two companies present that day. And to be connected with other companies in such an open-minded environment and international platform like the Circular Innovation Bootcamp does not come too often.

To keep up the amazing work this bootcamp did over the last years it is our strong belief that future students and companies should cooperate together, be inspired by each other and learn from each other. Why not even extend this format and bring on the last day of the week all the past companies again in one room to see what current approaches to sustainability are made. This could possibly result in an annual meeting of companies at Universidad la Laguna to exchange and benefit from each other. The structures and connections on the island but also all over Europe are already existing, also thanks to the Humboldt Cosmos Multiverse.

However, raising student awareness is a field in which companies should pay more attention. Holding frequent lectures, conferences, or courses - as teaching the circular economy provides students with the tools to address contemporary challenges related to sustainability and promote a balanced and responsible approach to the management of the island's resources.

Anyways the Canary Island should keep informing about their important role and location as well as their innovative installations all over the island to spread awareness for the small island economy with its challenges but also great potentials.

5.2 Similarities in the project

(Authorship: Jorrit Goossens, Ngoc Karianne Huynh)

Every company has a significant role in the Canary Islands regarding their limited economy and environment which is why the main purpose of this course was to find sustainable, restorative, and regenerative solutions for the companies to consider implementing. It gave us the opportunity to learn in-depth the circular economy's phases and how to apply it to different companies in Tenerife, adopting a professional role.

At first glance, each company has been vastly different from the others and are in a different stage in terms of regenerative economies, Loro Parque is working towards a restorative economy, EAVE with sustainable waste management and Wootpix going from a conventional to a sustainable company. However, thanks to this project, these companies have received tailor-made proposals in line with their raising issues that will improve their sustainability level not only with the aim to experience environmental benefits. But also to strengthen their market position, improve their relationships with stakeholders, and prepare for a more sustainable and ethical business future.

Loro Parque is the oldest company and relates to a better environment due to its zoo. They have already been working on becoming a restorative company, by saving animals from extinction and nurturing animals to give them another chance at life. This makes the company more conscious about the environment and it is showing their willingness to continuously change their company to the benefit of the world. We expect Loro Parque to continue their path to a regenerative economy.

EAVE, known for its creative and innovative mindset, is a green business that goes beyond just offering sustainable energy solutions. But it also plays an important role in creating a more visible and flexible future, while providing social, economic, and environmental benefits. Thus, with these out-of-the-box proposals, we expect EAVE to achieve the next chapter in order to differentiate itself from the steadily increasing competition by successfully implementing collaborations to build a more sustainable and resilient future for both, companies and the archipelago.

Wootpix is a conventional business in the semiconductor industry, moving towards more sustainable practices. By aligning with the Canary Islands Agenda 2030, with clear priorities for action that can be easily related to the company's practices, Wootpix will not only strengthen its commitment to sustainable development but also contribute to regional progress. The action plan is aligned with their future vision and core values of quality knowledge, continuation of experimenting, testing, and innovating to keep developing new and sustainable technological practices.

5 Final discussion

All in all, Loro Parque, EAVE and Wootpix are working towards a more circular economy. They were presented innovative and sustainable solutions for their companies to consider implementing, helping them perform more sustainably and become more viable in their actions.

As a result, these companies will be well-positioned to thrive in an evolving business world if they can be recognized by a careful balance between financial success and social/environmental responsibility. By adopting a long-term mindset and considering the impact their decisions will have on Tenerife.

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Appendix

Appendix 1

Key Partners  - Solar panel installers - Repair equipment manufacturers	Key Activities  - Repairing broken solar panels Key Resources  - Equipment/ tools for repairing solar panels - Service team/ employees (knowledge)	Value Propositions  - Closing the lack of repair service of solar panels - Increased number of customers due to the offer of repair service - Increase in sustainability	Customer Relationships  - Personal and friendly partnership - Giving the customer the opportunity to repair their solar panels and become more sustainable Channels  - Website - Social media (LinkedIn, etc.) - Face-to-face (WOM)	Customer Segments  - Solar panel owners located in Tenerife or Spain - Already existing customers of EAVE - Solar panels owner that require repairment for their solar panel installation
Cost Structure  - Transportation costs (if repair on site not possible) - Purchasing costs (Equipment/ tools) - Staff costs - Energy costs for way to customer (Charging electric vehicles)	Revenue Streams  - Monthly/yearly fee for repair service - Fee per service			
Eco-Social Costs  - Ecological: equipment costs + costs for recycling (in case it will break) - Social: salary costs (repair experts), training costs	Eco-Social Benefits  - Ecological: increasing lifetime of solar panel, reducing waste - Social: increasing staff jobs, changing mindset of customers towards sustainability			

