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ESG Investing in "White Gold": The Case of Lebanese Salinas

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Abstract: Lebanese sea salt is historically known as "white gold". Traditional coastal sea salt production now survives mainly in the coastal city of Anfeh, and is facing various constraints due to regulations, as well as environmental threats which affect the quality of the sea salt. This research points out the case of Lebanese Salinas that invested in ESG to improve the salt quality through social implications and diverse environmental techniques. Based on ESG investments and innovation theory, the main objectives of this research action project were to: create a plastic-free area and implement plastic-free sea salt production at 10 Salinas, using a local innovative tool to filter sea water that consists of a windmill, pump, metallic tube, and filter, which is placed on the main basin of a Salina to prevent the leakage of microplastics into the water used in sea salt extraction, to obtain a plastic-free sea salt. This would create a sustainable, ecofriendly process via the sorting of plastics at the source, clean-up activities, awareness activities, and incentive activities, resulting in the production of better sea salt and the promotion of local products and coastal tourism. The goal of the study was to implement methods that were recommended in the "S.O.S. (Save our Salt)" initiative, which was put into place by the Green Community NGO to protect Lebanese sea salt production and guarantee a reduction in the amount of these microparticles in sea salt. Data gathered from the project, as well as from in-person interviews and follow-ups with the project team, were used to conduct the empirical analysis. The amount of plastic that was present was reduced, resulting in one of the best sea salts in the area. Findings aligned with ESG investment for an increasing and sustainable firm performance and have several practical implications for many stakeholders, both internally and externally, including managers, investors, lenders, policymakers, government, and the public. Our results highlight the significance of formulating regulations for Lebanese Salinas to collectively handle production risks and enhance technical efficacy, and for regulators to lessen marine pollution.

Keywords: sea salt; sustainability; plastic-free; innovation; environment; Salinas

JEL Classification: O13; Q53; R11

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1. Introduction

We are currently in the "Plastic Age". Plastic has played a significant role in the evolution of civilization since its invention in the early 1870s, making daily living simpler. Yearly plastic output has increased considerably, going from 0.5 million tons in the 1940s to 550 million tons in 2018 (Plastics Europe 2018).

The sea plays a key role in regulating the climate, and it takes in 25% of the CO_2 produced (Bigg et al. 2003). Plastic makes up 75% of the garbage in the water.

The buildup of synthetic plastic items in the environment is at a point where they pose a threat to both human populations and wildlife and their ecosystems.

Plastic is a polymeric substance, which means that it consists of very massive molecules that frequently resemble lengthy chains with a great many interconnections.

On a global contextual level, the Sustainable Development Goals (SDGs) have been regarded as the top priority by member countries since the UN 2030 agenda was unveiled in 2015. SDG efforts require a large amount of funding (Pizzi et al. 2021). Seventeen priority areas that receive a sizable amount of environmentally and financially sustainable investment are implementing the SDGs. The goal of ESG investing, according to Soundarrajan and Vivek (2016), is to strategically migrate to economies with low carbon emissions, maximize wealth, and combat climate change. The annual production of plastic climbed from 1.5 million metric tons in 1950 to 359 million metric tons in 2018. Every year, nations with oceanic coasts dump 4.8 million to 12.7 million metric tons (5.3 million to 14 million short tons) of plastic into the oceans.

Only northern European countries—where rates differ significantly among nations—achieve recycling rates higher than 50%. Every year, several million tons of garbage, including a large amount of carelessly disposed plastic waste, enters the world's oceans. Bags, bottles, and objects associated with takeaway meals make up 44% of the plastic garbage found in rivers and seas, and along shorelines, in 2021 research.

Understanding the many components of the plastic production, distribution, and waste management chain is necessary to comprehend the extent of the input of plastics into the natural environment and the world's seas. This is essential for determining the scope of the issue, as well as for carrying out the best treatments for its mitigation.

Since half of the world's population lives in coastal areas, more than 80% of the plastic waste that enters the ocean each year comes from land-based sources (Jambeck et al. 2015; Bergmann et al. 2015). The majority of the contribution comes from large plastic garbage, which includes commonplace items such as drink bottles and various kinds of plastic packaging. Microplastics are under 5 mm in size, solid, and insoluble in water. These particles are present in all bodies of water right now. They are found even in the Arctic (Peeken et al. 2018).

An estimated 0.8 to 2.5 Mtons of primary microplastics is introduced into the ocean annually (Boucher and Friot 2017). The main sources are tire abrasion and textile fibers that enter wastewater from washing. Other sources include the dust from road paint wear, microplastics used in personal care items, marine coatings, and dropped plastic pellets.

A direct relationship between population density and microplastic concentration has been found (Driedger et al. 2015; Wang et al. 2017). Particularly high levels of pollution are caused by proximity to highly inhabited areas and inadequate waste management (Lebreton et al. 2012; Abayomi et al. 2017). Other significant point sources of plastic and microplastics are sewage treatment facilities and businesses that produce or process plastics (Nel and Froneman 2015; Zhao et al. 2014). Ports and industrial zones are particularly polluted with microplastic particles (Claessens et al. 2011). Most of the microplastics are found close to the beach (Harmon 2018).

Forecasts anticipate an increase in plastic manufacturing, which will result in a rise in the amount of plastics and microplastics entering the environment and oceans (Jambeck et al. 2015). Additionally, the persistent fragmentation of plastic that is already present in the environment contributes to the ongoing emergence of microplastics (Barnes et al. 2009). As a result, the marine ecosystem is becoming more contaminated with microplastics.

The Mediterranean Sea is one of the regions of the world most impacted by litter because it produces some of the most considerable volumes of solid trash per person each year (208–760 kg/year) (Eriksen et al. 2014). On the surface of the whole basin, there are thought to be 62 million macrolitter pieces floating around (Suaria et al. 2016).

