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A Review of Some Current Sustainability Management Practices in the Airline Industry: Proposed SMART Strategies and Methodologies for Improvement

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Abstract

This paper reviews some common sustainability management practices in the airline industry, focusing on the airport sector. It reviews and summarises the state of knowledge on current sustainability management practices in the airline industry and creates an understanding for readers of the need for the airport sector to improve its sustainability practice by engaging SMART sustainability strategies and methodologies. This paper proposes three sustainability strategies for the airport sector to adopt to improve its sustainability management practices. Two methodologies are recommended for each strategy proposed for airports to adopt and operationalise.

Subject Areas

General Management

Keywords

Sustainability Strategies, Sustainable Management Practices, Carbon Emission, Airport Carbon Accreditation, Climate Change, Green Infrastructure, Airline Industry

1. Introduction

This research reviews some current environmental sustainability management practices in the airline industry. Airline operations are often associated with environmentally damaging consequences. The airline industry also contributes substantially to the increased global inventory of greenhouse gases with negative

climate change implications (Whitelegg, 2000) [1]. Although this study is a review of current sustainability management practices of the airline industry, it aims to propose appropriate sustainable management strategies that the airline industry could use to facilitate positive environmental sustainability management practices. The study also presents sustainability management methodologies to help the airline industry implement the strategies proposed.

Since the major player in the airline industry is the airport sector, airports should be committed to a long-term sustainability management approach in implementing a sustainable vision that could help build the "airport of the future". Thus, positive sustainability management is important to airports as long-term multi-generational businesses requiring medium and long-term strategies to achieve targets such as reducing carbon emissions and improving environmental performance. Airlines and airports should remain committed to sustainability, making a positive contribution through their operations in the business activities in the economy, local environment, and community (Auckland Airport, 2020) [2]. There has been significant academic study of the airline industry relative to the impact of the industry on environmental sustainability (Zieba & Johansson 2022) [3] (Whitelegg, 2000) [1]. However, there has been no academic research focusing on environmental sustainability management strategies with appropriate methodologies for implementation in the airport sector Therefore, this study focuses on this perspective to reduce the identified gap in the related academic literature. In view of this, this study aims to examine the existing environmentally sustainable management practices of the airline industry; propose SMART sustainable strategies; and recommend sustainable management methodologies.

The research is structured into four sections: Section 1 introduces the airport sector and outlines the sections of the report. Section 2 presents a brief analysis of current sustainable airline practices and the role and influence of stakeholders in developing these practices for airports. Section 3 proposes three effective sustainable SMART strategies for airports. Subsequently, Section 4 recommends effective sustainable management methodologies to achieve the proposed strategies, followed by the conclusion and reference list.

2. Brief Analysis of Airlines' Current Sustainable Management Practices

There are various definitions of sustainability, but from a business and this study's perspective, sustainability is defined as meeting the needs of the present organisation and stakeholders without compromising the needs of future stakeholders (Alameeri *et al.*, 2018) [4]. There are three dimensions/pillars of sustainability development: economic, social, and environmental. To attain truly sustainable development in the airline industry, the industry must balance all these pillars (ICAO, 2019) [5]. Economic sustainability emphasises safeguarding and sustaining human and material resources, prevention of wastages possibly through recovery and recycling for conservation of resources for generations

coming after us (Whitelegg, 2000) [1]. Social sustainability involves people's needs and desires, considering how these could be delivered, the effects of lack of these, actions taken by the wider community and how social change can be embraced to enable people and communities to provide and plan for their social well-being in the future (Whitelegg, 2000) [1]. Environmental sustainability is the expected human responsibility for the conservation of natural resources and safeguarding the global ecosystem to realise environmental and human well-being now and in the future (Whitelegg, 2000) [1]. The most important emphasis on environmental sustainability is ensuring that our environmental activities today do not jeopardise the lives of future generations Omisakin & Kularatne (2022) [6].

The aviation industry has made some positive contributions to sustainability by its demonstration of the overall reduction of its enviro-socio-economic impacts and ensuring that it is contributing to positive enviro-socioeconomic impacts (ICAO, 2019) [5].

Prior to 2015, some airlines adopted sustainable innovation in the use of aviation fuel to reduce the amount of air pollution emanating from the carbon dioxide pumped out of their aircrafts engines. This was one of the first promising sustainability measures adopted by the airline industry to reduce the environmental impacts of its aircraft flight operations (ICAO, 2019) [5]. According to Gill (2018) [7], Virgin Atlantic 747 was the first airline to use sustainable aviation fuel (SAF) to fly from London to Amsterdam in February 2008. Since then, many airlines have adopted different sustainable aviation fuels. Overton (2022) [8] submitted that SAF can be produced from various feedstock: oil seed plants and energy grasses; agricultural and forestry residue; organic municipal solid waste; fats, oils, and grease from cooking waste and meat production; algae; and industrial carbon monoxide waste gas.