The Sustainable Global Business Model Canvas for the repair service of solar panel. Own illustration based on (Cardeal, Höse, Ribeiro, & Götze, 2020).

Law 7/2020, of April 8, on waste and contaminated soils for a circular economy

Reduction of organic waste (food, plant biomass, animal manure, etc.)

Date: 30.11.2023

Authors: Rodrigo Rodríguez Ferrer, Sara Arbelo, Christopher Meyer, Jorrit Goosens and Vsevolod Konovalov

Abstract

During our visit to Loro Parque, our team "Vamos a la Playa" identified a critical issue that warrants attention—biowaste management. This report focuses on a specific solution to this problem: composting with a bioreactor. Notably, we are revisiting a prior proposal, the acquisition of a composter, which was rejected some years ago. This report serves as a comprehensive and persuasive document to enrich the proposal presented to the board, introducing additional benefits and arguments.

The rejected proposal is considered an opportunity for reassessment, seeking to address any concerns that may have influenced the initial decision. By presenting a nuanced and expanded perspective, we aim to underscore the compelling reasons for acquiring a composter with a bioreactor. While acknowledging the existence of related work by Rodrigo Rodríguez, this document takes an incremental approach.

Key components of the proposal's enrichment include highlighting the critical nature of the biowaste issue at Loro Parque, emphasizing the advantages of composting with a bioreactor, and addressing any previous reservations that led to the rejection. Furthermore, the team underscores the proposed solution's cost-effectiveness, alignment with circular economy principles, and potential for educational outreach.

We have put this detailed section in the appendix to make the main report clear and easy to follow. This helps to keep the main report focused on other important points. Also, we have shared this detailed section separately with Rodrigo for review and discussion. This way, we can get specific feedback on those details without making the main report too complex.

Introduction

The new Waste Law, Law 7/2022, effective from April 8, focuses on waste prevention and management for a circular economy. It emphasizes avoiding waste generation and advocates for its management through measures prepared for reuse and recycling. A key highlight of this law is its specific attention to treating biowaste.

Article 18 establishes the following key points:

- Promotion and support of sustainable and circular production and consumption models.
- Target: 50% reduction of food waste per capita at the retail and consumer level in restaurants and food services.
- Target: 20% reduction in food losses along production and supply chains by 2030, compared to 2020.
- Promotion of food donation and other redistribution methods for human consumption, prioritizing it over animal feed and the transformation into non-food products.

In Article 19, the law empowers local entities to take measures to reduce food waste in food distribution and catering companies. These measures may include discounts on waste collection fees or non-tax public property taxes related to waste collection services. Local entities can also establish up to 95% bonuses for fees or property benefits, incentivizing food distribution companies and restaurants to collaborate with non-profit social economy entities to implement systems that significantly reduce and verifiably remove food waste. This incentive is contingent on the local entity's verification of the effective operation of such systems.

Moreover, the law encourages the management and transformation of other types of waste into value-added products. Overall, the legislation aims to foster a more sustainable and circular approach to waste management, explicitly emphasising reducing food waste and promoting responsible waste practices in various sectors.

Regarding the prevention of waste generation, as outlined in articles 17, 18, and 19, which define objectives and measures for waste reduction, the prioritization for the sector, specifically collective catering companies, is established as follows:

- The primary focus is on donating food and other forms of redistribution for human consumption.
- The secondary option is the transformation of unsold but still consumable products.
- In the absence of the above, the next priority is using waste for animal feed and feed manufacturing.
- If none of those options are feasible, the waste should be repurposed as by-products in another industry.
- A particular emphasis is placed on obtaining compost and digestate of the highest quality for use in soils to yield a benefit.