The Mediterranean Sea's mean density of floating microplastics is above 100,000 items/km^2 (Fossi et al. 2012), which highlights the significance of this danger to the basin.

Since 2015, Lebanon, a nation in the eastern Mediterranean basin, has struggled with garbage mismanagement, with the majority of the debris being dumped in coastal waterways or burned. In fact, it is estimated that Lebanon produces 2.55 million tons of trash annually, and that only 12% of that is burned (Abbas et al. 2017). Additionally, 15% of this solid waste is made up of plastics, which is two to three times more than what is found in Sweden, France, and the United States (Abbas et al. 2017; Kazour et al. 2019). Recent research has shown that microplastics are present in the marine biota, marine sediments, and seawater in Lebanon (Hassoun et al. 2021).

To the best of the authors' knowledge, the effort carried out by the Green Community S.O.S. (Save our Salt) initiative to remove microplastics from sea salt was the first to bring about awareness of and modifications to the method of sea salt manufacturing in Lebanese Salinas.

The objectives of this study were to demonstrate how Anfeh Salinas were able to decrease the occurrence of, and exposure to, microplastics in sea salt production through the implementation of environmental awareness and measures leading to better performance and quality production, resulting in the safe consumption of edible salt available in Lebanon. Technologies that could be used to reduce the presence of microplastics in sea salt were also discussed.

Since there is a dearth of pertinent research, the uniqueness of the study stems from the topic itself. Additionally, the researchers are aware of no research on the effect of ESG practices on Salina performance that has been performed in Lebanon.

In the current study, the main research question that was addressed is: what is the importance of ESG factors in the better performance of Salinas and better salt quality in Lebanon?

The paper is organized as follows: The study will lay a foundation for the environmental issues that Lebanon is currently dealing with, particularly in a long-standing and reputable business. The literature and theoretical background are reviewed in Section 2. The conceptual framework and techniques of the studied case are developed in Section 3. The results of the data analysis are then discussed in Section 4. The task is concluded in Section 5.

2. Research Methodology

2.1. Microplastic and Sea Salt Extraction

Humans need salt for important nutrients, and it is also utilized in food preservation techniques (World Health Organization 2012). Salt is typically obtained from the ocean, salt lakes, salt rocks, and salt wells (Yang et al. 2015). Sea salts are commonly created in Salinas (solar saltwork ponds) via crystallization as a result of the combined effects of evaporation and sunlight (Renzi and Blašković 2018; Rocha et al. 2012; Yang et al. 2015). Numerous saltworks are situated in coastal areas that have been influenced by anthropogenic activity in a number of regions, including Europe. They are therefore frequently exposed to various pollutants. A number of saltworks are expected to be affected by these pollutants because these regions are regarded as hotspots of microplastic (MP) pollution (Kim et al. 2018). Prior to sea salt crystallization, freshwater and saltwater are mixed in solar saltwork ponds, creating a gradient of habitats with varying salinity levels (35–240, Practical Salinity Scale). Consequently, MPs that were in the water during or after the crystallization operations may be present in marketed sea salts (Serrano et al. 2011; Yang et al. 2015).

One of the most urgent environmental challenges today is plastic pollution, which has gained international attention (United Nations Environment Program) (UNEP 2022). Plastics are materials with very practical physical and chemical characteristics and low production costs, making them suitable for a wide range of applications (Andrady 2015; Andrady and Neal 2009). In 2016, there were approximately 335 million tons of plastic produced, and over the next 20 years, that figure is projected to quadruple, along with an increase in waste output (Plastic and The Fact 2017). Only about a third of plastics are recycled, and every year, 5 to 13 million tons of plastics, or around 1.5 to 4% of the world's total plastic production, ends up in the oceans (European Commission 2018).

When plastic is dumped in the sea, it is difficult to remove from the water because it accumulates in marine life and sediments and lasts far longer than it does on land (Ugwu et al. 2021). Different types of plastic behave differently in the environment and degrade into smaller pieces in water at varying rates, creating micro- and nanoplastic particles (Urbanek et al. 2018). Microplastics (MPs) are tiny plastic particles with a dimension of less than 5 mm, whereas nanoplastics have a size between 1 and 1000 nm (Gigault et al. 2018). In the European Union alone, it is estimated that between 75,000 and 300,000 tons of microplastics are released into the environment each year (European Commission 2018).

According to recent studies (De-la-Torre 2020; Rubio-Armendáriz et al. 2022; Zhang et al. 2020), MPs are increasingly important food pollutants that pose a risk to human health, food safety, and food security. Microplastics can enter the human body through the food chain, as is widely known (Revel et al. 2018; Zhang et al. 2020). Microplastics can penetrate biological membranes when inhaled or ingested and exert localized particle toxicity, disrupting the genetic expression of oxidative stress control, activating the E2 (Nrf) nuclear factor expression, altering the endocrine system, causing neurotoxicity, and causing cancer, among other effects (Kannan and Vimalkumar 2021; Rubio-Armendáriz et al. 2022; Banerjee and Shelver 2021).

The most common food component, used globally as an additive for flavor, preservation, and other functional effects, is salt (NaCl) (Henney et al. 2010), and 90% of commercial salts from 35 nations on 5 continents were found to contain microplastics (Peixoto et al. 2019). Globally, people can consume up to 10 g of salt daily, which is more than the 5 g advised by the World Health World Health Organization (2019). All sea salt tested in 5 countries bordering the Mediterranean basin contained microplastics (Renzi and Blašković 2018; Kim et al. 2018; Ajith et al. 2020; Alimi et al. 2021; Seth and Shriwastav 2018).