GelirliSahin and Yasar [9] identified three main criteria (environment, economy and social) that should be used to guide the airline industry in its sustainable management practice. These three criteria are further divided into 23 sub-criteria as the most sustainability-related practices common to the airline industry. The authors concluded that fuel efficiency is the topmost sustainability practice of the airline industry in Turkey. However, examining the three main criteria, Gelirli and Yasar (2021) [9] found that economic (71.4%) concerns constituted the major influencing factors in the airline industry, followed by environmental (15.8%) and social (12.7). Examining the 23 sub-criteria, the authors ranked them in terms of their priority for the airline industry in Turkey. The first to third rankings were from economic criteria: fuel efficiency (1.167), aviation revenues (0.155), and network development (0.154). It could be concluded that the focus of the airline industry in Turkey is economic issues. This could be at the expense of the remaining two pillars (environment and social). If this is the case, it will negate the principle behind the Triple Bottom Line model supporting the three pillars of sustainability development as presented in **Figure 1** below.

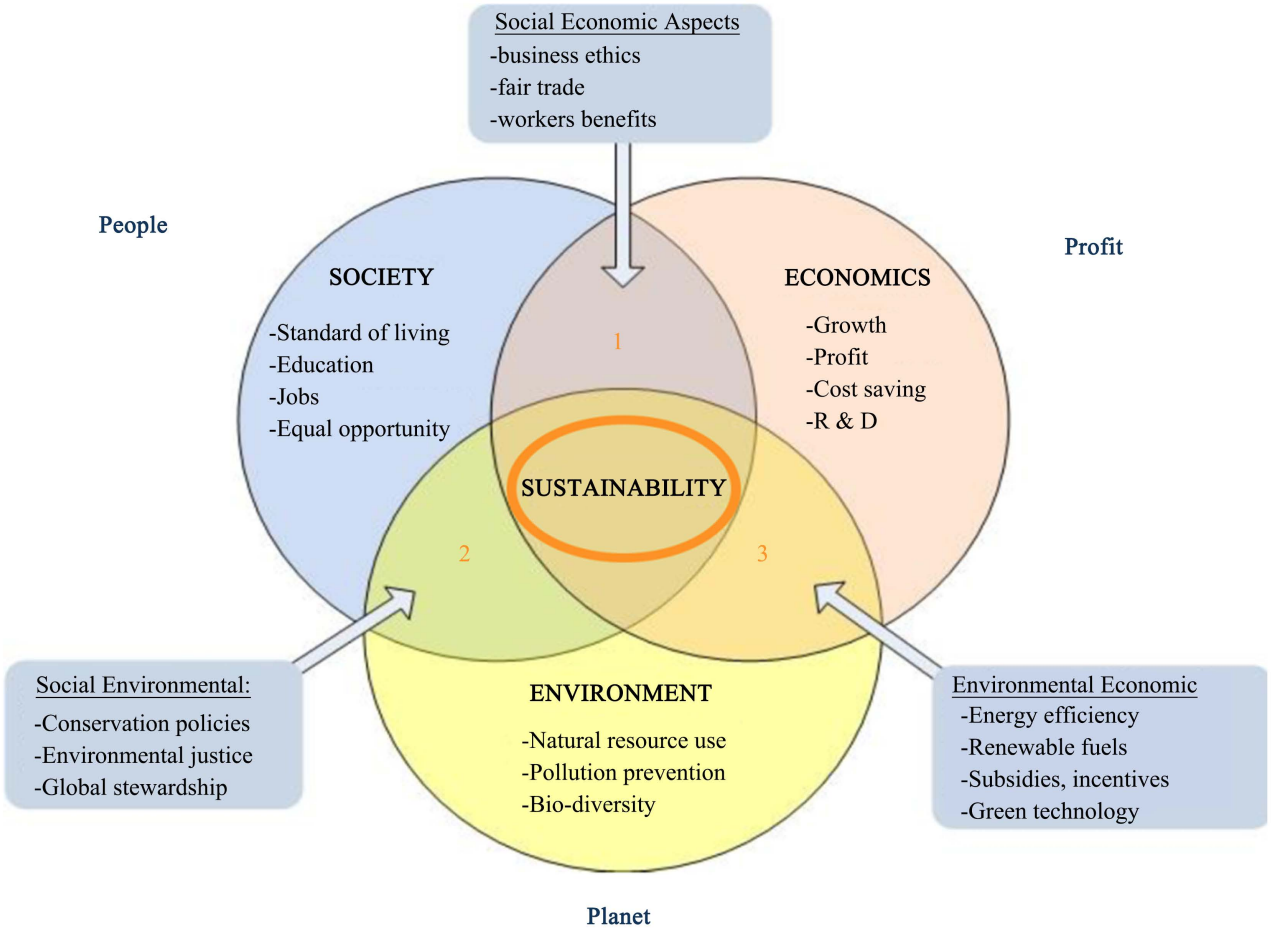

Figure 1. Relation of sustainability with environment, society and economic (Abood & Kamil, 2021).