- As a last resort, when the above options are not possible, the waste should be repurposed to obtain fuels.

Regarding the management of biowaste, as established in Article 20, the generator of biowaste is obligated to ensure proper waste treatment by having the following options:

- Conduct the treatment themselves, provided they have the corresponding authorization for the treatment operation. In this regard, Article 34, which outlines exemptions from authorization requirements, must be considered (page 4).
- Natural or legal persons conducting the disposal of their non-hazardous waste at the place of production or recovering non-hazardous waste may be exempt from authorization, as well as, where applicable, the facilities where these operations occur. (The authorization exemptions provided in the previous section will be established by regulation by the Ministry for the Ecological Transition and the Demographic Challenge...)
- Entrust the treatment of their waste to a registered dealer or an authorized waste manager who carries out treatment operations.
- Deliver waste to a public or private waste collection entity, including social economy entities, for treatment, as long as the provisions of the Law register them.

To encourage domestic and community composting (including Brunelli's, Hotel Botánico, Loro Parque, the Fincas, and other establishments of the group), regulations will establish the conditions under which domestic and community composting will be exempt from authorization, by Article 34 (page 4). This article indicates that natural or legal persons conducting the disposal of their non-hazardous waste at the place of production or recovering non-hazardous waste may be exempt from authorization, as well as, where appropriate, the facilities where these operations occur. Regulation by the Ministry for the Ecological Transition and the Demographic Challenge will establish the exemptions from authorization provided for in the previous section.

Article 34: Exemptions from Authorization Requirements

1. Natural or legal persons conducting the disposal of their non-hazardous waste at the place of production or recovering non-hazardous waste may be exempt from authorization, along with, where applicable, the facilities where these operations occur.
2. Authorization exemptions outlined in the preceding section will be established by the Ministry for the Ecological Transition and Demographic Challenge regulations. This will be done about each type of activity through general rules, following a report on waste from the Coordination Commission. The Ministry will inform the European Commission of these regulations. They must specify the types and quantities of waste to which the exemption may be applied and the treatment methods, ensuring that waste treatment poses no risk to human health or the environment. These regulations must also define the communication content outlined in Article 35.1.c). Regarding disposal operations mentioned in paragraph 1, these standards must consider the best available techniques.
3. Facilities or parts used for research, development, and experimentation of new waste treatments are exempt from the authorization regime specified in Article 33. Similarly, natural or legal persons conducting such activities are exempt. Before initiating these activities, the autonomous community where the facility is located must be informed through a responsible declaration. This declaration should detail the treatment, type and quantity of waste and the estimated duration of the activity.

Alternatives for Compliance with the Law

Throughout its history, Loro Parque has been a sustainability champion, advocating for the rational use of resources and minimizing its environmental impact as critical tools to support a circular economy. Following the new Law 7/2022 analysis, effective from April 8, on waste and contaminated soils for a circular economy, we can conclude that incorporating composting into our organization is a logical step to achieve the group's sustainability objectives. Addressing and implementing composting ensures compliance with the law and reinforces our commitment to environmental preservation. This commitment reduces expenditures on phytosanitary products and fertilizers, closing the loop on biowaste generated in the group's activities and nurturing our soils. Improved soil fertility and plant growth in all our green areas and farms are among the positive outcomes.

To reintroduce composting activity at Loro Parque and based on the reflections of the law, I will now present the composting alternatives available to us and assess the suitability of each option.

Option 1: Conduct the treatment internally, obtaining the necessary authorization for the treatment operation. This approach would complete the biowaste cycle, allowing us to self-generate compost utilized in all green areas and agricultural farms. This practice improves soil fertility and biology, fostering trophic networks through various organisms (bacteria, fungi, protozoa, nematodes, microarthropods, worms, etc.). These organisms generate nutrients in a form assimilable by plants, reducing the need for and consumption of phytosanitary products, fertilizers, and water.