Seawater desalination and sea salt extraction are two typical commercial seawater application industries. Seawater is redirected into substantial basins to produce sea salt. Sea salt that had been previously dissolved is left behind as the water evaporates over time due to wind and the heat of the sun (Sha 2009). The media frequently discuss the high level of microplastic contamination in sea salt. A growing microplastic load has effects on the marine ecology, which in turn has effects on humans, as well as the costs and effectiveness of the sea water usage process.

Due to the production process, most polymer blends also contain dangerous components, such as softening agents or monomers, which can then be released upon ingestion of the particles through food and have an immediate negative impact on the body (Lithner et al. 2011).

The ability of microplastics smaller than 150 μm to infiltrate the circulatory system, surrounding tissues, internal organs, and even the brain has already been demonstrated in laboratory studies (Lusher et al. 2017). The potential for lesions and inflammations then exists.

There is currently no practical way to remove microplastics easily and economically from seawater. A viable research strategy is focused on adapting a Herbort and Schuhen idea for freshwater systems and simultaneously developing supplemental technologies for stationary (e.g., waterside plants) and mobile (e.g., ships) seawater usage processes (Herbort and Schuhen 2017).

In the method created by Herbort and Schuhen, silane-based microplastic agglomerates are produced in accordance with the cloud point theory by using specific organosilane-based precursors that, via Van der Waals forces, have a high affinity for inert organic-chemical macromolecules (IOCS) and a high reactivity in water (Herbort et al. 2018).

2.2. ESG Investing

ESG practices and the transition to a low-carbon economy have attracted significant attention from researchers and governments over the past two decades and are now rapidly expanding commercial phenomena. ESG first became popular as a concept for managing portfolio risk in the early 1990s (Boffo and Patalano 2020). More than 500 organizations from more than 70 countries had embraced ESG reporting by 2021 (World Economic Forum 2020). This expansion is crucial for businesses and is now frequently used to gauge sustainability benchmarks for holding businesses accountable (Howard-Grenville 2021). Any business that wants to be competitive in the market must now start with this idea (Orlitzky et al. 2011).

National legal authorities are responsible for upholding their social and economic obligations, protecting investors, and increasing market understanding. Stakeholder theory has been applied to comprehend SMEs' demands and clarify how SMEs and ESG practices relate to one another. A corporation should have stronger ties with all its stakeholders, according to the stakeholder hypothesis. Similarly to efforts connected to corporate social responsibility, it will become increasingly successful with time. It shows the number of people or groups who are specifically targeted by business firms and are positively or negatively affected by their activity (Freeman 1994). According to Freeman's theory, a company's market performance may be able to incorporate or transfer ESG efforts. Boustani and El Boustani (2017) imply that protecting the bottom line and boosting shareholder value specifically in founder syndrome companies are both made possible by the practices of active ESG activities. ESG initiatives can help managers and stakeholders work out their differences because their involvement improves firm performance, according to Jambeck et al. (2015).

In the current research, the authors focused on the three ESG investment pillars in Salinas, demonstrating stronger ties with all its stakeholders and filling the gaps in awareness and irresponsible actions from citizens, government, and firm managers. A conceptual action plan is shown in Figure 1 that illustrates the three actions carried out throughout the study, which led to an increasingly successful project and better quality and performance.

Figure 1. Proposed Conceptual Framework.

3. Case Study

3.1. Location and Context of the Study

From a previous study conducted by Nakat et al. (2023) between September 2019 and December 2020, all human consumption salt brands (n = 16) available on the Lebanese market were gathered and examined, and they found the presence of various forms of microplastics in 55.6% of all samples and 81.3% of the evaluated brands. Additionally, all samples and replicates included contamination from microplastics or other foreign substances.

Compared to salt sold in bulk or fine salt, sea salt that was packed and coarse was more likely to be polluted. Polypropylene, polyester, thermoplastic elastomers, and polyethylene were among the several kinds of microplastics found. Although the environmental effects of microplastics have drawn a lot of attention, additional research and risk analysis are needed before any firm conclusions can be made about the effects of long-term human exposure to dietary microplastics. To reduce human exposure to these developing pollutants, it is necessary to implement novel approaches during salt production.

The primary forms of pollution that have wreaked havoc on Lebanon include those in the air, water, and land. The United Nations Environment Program (UNEP) highlighted that due to the severity of its impacts, the impact of environmental deterioration is difficult to assess. The illnesses caused by the consequences of pollution have led to numerous fatalities and human misery. Respiratory infections, water-borne illnesses, and malignancies are the principal diseases that are frequently linked to environmental pollution and cause many preventable deaths.

The fishing sector has been severely impacted by water contamination, notably in south Lebanon near the Mediterranean Sea. According to the Inter Press Service, pollution and oil spills have a negative impact on Salinas in south Lebanon, making living circumstances challenging and unhygienic. Tons of trash and oil spills have been left all over the beaches at the port of "Ouiza", making the region inhabitable.

According to the Inter Press Service, the area had eight dumping sites that were not adequately managed, resulting in significant and irreversible environmental harm. The largest and most obvious is the enormous "Costa Brava" dump, where much of the trash from the nearby towns is deposited by people with political connections. The waste makes its way into the sea, where it causes problems. The discharge of sewage from the two million residents and industrial waste that goes directly into the sea without proper treatment to eliminate residues of heavy metals and other substances damage the ocean as well.

This historic coastal town in Lebanon is home to one of the world's oldest sea salt mines. It was one of the first places in the world to produce sea salt, and it is situated on the beach of the historic port city Anfeh, also known as Ampi. Anfeh Town can be found in the "Koura" District in the North Governorate of Lebanon, 65 km to the north of Beirut and 15 km to the south of Tripoli. It has a surface area of 4.93 km^2, and 6000 people reside there. The use of sea salt has been a long-standing tradition in the little nose-shaped village south of Tripoli. Some people assert that this place is the earliest sea salt mine ever discovered, citing Cuneiform texts from 1400 BC that praise Anfeh sea salt.