2.1. Triple Bottom Line (TBL) Theoretical Model

Figure 1 presents a framework for organisations to manage and measure their sustainability performance using three components/pillars (social, environmental, and economic). This model is fundamental to an organization's sustainability strategy implementation Loviscek (2022) [10], and many organisations have adopted it to evaluate their sustainable management practices (Law, 2015) [11]. Conceptually, the model establishes that the three pillars should relate together positively without any of the three having a negative impact on the others. For instance, while the economic pillar focuses on organisation growth, profit, cost saving, and research and development, the same applies to the airline industry. This should not be to the detriment of society and the environment. Expectedly, the airline industry should contribute positively to society and ensure society has a sustainable standard of living, education, provision of jobs and equal opportunity for all. The same is expected of the airline industry in relation to the environment. Its economic activities should not have a negative impact on the environment. It is expected that the airline industry should engage in sustainable use of natural resources, desist from environmental pollution, and contribute to biodiversity as required to sustain our natural ecosystems on which all life de-

pends. It is believed that if these three dimensions are well addressed and managed, they will support airlines' processes of attaining sustainability Pryn *et al.*, (2015) [12]. Gibson (2005) [13] argues that the triple bottom line model encourages trade-offs to establish a sustainable development spot in the center (as shown in Figure 1) and oversee the interdependence of the dimensions. Trade-offs can lead to default prioritization of the economic dimension to the detriment of the social and economic dimensions. However, Faisal *et al.* (20017) [14] and Schulz & Flanigan (2016) [15] argue that it is difficult to assess the contributory effects of each of these pillars based on the relationship between them, especially when an organisation does not have an appropriate sustainability accounting system/practice to measure, analyse and report such an organisation's economic, social, and environmental impacts (Keddie, 2021) [16].

2.2. Nested Theoretical Model

To address Gibson's (2005) [13] argument against the triple bottom line theory, the nested theoretical model was proposed as an alternative model to the triple bottom line. The nested model also has three dimensions which are not intersected in nature but are nested spheres. The three nested circular dimensions are the economic circle that is nested within the social circle, often referred to as socio-economic circle. These two are nested within the environmental circle as presented in Figure 2. This study's understanding of the above analysis of the nested model is that economic needs are nested within society's needs which in turn are nested within the needs of the environment. Ultimately our economy and society are dependent on the environment and would cease to function without the environment.

Figure 3 shows the conceptual framework of the airport current sustainability practices proposed sustainable strategies and recommended sustainable management methodologies.

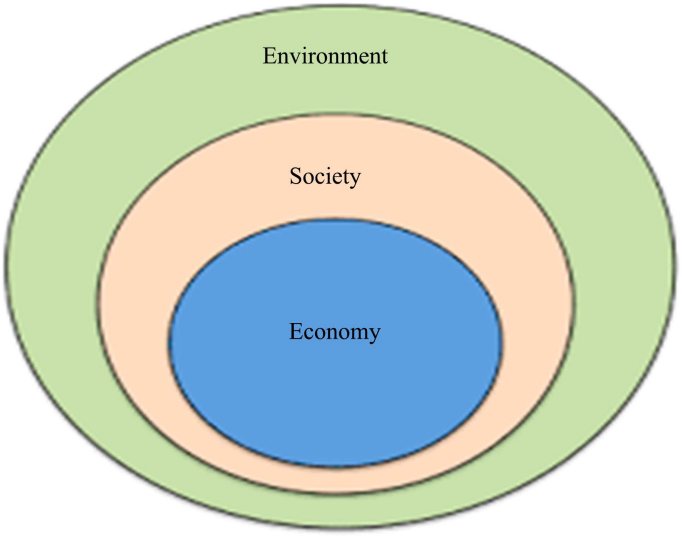

Figure 2. Delimitating sustainability and its dimensions (Gehringer & Kowalski, 2024).