Option 2: Entrust waste treatment to a registered dealer or an authorized waste manager conducting treatment operations. However, this would entail a double extra cost, covering the treatment and the acquisition of compost for fertilizing green areas and agricultural crops.

Option 3: Deliver waste to a public or private waste collection entity, including social economy entities, for treatment. Similar to Option 2, this would result in a double extra cost, primarily for the treatment and acquisition of compost for fertilization in green areas and agricultural crops.

Option 1: Conduct the treatment internally, obtaining the necessary authorization for the treatment operation.

This is the optimal option for Loro Parque; there are two alternatives to consider for composting: traditional composting or Composting with a bioreactor:

	<u>Traditional Composting</u>	<u>Composting with a bioreactor*</u>
Composting Time:	2 months	7-10 days + stabilization
Required Area:	> 1,000 m ²	300-400m ²
Necessary Personnel:	2 operators 8 h/day	1 operator is responsible for crushing, depositing, and loading waste into the bioreactor and collecting finished compost, specifying the time required for each operation. Continuous supervision is not necessary.
Accepted Biowaste:	Plant remains food waste (vegetable and animal), compostable food packaging used in the group, and animal faeces.	Plant remains food waste (vegetable and animal), compostable food packaging used in the group, and animal faeces.
Energy Sources Used:	Diesel is used as vehicle fuel for the machinery that crushes and turns compost, including a tractor.	Diesel serves as the vehicle fuel for crushing machinery, while electricity is employed for the continuous turning of the bioreactor, contingent on the model.

* Utilizing a Bioreactor would result in reduced composting times, a smaller requirement for soil surface, and the ability to compost a larger quantity of biowaste due to the achieved temperatures. The existing personnel in the Park and Farms could be employed effectively as the equipment operates autonomously once fed with biowaste. Supervision is only necessary to ensure the entire process proceeds correctly, eliminating the need for continuous labour throughout.

Considering the combined dimensions of Loro Parque, Hotel Botánico, Brunelli's, and the agricultural production farms, the self-management and use of compost for internal consumption emerge as a mutually beneficial project. The Park's significant demand for ecological compost makes this initiative a win-win proposition.

In Tenerife, there is a representative of XACT Systems, a Canadian-origin technology with over 25 years in the market, known for its high effectiveness.

Among its advantages, the following can be highlighted:

- **Low Energy Consumption:** This is attributed to the bioreactor's design and rotation using four steel wheels. The dimensions, consumption per wheel for each unit, and the management capacity, including the structuring agent to add, are provided in the table.
- **Low Labor Demand:** The process involves minimal labour, mainly for loading and opening to remove the compost.
- **Easy Installation Expansion:** The installation can be easily expanded by adding more bioreactors in parallel, ensuring it remains up-to-date and facilitating size increases.
- **Space Efficiency:** Each bioreactor occupies minimal land space.
- **Aerobic Process Speed:** The aerobic process is rapid, with compost reaching at least 85% maturity in seven days. It can then be utilized or matured in a designated patio or composting area.
- **Strict Aerobic Process:** The process maintains strict aerobic conditions without losing moisture.
- **Closed Systems:** These prevent unpleasant smells and maintain ideal composting conditions.
- **Easy Process Control:** The control panel facilitates easy monitoring and management of the entire process.

To determine the suitable bioreactor type for Loro Parque, an analysis of the total biowaste generated by the Group every week is essential to size the equipment correctly. An additional national alternative from the company Earth-Care is also under evaluation.

Attached is a table with the available Models, dimensions, consumption, and Composting capacity in Tons/Week. The KW must be multiplied by the 4 motors that the Bioreactor has.

Modelo XACT	Dimensión bio-reactor (m)	KW requeridos	Biocapacidad (ton./semana)
1060	3,0 x 18,0	6	89
1040	3,0 x 12,0	4,4	59
740	2,1 x 12,0	4,5	29
637	1,9 x 11,4	2,2	25
630	1,8 x 9,0	1,1	16
620	1,8 x 6,0	0,70	11
515	1,4 x 4,5	0,40	6
510	1,4 x 3,0	0,40	4

The following figures are provided for comparison purposes, considering a weekly biowaste generation scenario ranging from 16 to 18 tons. This scenario encompasses the sum of all types of biowaste generated per week, with the likelihood of generation peaks occurring at different times of the year.