From the Salinas, or sea salt ponds, in Anfeh, sea salt is organically harvested today. Up until 40 years ago, Anfeh's sea salt mines provided the majority of Lebanon's sea salt needs. When salt extraction was still practiced, many locals had jobs that provided a means of subsistence. Due to the reduction in import taxes in Lebanon in the 1990s, Anfeh's production of sea salt declined. Despite this, locals still mine for the aforementioned "white gold", carrying on a family heritage. The sea salt marshes, which acknowledge the significance of sea salt extraction in the area, give the town's environment a unique flair. By installing the original wind wheels, the area's traditional sea salt extraction methods were secured and preserved.

3.2. The Project Overviews

One of Lebanon's oldest and most well-known resources is Anfeh's sea salt, also referred to as "white gold" in Lebanon. Nature has bestowed Lebanon with untold riches in a variety of shapes and textures. To have a better grasp of Lebanon's own history, it is crucial to understand the role that the country's shore had in the development of sea salt. Since the earliest Phoenician records, sea salt ponds have existed on the stony beaches of Anfeh, a historic harbor immediately south of Tripoli. The sea salt that was extracted from Anfeh enjoyed enormous economic success over time. The superior quality of Anfeh sea salt is attested to by Cuneiform-written tablets from 1400 BC.

The Salinas of Anfeh were destroyed and sea salt manufacture was forbidden under Ottoman authority, despite their history. The sea salt ponds were cracked and empty for the first time in their long history, and Ottoman rule persisted until 1943. Sea salt extraction was not permitted again until Lebanon achieved independence in 1943, which prompted the development of tens of thousands more basins along the Anfeh coast. The sea salt beds were spread out over 500,000 square meters of rocky shore, and the majority of them are still owned by the Greek Orthodox monastery called Deir El Natour.

Up until 1990, Lebanon generated its own sea salt and sold 45,000 tons of it on the domestic market annually. It was the zenith of the sea salt trade for Anfeh and the adjacent settlements. It resulted in the growth of the tourism business, which improved employment opportunities throughout the entire region. Unfortunately, the production of sea salt has significantly decreased in Lebanon. According to Lebanon, just 15 of the 44 accessible

Salinas in the village of Anfeh are open for business. The location of the sea salt ponds was designated as a touristic area on one side, which promoted the growth of commercial tourist resorts as a more convenient means of income for sea salt workers. In contrast, the government removed taxes on imported sea salt, especially Egyptian sea salt, which was less expensive than locally produced sea salt and improved competitiveness and productivity in a market that was steadily decreasing.

3.3. "S.O.S. (Save Our Salt)"

A number of sea salt producers have recently started working to carry the demands of the sea salt workers and present them to the Ministries of Labor, Environment, Economy, and Tourism with the aid of the media in an effort to draw attention to the city of Anfeh and its history as well as to save the sea salt production industry from extinction.

The S.O.S project was implemented at 10 Salinas of Deir el Natour—Anfeh. The main objectives of the project were to:

- Create a plastic-free area at Deir el Natour Salinas.
- Implement plastic-free sea salt production at 10 Salinas at Deir el Natour.

During this project, an implementation of the technical plan to install a plastic-free system for sea salt production was performed. In order to commence the work, the team has given the approval to the technical map presented by sea salt producers and the engineer.

Moreover, S.O.S. (Save Our Salt) is aiming at preserving the quality of our sea salt by installing plastic-free techniques and promoting the importance and cultural heritage of the Salinas mainly at Deir el Natour—Anfeh.

The surface area is around 5 km^2 and the number of indirect beneficiaries is 6000.

We attempted to implement a local innovative tool to filter sea water that is structured from a windmill, pump, metallic tube, and filter that will be placed on the main basin of Salinas, so we aim to prevent the leakage of the microplastics to the water used in sea salt extraction in order to produce plastic-free sea salt.

At the end of this project, "S.O.S" had installed filters to prevent microplastics from getting into the Salinas so that the sea salt produced would be plastic-free and of good quality. The sea salt of Lebanon was known as "white gold" and one of the best worldwide; therefore, GC worked on conserving a local precious product that can still create job opportunities and generate income.

Moreover, in order to create a pilot area with sustainable environmental activities, the S.O.S team did a cleaning campaign at the site and collected 50 bags of recyclables and trash. Additionally, to keep the place clean, the team installed two sets of sorting bins made of wood to sort the waste on site into three categories: plastics and aluminum, glass, and waste (already on site).

In summary, the results of the "S.O.S" project were considered positive as before the project there were Salinas with no filter and the presence of waste without sorting materials. Additionally, after the implementation of the project, we had an eco-friendly site with a filter system to deal with microplastic, a clean site, and sorting barrels.

This project had mainstreamed cross cutting issues with youth as the Salinas are a kind of family business where young people help their parents, and in two of the Salinas, the owner was a young man who was in charge of the "family business".

It would be a success story for us if we could help local production and encourage youth in developing their business.

The objectives and number of Salinas targeted: half of the Salinas (10 out of 20).

- Create a plastic-free area at Anfeh Peninsula, Deir el Natour, and Ras el Safi.
- Implement plastic-free sea salt production for the project entitled "Droub el Meleh" (paths of the salt) at two northern Lebanese regions, Deir el Natour and Ras el Safi.

This project conducted by the two co-authors, who are executive board members of Green Community NGO (established in 2019, legal status number: 1446), was also in participation with a lead applicant "Comité de Sauveguarde de l'Environnement à Bsharre" (CSEB) and in collaboration with "Droub el Meleh" Initiative.