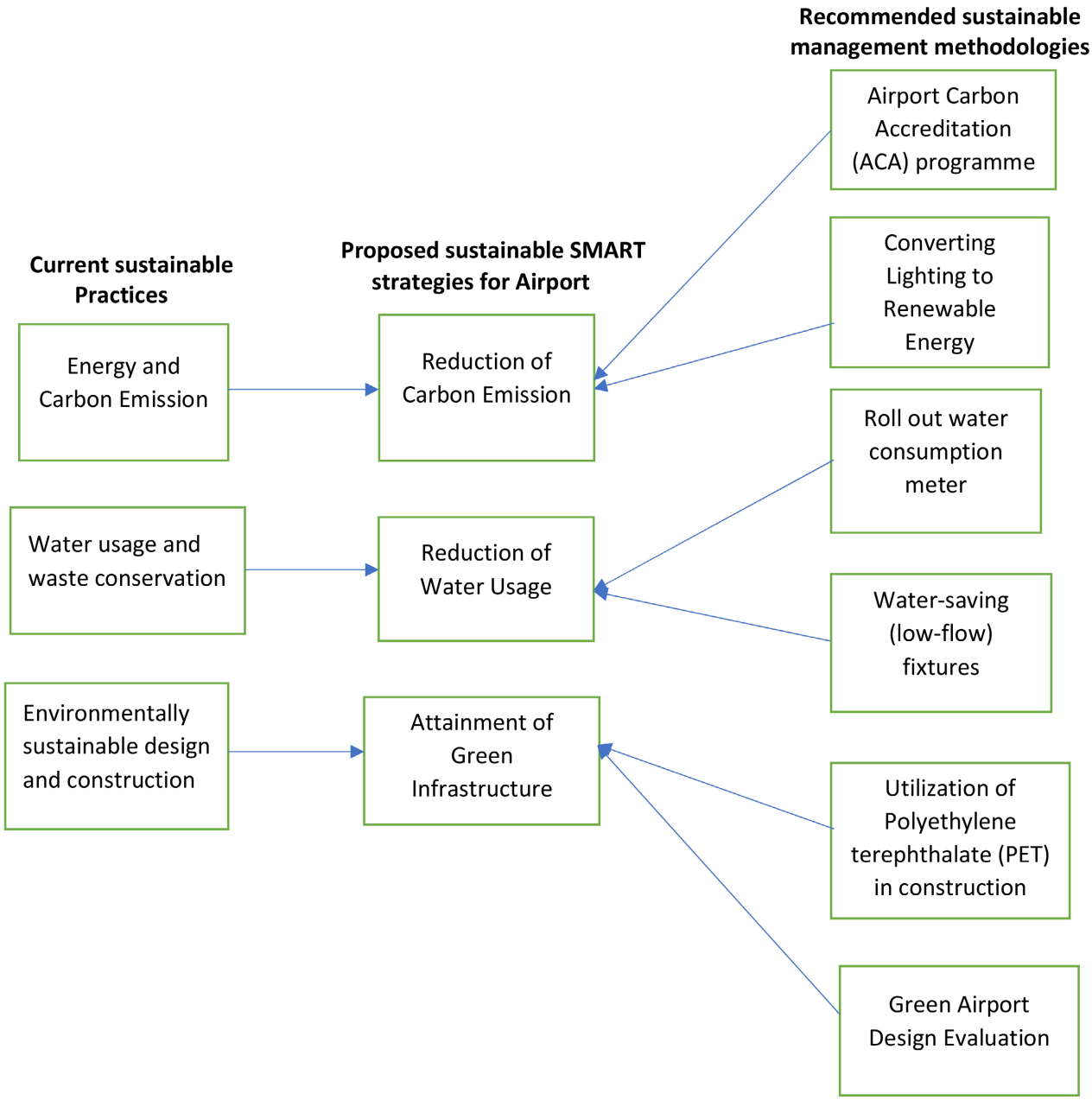

Figure 3. Airport current sustainability practices proposed sustainable strategies and recommended sustainable management methodologies conceptual framework. Conceptualised by the authors.

2.3. Airlines' Current Sustainability Practices

According to Wesselink *et al.*, (2015) [17] airline companies adopt sustainable development practices by integrating economic, social, and environmental concerns in their business strategies. These strategies include interacting with stakeholders to contribute to society in a sustainable manner. Airlines involve stakeholders in their business and sustainable development plans by incorporating their views and consulting them on a one-to-one basis as needed. The key internal stakeholders of airlines are their employees, shareholders, managers, supervisory boards, and the board of directors. whereas their main external

stakeholders include airline business partners, government, investors, customers, suppliers, retail and property tenants, ground handlers, joint border agencies, transport agencies and the community (Auckland Airport, 2019) [18]. The next section presents three current sustainability practices of the airline industry.

2.3.1. Climate Change (Energy and Carbon Emission)

Across the globe, the aviation sector accounts for carbon emissions which make up between 2% - 3% and 2.5% of greenhouse gas (GHG), which is projected to rise to 5% in the year 2050 Ritchie (2020) [19], Greer *et al*., (2020) [20]. To reduce greenhouse gas, airlines should sign a declaration with Airport Council International (ACI) on climate change to help them work towards carbon neutrality in 2050. This will be significant in reducing energy and fuel consumption across the airline industry. Similarly, airlines should work collectively with their partners to reduce airline fuel burn by introducing and improving the utilisation of ground power units (GPUs). Sadati and Cetin (2020) [21] argue that the application of GPUs is highly reliable and efficient in reducing noise and air pollution from engines during an airport stopover. This results in international flights not burning their own jet fuel, hence reducing carbon emissions. Some airports have engaged in the use of GPUs. For instance, Auckland International Airport Limited (AIAL) helps its airline partners with GPUs and pre-conditioned air (PCA) during the arrival and departure of aircraft, enabling them to use a low-carbon electricity grid before the next trip (Auckland Airport, 2019) [18]. This application was reflected in Sydney Airport as the "Ground Power Improvement Program" in 2018, which helped largely reduce carbon emissions de Castro *et al*., (2013) [22].

Consequently, energy consumption has been the main contributor at airports to the operation of terminal buildings, which includes lighting, heating, and cooling Ortega *et al*., (2016) [23]. Compared with 2019, most airports have reduced their energy consumption (electricity and natural gas) by 19% through the Energy Management Plan (EMP) (Auckland Airport, 2020) [2]. Additionally, if airlines are committed to transiting their operational fleet from diesel to electric transmission, this will help reduce their carbon footprint as well as improve the quality of air in the environment in which they operate.

Most airlines have been efficient in managing their carbon footprints through accredited external carbon auditing organisations. These airlines have partnered with the Climate Leaders Coalition to reduce emissions and have pledged to support the government in its policy on Zero Carbon (Auckland Airport, 2019) [18]. However, to achieve carbon neutrality, airlines need to adopt specific strategies that should focus on sustainability and explore new ways and methods of increasing efficiency, ensuring that developments are low-carbon and energy-efficient.