In this comparison, the price and expenses associated with option 4, which involves frequently sending waste to the landfill, will be considered, despite its contradiction with the philosophy and requirements of the new law.

Now, let's delve into the specific generation scenario of 16 tons per week.

Option 4: Collect the waste and send it to the Arico landfill.

This option stands out as the one that most contradicts and fails to comply with the law, which advocates for sustainable waste management. Nevertheless, it is the most frequently practised method in the territory and considered the least favourable for waste management within the group, but it is used in this comparison.

Financial part:

Cost Savings:

- Landfill reception cost: €42/ton (estimated cost; deposition by an authorized manager is required).
- Weekly Cost: 16 tons x €42/ton = €672/week
- Monthly Cost: €2,688/month
- Annual Cost: €32,256/year
- Transportation expense to the Arico landfill, using a truck that loads 16 tons per trip. The market trip price (diesel, carrier, costs) is approximately €275-300 per trip.

- Monthly Transportation Cost: €300 x 4 trips/month = €1,200/month
- Annual Transportation Cost: €14,400/year

While these figures represent cost savings, it's essential to consider **Increased Revenue**:

It is assuming a selling price of €130 per ton with operating expenses around €70, resulting in a profit of €60 per ton. Additionally, assuming the company sells 1 tonne to other companies for composting (if composting capacity is still allowed), which equates to $(365/10) * €60 = €2,190$. Furthermore, the company can sell organic materials after composting, assuming a selling price of €100 per ton and obtaining around 30% organic materials (final product) from each ton, resulting in €30 per ton from composting. This amounts to $(365/10) * €30 = €1,095$.

Total Increased Revenue: €3,285

Total Benefit (Revenue + Cost Savings): €49,941 (equivalent to \$54,860 based on the current exchange rate at the time of this report's publication).

Attention:

This calculation does not account for labour and other expenses associated with collecting the group's biowaste and any required management until loading it on a truck. Furthermore, the assumed prices of €130 for composting and €100 for the final product may be conservative. In reality, market conditions could potentially yield higher prices, further increasing the overall benefits.

The costs associated with landfills are unstable, especially considering new legislation that may lead to increases, incentivizing a shift towards sustainable practices. Composter suppliers are likely to be aware of this trend, and as demand rises in the market, they may adjust their prices accordingly. This underscores the urgency of **acquiring** a composter bioreactor **in the near future** to secure favourable pricing amid these potential cost escalations.

To the points mentioned above, we must factor in the group's annual expenditure on fertilizers and pesticides since biowaste is not currently managed or transformed into compost to nourish the soil.

Option 1: Carrying out the treatment internally, with the necessary authorization to perform the treatment operation, is being compared to the management using the XACT Bioreactor, a Canadian technology. For the management of 16 tons of biowaste generated per week, along with the need to provide structuring material to achieve the appropriate humidity and C/N ratio for a correct composting process, it is assumed that the 637 model would be required. This model can handle 25 tons per week (comprising 16 tons of biowaste and 9 tons of structuring agent to be added based on the starting material). **It's important to note that this is an upward estimate, and a detailed study of the total tons generated is necessary to determine the appropriate size of the bioreactor.**

- The acquisition cost of the model 637 bioreactor is \$229,750, and the mixing unit (6m³) costs \$15,415, totalling \$245,700. (Transportation costs and import taxes are not included.)

Suppose we divide the cost of the bioreactor and mixing unit by the annual amount spent on shipping waste to the landfill. In that case, the result indicates that the investment in purchasing the equipment would be at a break-even point in 4.8 years compared to continuous landfill shipping costs.

Additionally, the self-generation of compost within the group would enable the treatment of soils in green areas and agricultural farms, leading to significant savings in inputs (fertilizers and phytosanitary products). The improved soil would strengthen its biology and organic matter content, resulting in more productive and fertile crops with the absence or sporadic appearance of pests. This would render external input contributions unnecessary.