*Defining the partners and leading entities involved in the project: (*Figure 2 *shows the key partners NGOs involved in the project on site).*

Green Community is part of the ECOMEDPORT start-up that aims at implementing innovative and sustainable technology for sediment management in water basins and harbors.

CSEB: Responsible for project supervision, technical and financial reporting, and the implementation of sorting at the source at the peninsula and clean-up activities.

GC: Training and awareness activities and work on incentive activities.

"Droub el Meleh": On-site implementation, responsible for the innovative filter techniques, consisting of sorting barrels and cigarette collection bins.

Figure 2. Key partner NGOs on site.

3.4. Methodology and Action Plan

This case study makes use of the ADDIE development model, which was developed by (Freeman 1994) and included five stages: analysis, design, development, implementation, and evaluation. This study concentrated on the first two stages. The first stage entails two analyses: one of performance and the other of needs (Boustani and El Boustani 2017). Performance analysis is performed to identify the most prevalent technologies in use and the challenges Salinas face in producing salt, and the analysis needs are utilized to identify the industrial salt requirements. The second stage entails creating a model for extracting microplastics from sea salt in order to increase production and provide recommendations for enhancing salt quality and production.

The outcomes of the first round of analysis served as the foundation for this design. As part of the S.O.S. (Save Our Salt) program, this research project was conducted concurrently from 2019 to 2020.

The analysis was qualitative and descriptive in nature. Its investigation included a comparative and synthetic study, followed by the creation of a conceptual model and an elaboration of an action plan that was implemented.

1. Implement a local innovative tool to filter sea water that is structured from a windmill, pump, metallic tube, and filter that will be placed on the main basin of Salinas; therefore, we will be working on preventing the leakage of the microplastics to the water used in sea salt extraction in order to achieve plastic-free sea salt.
2. Train volunteers.
3. Make and distribute special handmade barrels for sorting at site locations and put informative signs on the beach for visitors of the touristic coastal area.

4. Raise awareness for the local community to maintain a clean sea all year long.
5. Create incentives for the local community to be encouraged to collect waste and reuse it at the "Beit el Meleh" (house of the salt) Museum.
6. Clean-up day for the project locations and "Droub el Meleh" with volunteers.
7. Set up cigarette collection on the shore.

Moreover, in order to fight single-use plastic, the project consisted of another environmental and social action to encourage the collection of plastic bottles and bottles caps to be used for the financial benefit of cancer treatment. Others will be used for shaping statues to the "Droub el Meleh" Museum.

3.5. Organic Sea Salt MP-Free Production—Artisanal Production

Several methods, including the conventional saltworks method (Ahmed et al. 2001), the electrodialysis-based method (Tanaka et al. 2003), the multi-effect evaporation-based procedure (Melián-Martel et al. 2011, 2013), the multistage flash distillation-based system (Turek 2002), etc., can be used to combine seawater desalination and sea salt production. The approach that makes use of already-existing saltpan facilities and chemical machinery is both the most financially sensible and capable of integrating cutting-edge technologies. This will meet the demand for handling concentrated saline left over from saltwater desalination and for providing enough sea salt (Feng et al. 2005)

The ability to produce sea salt will soon dwindle, putting the salt chemistry sector's long-term growth at risk. Fortunately, seawater desalination provides an opportunity to recover and compensate for capacity loss. The problem of disposing of concentrated saline produced by seawater desalination will be successfully resolved by integrating seawater desalination and sea salt manufacturing, which is in accordance with the concepts of the circular economy and industrial symbiosis. The end symbiosis chain can be described as a "mariculture–power-plant cooling–seawater desalination–Artemia culture–bromide extraction–sea salt production–salt chemistry" process. Without a doubt, this symbiotic relationship will boost Lebanon's capacity building for long-term progress.

Only in Anfeh, a beach town some 70 km north of Beirut, is the old-fashioned coastal sea salt production being carried out entirely by hand (Figure 3 shows Anfeh's Salinas by the shore of a northern Lebanese beach). Salt producers assert that the business has seen a number of difficulties, including the elimination of import restrictions and the relocation of pond owners during the Lebanese civil war.

Figure 3. Anfeh's coastal Salinas.

According to reports, the government forbade Anfeh's sea salt producers from fixing their equipment so that real estate developers could occupy prime beachfront property. The municipality confirmed that the federal government is not issuing any new licenses.

Only about four months of the year can sea salt be extracted because it takes a long time and is weather dependent. First, meter-deep concrete ponds are filled with seawater using tiny windmill-powered pumps.

Over a period of at least 20 days, the water in the ponds, which can be up to 20 square meters, evaporates, leaving behind a salty liquid residue. Following that, the sea saltwater is put into smaller, shallower concrete pans where it is allowed to concentrate for a further 10 days. Producers constantly swirl sea water around the pan to achieve even drying.

As the liquid drains, lines of sea salt crystals that are dazzlingly bright and shimmer in the sunlight develop. Between 1955 and 1975, when it was at its height, Lebanon's traditional sea salt industry produced 50,000 tons of sea salt each year. However, after the commencement of Lebanon's 15-year civil war in 1975, the sector began to suffer a series of setbacks.

Many pond owners were among the Lebanese who departed in considerable numbers during the protracted fighting. Following their departure, supply fell behind demand, which prompted the government to eliminate the import tariff on sea salt in the 1990s.

Due to the decision, local producers found it difficult to compete, and when the business had completely collapsed, the government claimed that many of the sea salt pans were built illegitimately on public seashores. Thus, it stopped taxing the income from the production of sea salt in 1994. Due to a lack of tax revenue, municipalities started to turn down maintenance permit requests from manufacturers. These rejections prevented the sector from having its aging infrastructure updated. About half of Anfeh's sea salt pans are no longer functional due to the 1994 verdict.