2.3.2. Water Usage and Waste Conservation

Waste and water management is perceived as a serious environmental issue for airline airports across the world Greer *et al*., (2020) [20]. The International Air

Transport Association (IATA) confirms the whole amount of passenger waste recorded in 2017 was 5.7 million tonnes (Sadati & Cetin 2020) [21]. Subsequently, a substantial volume of water is used by airports to maintain operations and infrastructure de Castro *et al.*, (2013) [22]. Thus, it is significantly expected for airports to implement sustainable water and waste management policies, strategies, and systems aligned with the Sustainable Development Goals (Baxter, 2021) [24]. However, the most prominent sustainable strategies of most airlines focus on 1) reducing waste at terminals, 2) reducing waste from arriving aircraft by working with airline partners, and 3) reducing their water use for operations (Auckland Airport, 2019) [18]. On average, very busy airports' services operate more than 50 international flights per day, producing more than 40 tonnes approximately of unprocessed cabin waste, such as plastic (PET), newspapers, and several other items left by passengers (Auckland Airport, 2021a) [3]. It is obvious that Airlines' sustainability improvement targets can be achieved by reducing waste to landfill (Auckland Airport, 2020) [2].

This could also be achieved by leveraging Airline supply chain relationships and encouraging food and beverage outlets to reuse utensils and cutlery instead of depending on single-use items in collaboration with their terminal retail tenants (Tofalli, Loizia & Zorpas, 2018) [25]. In addition to this, airlines should manage their aircraft cabin waste reduction in partnership with their waste management supplier, airline customers, and related Ministry by establishing the "Transition Waste Facility" approach (as shown in **Figure 4**) which will help sort recyclables out of waste as well as encouraging airlines to reuse headphones and trays (Auckland Airport, 2020) [2].

2.3.3. Environmentally Sustainable Design and Construction

According to Harris, Shealy & Klotz (2016) [26] if airport infrastructures are designed and developed thoughtfully, they can be more sustainable and cost-effective, but on the contrary, they could contribute negatively to the environment, through energy, carbon emission, and water consumption. However, during construction, there may be situations where the actual designs change because material choices go beyond conventional construction standards. This may impact sustainability outcomes (Shealy *et al.*, 2016) [27]. Thus, a major airline's goal should be to create a positive, sustainable, and attractive environment for its

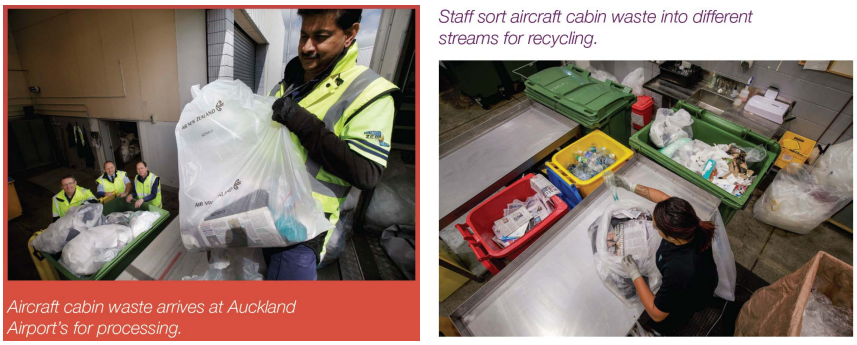

Figure 4. AIAL transition waste facility.

customers and employees. Airlines should ensure their suppliers and business partners contribute positively towards the achievement of an airport's long-term sustainability objectives by engaging in sustainability programmes for airport developments and infrastructure construction through partnering with stakeholders to maximise economic, social, and environmental benefits (ICAO 2019) [5]. Raouf & Al-Ghamdi (2019) [28], suggest Building Information Modelling (BIM) as a growing trend in construction, as it is a technology model used for sustainability to tackle problems faced with green building. As indicated in the Sustainability Report Auckland Airport (2019) [18], it is evident that integration of BIM and Geographical Information Systems (GIS) software in airline building works to create digital 3D replicas of the airport asset, will help in achieving cost-effective building. These will enable airports to build a new sustainable departure area, which will reflect the elements of the sea, land, and sky (Auckland Airport, 2019) [18]. (**Figure 5**)

This type of framework of airport infrastructure will ensure an airport will be sustainably designed. This should be done in consultation with business partners, seeking stakeholders' views and contributions to the plan and decisions on airport construction phases (Griffiths, 2014) [29]. However, airlines should ensure that they develop specific sustainable design standards for the airport in relation to architecture and engineering developments. Having analysed three common sustainable management practices of the airline industry, this research presents three proposed SMART strategies which the airlines industry could use to improve their sustainability practices.