A comparison with traditional composting is not included due to its high labour demand, daily task requirements, and significantly longer composting times, making this option less attractive.

In conclusion, comparing Option 1 and Option 4 demonstrates that managing biowaste within the group using XACT technology is highly advantageous. It aligns with the new law's requirements, enhances the company's sustainable image, reduces the carbon footprint and greenhouse gas emissions, and produces compost that improves the growth of all plants and agricultural operations, thereby enhancing soil fertility and biology. Implementing this practice meets regulatory requirements and contributes to a more sustainable and environmentally conscious company, increasing its overall appeal.

Marketing part:

In addition to the evident financial advantages of acquiring a composter bioreactor, there lies a profound opportunity to fortify Loro Parque's brand image and market positioning. By embracing sustainable waste management practices, Loro Parque stands as a beacon of environmental stewardship, a fact that resonates strongly with modern consumers, investors, and donors.

Attracting Investors

In today's investment landscape, it's not just about the numbers; investors are increasingly drawn to businesses that prioritize ethical and sustainable practices. Integrating a composter bioreactor showcases Loro Parque's commitment to environmental responsibility, which can be a compelling factor for socially conscious investors. This green initiative can elevate the park's attractiveness to investors seeking sustainable ventures.

Customer Appeal

Modern consumers are increasingly conscious of the environmental impact of the brands they support. By adopting eco-friendly practices, Loro Parque can strengthen its connection with visitors who

prioritize sustainability. This alignment with eco-conscious values can enhance customer loyalty, fostering a positive relationship beyond the park experience.

Donor Engagement

Institutions and individuals contributing to environmental causes often seek tangible proof of commitment from organizations. The acquisition of a composter bioreactor becomes a symbol of Loro Parque's dedication to green initiatives. This can resonate powerfully with donors, potentially increasing philanthropic support for the park's conservation efforts.

Marketing Leverage

Adopting sustainable practices provides Loro Parque with a compelling narrative to share. Marketing campaigns centred around the park's commitment to environmental preservation create a positive public image. This narrative becomes a valuable asset in promotional materials, social media, and public relations, positioning Loro Parque as an industry leader in sustainable tourism.

Global Visibility: Environmental Leadership

Loro Parque's commitment to sustainable waste management attracts local attention and can garner global recognition. Participation in eco-friendly practices places the park in a leadership role in the worldwide conservation and sustainability conversation. This recognition can attract visitors from around the world who actively seek out environmentally responsible destinations.

Competition part:

Zoo Doo initiatives actively involve the public in composting programs, using product sales, educational events, and facility tours to showcase their efforts. These zoos have received commendation for their transparency, regulatory adherence, and high-quality compost products, earning praise from customers and city stakeholders.

Taronga Zoos employ an anaerobic digester to convert all food waste into electricity and nutrient-rich pellets, contributing to soil enrichment. The zoos collectively generate 50 tonnes of waste each month, with Taronga Zoo in Sydney transporting its waste to a nearby composting facility. In contrast, Dubbo Zoo processes waste on-site, utilizing the resulting compost within the zoo grounds.

Zoo Atlanta's commitment to composting helps save approximately 8% of greenhouse gas emissions from food waste. Zoos Victoria, recognized as the world's first certified carbon-neutral zoo organization, boasts an impressive 89% diversion rate and a yearly reduction of 2,400 tonnes of CO₂ emissions through composting and recycling.

The competition among zoos worldwide to become the most sustainable is significant. Considering the achievements of competitors, investing in a composter becomes a strategic move for Loro Parque to reduce CO₂ emissions and maintain a leadership position in global sustainability efforts.

In essence, **acquiring a composter bioreactor is not just a strategic financial move**; it's a visionary step that transforms Loro Parque into a symbol of environmental responsibility. This aligns with contemporary values and positions the park as a leader in sustainable tourism, appealing to a broad spectrum of stakeholders, from visitors to investors and philanthropists. This transformative initiative becomes a cornerstone of Loro Parque's legacy, embodying a commitment to preserving wildlife and the planet we call home.