Local officials attempted to shut down the operation in 2015 and 2016 due to plastic contamination in the sea water supplying the ponds.

3.6. Using Procedures to Eliminate Microplastics in Seawater Use Processes

The methodical application is to prolong the useful life of the current desalination plants by initially restraining the microplastic particles (0.1–5 m) that lead to membrane blockages (pore size 0.002–0.1 m) during pretreatment.

By doing this, it is possible to increase the microporous membranes' service life, lower operating costs (without the use of questionable chemicals such as antiscalants), and sustainably remove the water cycle's harmful microplastic particles. The removal is not constrained by particle size or form like a filtration process because it is based on a physicochemical agglomeration process. All size classes of fibers, films, and fragments can bind to the agglomeration reagent, which fixes them in large agglomerates.

As a result, by lowering the microplastic particle load, the quality of the water on the removal side near the coast/surface as well as on the output side will be enhanced. By removing microplastics from the sea saltwater flowing into the evaporation basins, contamination of the resultant sea salt and the transfer to humans will be successfully prevented in the application in sea salt extraction.

This is made feasible by the joint creation of an inorganic-organic functional material and a pretreatment step consisting of a number of stirred tanks. A high-performance cascade process is also created as an add-on technology to help with the material reaction and enable a throughput of more than 600 m^3 per day. By tying together many cascades, continuous functioning is achieved. For the first time, a modular pretreatment step upstream can efficiently and sustainably remove plastic particles with a particle size of 5 m from sea saltwater. This is made possible by the modified idea and the accompanying technological execution method (Figure 4 shows the organic and artisanal sea salt production).

The cutting-edge add-on technology for the removal of microplastics from industrial seawater usage facilities is intended, among other things, to be the first solution for the risk of blockage caused by the massive amounts of microplastic particles in the sea. The downstream RO membranes are relieved due to the pretreatment stage's significant reduction in microplastic burden. The service life of RO membranes will be substantially prolonged, and because of their improved performance, they can be operated more cheaply and on a smaller scale.

Figure 4. Organic and artisanal MP-free sea salt production.

The phases of common salt manufacture are listed by Artegiani et al. (1997). The primary element in salt manufacturing, seawater, is directed to evaporation ponds in plots or ponds. Different forms of salt will be generated when saltwater is evaporated. Sea water evaporates till it is reduced to 60% of its original capacity. Then, it flows into the next pool for the following step, where $CaCO_3$ precipitate is created.

The introduction of potentially dangerous microplastics into sea salt is decreased with the use of innovative add-on technology in sea salt extraction, which also reduces the contamination of common foods. This method helps to assure the sustainable use of sea saltwater in light of the rising microplastic pollution of the seas.

3.7. Environmental and Social Actions in Anfeh Salinas

List of Achievements:

1. Implement a local innovative tool to filter sea water and prevent the leakage of the microplastics to the water used in sea salt extraction in order to achieve plastic-free sea salt.
2. Train volunteers.
3. Make and distribute special hand-made barrels for sorting at site locations and place informative signs on the beach for visitors of the touristic coastal area.
4. Raise awareness for the local community to maintain a clean sea all year long.
5. Create incentives for the local community to be encouraged to collect waste and reuse it at the "Beit el Meleh" Museum.
6. Clean-up day for the project locations and "Droub el Meleh" with volunteers.
7. Set up cigarette collection on the shore.

Additionally, many field visits by the team were conducted to make sure that the system is reliable and make sure that target groups are satisfied.

A clean-up day was set up for the project locations and "Droub el Meleh" with volunteers.

This activity was essential as S.O.S wanted to work on a clean site where the sea, the shore, and the Salinas' area are sites of good environmental practices. It is important to have a filter that will provide plastic-free products, but it is necessary to have a surrounding area that is free of plastic and without waste, so the project will be more homogeneous.

This activity took place at the beginning of the project, in parallel with the preparation of the filter setup. The main constraint was the lockdown rules and the restrictions in gathering people. Therefore, the clean-up campaigns were performed by four people and a bobcat.

The campaign lasted for 10 working days and the result was 50 big bags of recyclables and trash. S.O.S completed the form requested by "Bahr Bala Plastic" (Sea without Plastic as shown in Table 1).

Table 1. Beach clean ups.

Beach Clean Ups	
Name of association	CSEB, GC and "Droub el Meleh"
Name and contact details of person in charge of activity	"Hafez Jreij"
Location	"Deir el natour—Anfeh"
Surface of area cleaned	8 km^2
Time of activity	10 days
Weather conditions	Early spring
Number of trash bags collected	50
Categories of plastics collected and their weight	Mainly plastic bottles
Number of people participating in the clean-up	4
Identify stakeholders involved in the facilitation of and/or in participation to the cleanup (i.e., municipality, fishermen, other)	Salinas' owners
Destination of disposal	Sorting facility in "Zgharta"
Media coverage yes/no If yes, provide details of the coverage	GC social media

Raise awareness for the Salinas' owners to maintain a clean area all year long.

This activity has been repeated several times since the start of the project. The "S.O.S" team was happy to establish an eco-friendly area, but it was considered incomplete when the human resources involved in the event were not aware of the necessity of performing in a clean functional environment.

Therefore, awareness campaigns were conducted at the beginning to brief on the importance of the project. Researchers also explained that this project is vital at an economic level as it maintains the good quality of the sea salt and aids in raising awareness on social media about Lebanese sea salt production.

Afterwards, researchers conducted some awareness campaigns to illustrate the clean-up campaigns and launch the sorting at source.

Researchers completed this form as requested by "Bahr Bala Plastic" and its results are reported in Table 2:

Table 2. Awareness.