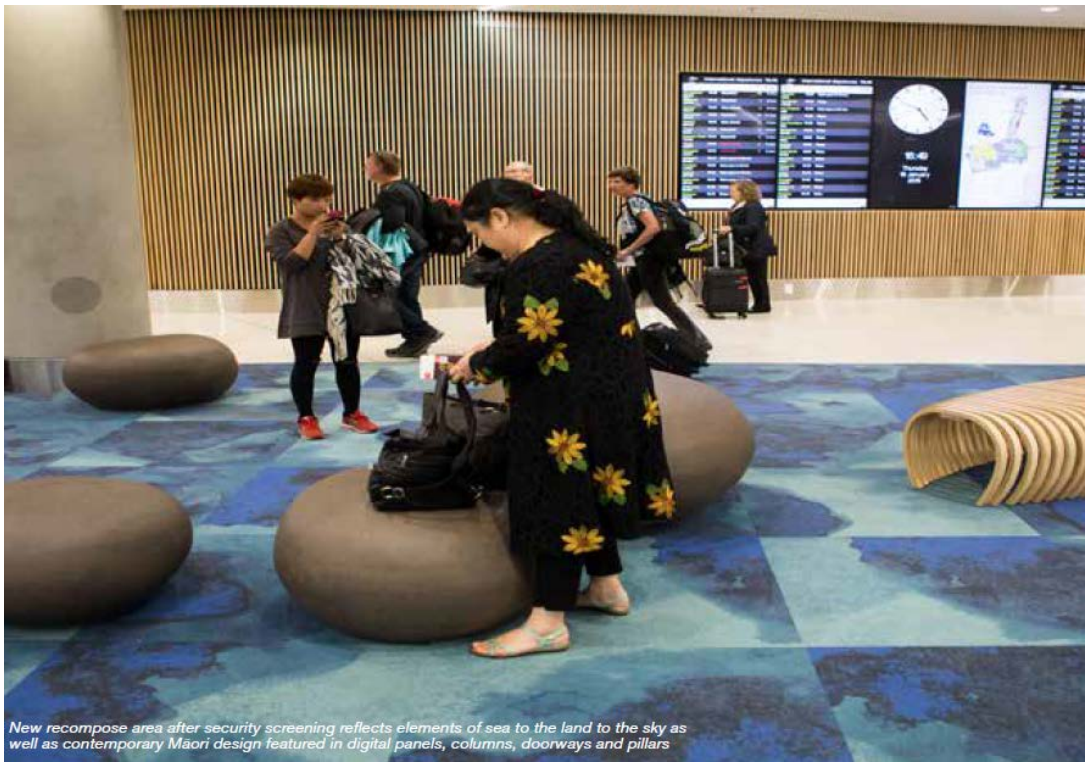

Figure 5. Sustainable design and construction at AIAL.

3. Sustainable SMART Strategies Proposed for Airports

3.1. Reduction of Carbon Emission

In recent years, the aviation industry has been recognised for several impacts and consequences on the environment. Thus, airports around the world are majorly focusing on their environmental impact to provide effective measures to combat climate change de Castro *et al.*, (2013) [22]. For instance, in 2018, Auckland Airport was recognised as a sustainability champion in New Zealand and was among the top 20 reducers of the carboNZero and Carbon Emissions Management and Reduction Scheme (CEMARS) programmes for its significant reduction of carbon emission by 22.6% (Nadkarni, 2014) [30]. However, for other airports to achieve more reduction in their carbon emission towards net-zero carbon, they need to devise a tangible and reliable carbon emission strategy such as implementing 100% Electric Vehicle (EV) for operational activities and installing GPUs and PCA units for domestic airports as well. Christchurch International Airport Limited (CIAL) reduced its emissions by 10% with these implementations (Christchurch Airport, 2021) [31]. Also, Airports can become net-zero carbon airports by prioritising zero-carbon operations and minimising carbon offsets through participating in the Airport Carbon Accreditation Programme (Newsroom 2019) [32]. Baxter Baxter (2021) [24] claims that Sydney Airport has adopted this programme and is on a pathway to zero carbon footprint by 2025. Additionally, this programme enables airports to implement best practices for carbon and energy management.

3.2. Reduction of Water Usage

Airports usually consume large volumes of water in operations and building infrastructure [29]. Moreover, water is also used for many other essential services at the airport, such as flushing toilets, cleaning, drinking, retail, and ground maintenance (Ashford *et al.*, 2013) [33]. This leads to airports generating substantial volumes of surface and wastewater. These wastewaters may contain hazardous contaminants which would have a highly negative impact on the soil and groundwater affecting the environment. However, Baxter, Srisaeng & Wild [29] in another article, mention that the water consumption at airports is equivalent to mid-size cities. Thus, it is necessary and important for airports to implement sustainable water management practices as a key component in their environmental plans and strategies Krop *et al.*, (2016) [34]. However, Auckland Airport has been using a considerable amount of water for its ongoing infrastructure and development programme for the airport, due to which it has been unable to achieve the water reduction target for 2020 Auckland Airport (2021b) [35]. Hence, airports need to propose strategies to reduce water usage that can improve their water usage plan. These could include water generation and consumption at the airport, thus reducing the impact on the environment. However, the process of achieving this sustainable strategy will include rolling out water meters, upgrading to low-flow fixtures, rainwater harvesting systems, pumping

stations, pipe leak repair programmes, and conducting surveys on water efficiency with stakeholders to identify areas of improvement in the airport precinct (Budd, Budd & Ison, 2015). [36]. These practices were implemented by London Stansted Airport which reduced its water consumption by 30% in five years from 753 million litres to 412 million litres in 2012 (Stansted Airport, 2013) [37]. Thus, this strategy will prove to be effective if the right methods are applied and managed successfully.

3.3. Attainment of Green Infrastructure

Studies reveal that the aviation sector contributes to air pollution and greenhouse gas which impacts the environment causing climate change. Thus, several airports across the world should be improvising their approach and taking vital measures in designing green infrastructures, by working with architects to move towards sustainable technologies and construct environmentally friendly airports (Sumathi, Phanendra & Teja, 2018) [38]. Therefore, airports need to focus on developing buildings and infrastructures that reflect the elements of green building design. However, there are certain limitations that depend on airport infrastructure growth, such as the number of runways and the extent of a taxiway. These could have an adverse impact on the environment, for instance, pollution, water consumption, availability of materials and energy resources and climate-change conditions, through the operations carried out at the airport (Ferrulli, 2016) [39]. Relative to this proposed strategy, Auckland Airport's current practices measure only 15% of green initiatives in their sustainable design and construction Auckland Airport (2019) [18], which means it is not doing much to alleviate its environmental impact. Therefore, adopting green infrastructure is a recommended strategy to airports to meet sustainable goals. It is argued that green infrastructure not only focuses on sustainable design but also renewable energy technologies (Santa, *et al.*, 2020) [40]. Likewise, airline sustainable infrastructure design should focus on reducing carbon, waste, and energy as well as improving customer experience at the airport. Airports can achieve this strategy through several methods, such as rooftop gardens, rainwater harvesting, and use of renewable energy by installing solar panels, using recycled materials for seating, recycling wastewater, and EV charging stations (Gómez Comendador, 2019) [41]. Some of these initiatives were implemented by Seymour Airport, Chicago O'Hare International Airport, and Denver International Airport, and have proved successful in reducing energy and carbon emission. They are popular in environmental performance and are recognised as the world's primordial green airports Sumathi, Phanendra & Teja, 2018) [38]. Hence, airlines should adopt some of these methods to achieve green infrastructure soon.

4. Recommended Sustainable Management Methodologies

To achieve the goal as proposed and analysed in the strategies above, airports can adopt several methods aligned with environmentally sustainable practices. A

few effective methods will be discussed in this section for airports to implement in order to reach their sustainable strategic goals.

4.1. Reduction of Carbon Emission

4.1.1. Airport Carbon Accreditation (ACA) Programme

The Airport Carbon Accreditation (ACA) programme is a framework designed, especially for airports to adopt to manage and reduce carbon emissions independently Baxter (2021) [24]. Baxter (2021) [24] further mentions that the ACA programme helps airports to evaluate, report, measure, and verify their efforts in managing and reducing emissions with the aim of accomplishing carbon neutrality. Participating in the ACA programme will guide and support airport environmental practices through a method of continuous improvement and partnership with stakeholders (Miedico, 2018) [42]. The ACA programme will help airports achieve their strategic goals through the following four level steps as illustrated in **Figure 6**.

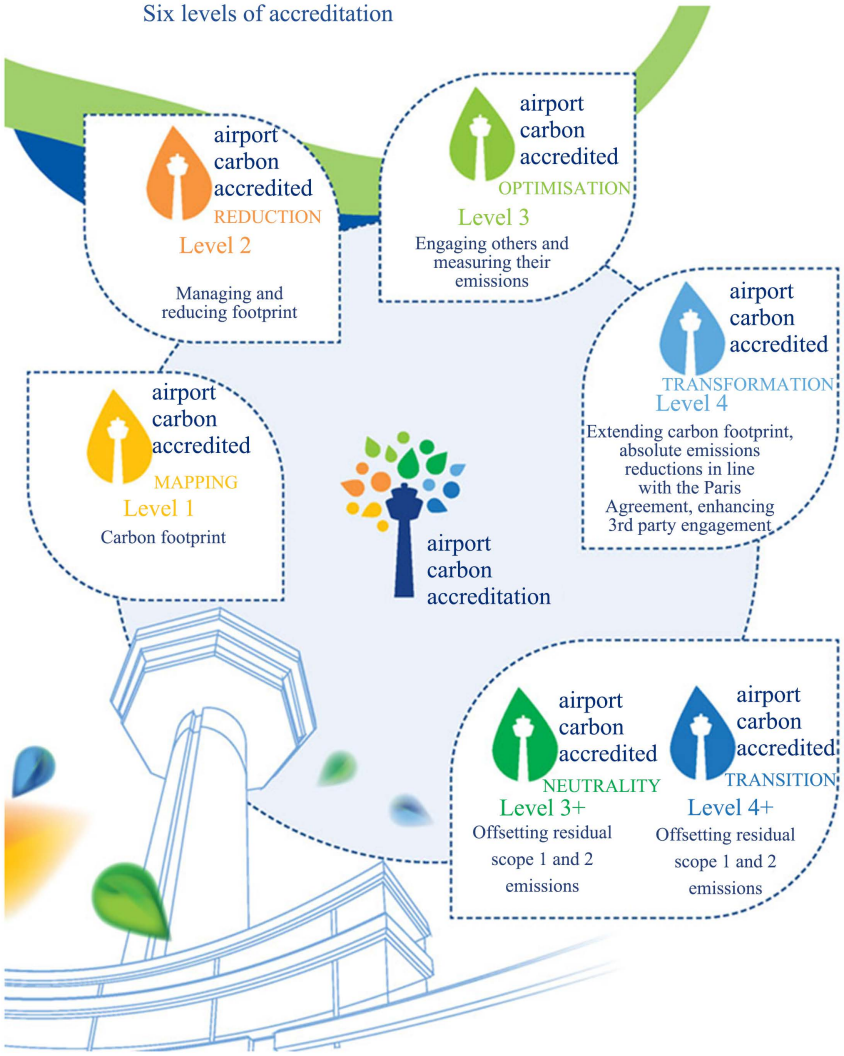

Figure 6. ACA certification scheme.