Name of Association	Green Community and Comité de Sauveguarde de L'environnement—"Bshare"
Name and contact details of person in charge of activity	"Dr. Sana Boudib Antoun"
Number of campaigns/sessions conducted	10
Where did these campaigns/sessions take place	Anfeh
Material distributed/produced (including bags, flyers, videos, others)	
Number of people reached	10

Table 2. *Cont.*

Name of Association	Green Community and Comité de Sauveguarde de L'environnement—"Bshare"
Identify stakeholders involved in the facilitation of and/or in participation to the activity (i.e., municipality, fishermen, students, professors, women, other)	There were 10 workshops and awareness campaigns with the Salinas owners to explain the importance of plastic-free sea salt production, explain the project and review the maps of installation, and launch the cleanup and sorting at the source activities
Media coverage yes/no If yes, provide details of the coverage	Social Media

We made and distributed special hand-made barrels for sorting at site locations.

This task took place to sustain the above duty which aimed at keeping the area clean and sorting at the source.

This activity was initiated with a field survey and awareness campaigns to target groups in order to justify the importance of having a clean environment and sorting the waste at its source.

Afterwards, several studies were conducted to select the best option regarding what material the barrels should be made of, as it is an area with special weather conditions due to the sea. This means that the area suffers from winds that carry sea salt. After several meetings and studies, the "S.O.S" team found that barrels made of wood would be the best solution.

Therefore, researchers worked with a carpenter to make the barrels. Two sets were made, each composed of two parts: one for plastic and aluminum and one for glass. The bin for ordinary waste was already located at the site.

During the M&E, researchers checked the plan and design of the waste bins' distribution for the sea salt production area as a first step. Then, further studies were conducted for "S.O.S" to put bins made of natural products near the Salinas at a minimum cost, and then, the best offers were selected from three quotations.

It should be noted that this was the last activity executed after the installation of filters as it was ensured that the project's funding was assured.

As per the M&E, the authors completed this form as requested by "Bahr Bala Plastic" and reported in Table 3:

Table 3. Sorting—Recycling—Up Cycling.

Name of Association	CSEB, GC and Droub el Meleh
Name and contact details of person in charge of activity	"Dr. Sana BoudIb Antoun" and Mr. "Hafez Jreij"
Number of bins distributed/number of spots	6
Number and location of spots where bins have been distributed	2
Categorization followed	Barrel for Plastic and Aluminum Barrel for Glass
Total weight of waste collected	NA (not collected yet)
Total weight of plastics collected	NA (not collected yet)
Number of people participating in the activities (if more than one activity, data needs to be filled for each activity separately)	3

Table 3. *Cont.*

Name of Association	CSEB, GC and Droub el Meleh
Identify stakeholders involved in the facilitation of and/or in participation to the activity (i.e., municipality, fishermen, students, professors, women, other)	Salinas' owners
Destination of disposal of material (if possible, provide separate information for recycling and up-cycling)	Sorting facility in "Zgharta"
Media coverage yes/no If yes, provide details of the coverage	Not yet, but it will be on social media soon

4. Results and Discussion

For now, producers in Anfeh are scraping by, selling sea salt to individual and industrial buyers at a rate of 2–4 USD per kg, which is much less than the price of imported sea salt.

Producers of sea salt in Anfeh said the industry has taken a lot of hits and they fear it will dry up. Presently, Anfeh sea salt manufacturers charge 2–4 USD per kilogram for sea salt, which is less than the cost of imported sea salt. The producers consider the struggle to defend Lebanon's shoreline, most of which has been devoured by developers, as part of a larger struggle to protect the sea salt ponds. The industry is in danger, and the cultural heritage is on the verge of extinction due to the contradicting ministries' policies and processes, pressure from coastal developers, and other factors.

The project "Droub el Meleh", which was implemented in cooperation with the Environment Committee in "Bshare", was titled "Sea without Plastic" and had funding from the European Union. The project was very successful and yielded positive results, in terms of facilitating the work of the sea salterns and improving the quality of the sea salt. The plan was based on protecting sea water, sea salt, and sea salterns from plastic, especially plastic particles (decomposed plastic), which could mix with sea salt in an invisible way.

Historically, sea salt laborers carried black hoses on their shoulders and hauled them from one location to another. These hoses served two functions: one was to transfer salty sea water to the containers, and the other was to transfer the water to the first and second evaporation reservoirs. Instead, we built an immovable network of taps and invisible pipes that connected the reservoirs, and each reservoir has its own tap that is utilized to fill a single reservoir. This considerably enhanced the working mechanism, improved the quality of sea salt, and reduced time and effort. This network was outfitted with a technology that prevents plastic atoms from reaching the reservoirs and, therefore, the sea salt.

The degree of acceptability among sea salt workers was very high, and this project may be applied to any similar project in the Mediterranean Sea.

In this analysis and in the case study, the authors looked at how Salinas' sustainability performance in Lebanon was impacted by environmental, social, and governance (ESG) practices. It reached the following very important conclusions as a result:

The first is that Salinas have recognized the necessity of corporate governance in achieving their strategic goals, but given the nature of those goals at the moment, this still needs to be achieved. As a result, creating a positive company culture is a protracted process that is difficult to complete but essential. According to the results, social activities are thought to be the most common ESG habit, according to Salinas in Lebanon. Second, the investigation revealed the dangers and frailties that limit the adoption of ESG practices. On the plus side, as shown by the strengths and possibilities, ESG practices can also be positively impacted. Third, Salinas participants felt that environmental practices were the foundation of sustainability and that all resources should be allocated to meet these objectives in light of the city's limited resources and the requirement for a defined sustainability strategy. Finally, Salinas attendees must comprehend ESG and its reports, pay closer attention, and be aware of its significance. The complexity of company regulation, and the resulting lack of knowledge, according to the respondents, does not help Salinas to adopt ESG principles.

This study's findings have a number of theoretical and practical ramifications. This study makes significant contributions to the literature in terms of the theoretical implications.

First, it confirms the impact of ESG practices on the sustainability performance of businesses, offering a potential indicator of whether or not businesses are prepared for this level of performance.

Second, researchers and practitioners implemented ESG evaluations for businesses in many industries based on the prior literature. However, Salinas is still developing its ESG evaluation procedure. Finally, this study adds to the body of environmental and ESG literature by shining a light on potential correlations between ESG activity and sustainability performance.

The potential link between ESG practice and Salinas' sustainability performance requires further study, either locally in Lebanon's southern region or overseas. Moreover, establishing a measurement framework for evaluating sustainability reporting in relation to the SDGs will enable performance comparison and disclosure (Ahmad et al. 2022; Boustani 2022).

Some species had significant histological alterations and impairments in cell function as a result of the absorption of microplastics in the tissues under study (Von Moos et al. 2012). According to field observations, MPs have been found in the gills and digestive tracts of pelagic and demersal fish, as well as in marine animals (Dantas et al. 2012; Sanchez et al. 2014).

Previous studies have demonstrated that many marine creatures mistake plastic detritus for food. Different harmful consequences, such as pathological change, hunger, and mechanical obstructions of digestive processes, are brought on by ingesting marine debris. Additionally, the interaction of plastic fragments with organic contaminants, particularly those at the micro- and nanoscales, is significant in terms of environmental pollution and the biological consequences on species in the water column, as well as in the sedimentary environment (Gomiero et al. 2018; Pittura et al. 2018).

Plastic pieces of various sizes could more efficiently carry pollutants across biological membranes and eventually within the cells of aquatic creatures. For a wide spectrum of chemicals under natural aquatic circumstances, the presence of organic contaminants on marine plastics has been demonstrated (Rochman et al. 2013; Bakir et al. 2014).

The toxicity of organic pollutant-enriched MPs is primarily inversely connected to the size of the particles, since the smaller the particle, the deeper it may penetrate into the body and release toxic compounds in the presence of an acidic gut environment (Batel et al. 2016). Numerous toxicity mechanisms are represented by increased oxidative stress, genotoxicity, loss of immune competence, impairment of key cell functioning, loss of reproductive performance, disturbances in energy metabolism, and changes in liver physiology (Auta et al. 2017; Riesbeck et al. 2017). These toxicity mechanisms are based on the properties of the adsorbed chemicals.

The application of concentrated hydrogen peroxide is another widely used method for eliminating organic debris (Imhof et al. 2012). However, its usage must be carefully considered in terms of digestion conditions, as treatments including incubation times longer than 48 h and temperatures higher than 50C may cause the degradation of plastic polymers such as polyethylene and polypropylene (Nuelle et al. 2014).

5. Conclusions

Considering the potential effects of ESG actions on artisanal production, this study's findings have a number of practical implications for various stakeholders, both internally and externally, including managers, consultants, investors, credit agencies, lenders, policy-makers, the government, and the general public. This study may be helpful for managers and consultants in terms of management, strategic choices, and environmental planning to enhance overall sustainability performance.

It also cautions external institutions to support ESG investment and take into account their involvement in societal concerns, non-opportunistic behavior, trustworthiness, and integrity as part of the decision making. Consequently, legislators and the government should offer enough assistance and enforce management's adoption of moral ESG disclosure procedures. As a result, all parties involved in artisanal matters have access.

A handful of the study's shortcomings present opportunities for further investigation. First, a Salinas in Lebanon's northern region served as the subject of the case study. Future studies might interview additional historic and traditional Lebanese productions, such as those with good ESG practices, and include more Salinas. To investigate a wider geographic range, additional study is required.

For the removal of organic matter from intricate environmental matrices, several authors have recently proposed an efficient combined multistep technique based on a series of enzyme digestions followed by a brief hydrogen peroxide treatment (e.g., wastewater samples). In conclusion, a number of interesting techniques have been investigated for the extraction, purification, and pre-concentration of plastic compounds from sediments and marine biota, all of which may have drawbacks. To isolate polymers from a variety of various environmental matrices, preferably at a low cost and without changing the plastic's characteristics, more study is required.

The findings of this study are unique because they examine how ESG practices can improve product quality in a developing nation while allowing it to maintain artisanal production, taking into account the environment and its different polluting variables. As another step toward the creation of new theories in this area, this study offers a significant theoretical contribution by taking into consideration new elements when examining ESG adoption to become an eco-friendly company.

This work has some limitations, which could lead to a new line of research. First, the factors influencing three ESG pillars of adoption for Lebanese citizens were investigated at a specific point in time through various awareness campaigns and actions; future research can address this issue through other actions from NGOs in the region and in other Lebanese regions, such as the southern parts of Lebanon. Second, Salinas exists solely through entrepreneurship and artisanal trade. As a result, it will be interesting to expand the sample size and include more Salinas from different regions in order to duplicate the results and search for differences.

Future research can replicate this study in multiple geographical regions and cultural situations, using a more inclusive sample to illustrate probable regional and cultural differences or factors that influence ESG adoption from a broader viewpoint. Finally, ESG action is still in its early stages in Lebanon; thus, while this study investigated the impact of ESG solutions on Salinas, other sectors and industries can be included in future work. Additional study can replicate this methodology to assess the impact of ESG solutions on entrepreneur venture performance.

Finally, this study used a case study approach. It would be interesting to include a qualitative method to analyze the true effect of the many aspects contained in the ESG model on the quality of products (sea salt) in terms of enhancing productivity and performance, increasing sales, and providing a better quality-to-price ratio.

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