Level 1 is **"Mapping"** which will verify the carbon footprint and policy commitment of the airport to reduce emissions. At this level, the airport must determine its operational boundary and its emissions sources within the determined boundary; collect data and calculate its yearly carbon emission; determine and compile its yearly carbon footprint report; engage an independent third party to verify its compiled carbon footprint to establish that the report meets with ISO14064 and accreditation requirements; create a policy commitment towards emissions reduction by the highest management cadre.

Level 2 is **"Reduction".** Prior to this level the airport must have met the Mapping requirements. At this stage the airport will develop a plan on carbon management with a definite goal of reducing emissions. In addition, the airport will demonstrate its ongoing carbon reduction plan to ACA, against the progressing average of emissions. To achieve this, the airline must ensure the following: establishment of a senior committee or body responsible for climate change/carbon/energy matters; such a body must regularly communicate airport emissions performance to relevant stakeholders; create procedures for formulating and determining its accurate carbon footprint; create a monitoring procedure or process for monitoring consumption of fuel and energy; develop carbon/energy reduction targets; create control processes towards minimising emissions; possibly engage in emission impact investments; train employees on emissions awareness; create a procedure and process on self-auditing and awareness towards monitoring emissions reduction and continuous improvement.

Level 3 is **"Optimisation"** Before this level, the airport must have fulfilled the needed requirement on Mapping and Reduction. At this level, the airport must widen the focus of its carbon footprint to include landing and take-off cycle emissions; surface access to the airport for passengers and staff; and staff business travel emissions. The airport must also include an elaborate plan of stakeholder engagement with third parties towards reducing emissions from scope 3 sources. However, to engage stakeholders, the airport must identify and categorise for guidance and influencing; allocate roles and responsibilities for engaged stakeholders; communicate and train stakeholders relative to emission reduction; create an implementation plan and approach for engaging with stakeholders on proposed actions and timing of current sustainability management practice of the airline industry (Annual Report, 2011) [43].

The fourth step is **"Neutrality".** The airport must complete all requirements of "Mapping", "Reduction" and "Optimisation" before engaging neutrality. At this stage, the airport should offset the carbon emissions which cannot be further reduced under the airport's direct control (Attanasio, 2018) [44]. Many airports using this framework have seen drastic results in carbon reduction, and thus this method will prove to be an effective solution for an airport to reach its carbon emissions reduction goal. For instance, Naples International Airport is currently certified at Level 3 – Optimization (Attanasio, 2018) [44], whereas Christchurch International Airport is the first airport in New Zealand to reach Level 4 Transformation in 2020 (International Airport Review, 2020) [45].

4.1.2. Converting Lighting to Renewable Energy

According to Nadel & Ungar (2019) [46], energy efficiency can reduce the use of energy and greenhouse gas emissions by nearly half by 2050. In the aviation industry, heating, ventilation, and air conditioning (HVAC) systems consume 50% of energy used, thus airports should move towards renewable energy to reduce emissions. Similarly, airport energy is mainly consumed by terminal buildings, which include the HVAC systems and Airport airside, as well as ground vehicles, runway lighting and auxiliary power units (APUs) (Kivits, Charles & Ryan, 2010) [47]. Thus, reducing these systems will significantly reduce energy consumption at the airport overall. The first step to reducing emissions for an airport is consideration of the following energy conservation measures: replacing conventional lighting with LEDs, upgrading HVAC systems, and transiting to 100% electric vehicles on the ground (Rai, 2016) [48].

The next step would be evaluating these measures using renewable energy like solar PV and hydro [55]; Greer *et al.*, (2020) [20]. Ortega *et al.*, (2016) [23] argue that many airports are actively participating in utilising solar power by installing solar photovoltaic (PV) on rooftops and large grounds at the airport. An airport can achieve this by purchasing long-term renewable energy through Power Purchase Agreements (PPAs), as these will help in reducing emissions up to 100% (Barrett *et al.*, 2015) [49]. The advantage of this is that it does not require an airport to have its own infrastructure that generates renewable energy. PPA guarantees renewable energy with a continuous supply but investing in it initially will be costly for airport, which can be a drawback Ortega *et al.*, (2016) [23]. However, opting for renewable energy will help airport operations become more sustainable and reduce emissions to achieve this strategic goal.

4.2. Reduction of Water Usage

4.2.1. Roll out Water Consumption Meter

Rolling out a water consumption meter program will systematically evaluate the activities and areas of water usage across the airport (de Castro *et al.*, 2013) [22]. Furthermore, water metering proves to be an essential and significant stage in analysing water consumption at the airport. If airports do not have this facility, rolling out water metering will not only help them to reduce water usage but also track its usage thoroughly. Moreover, studies claim that introducing economic tools like water metering results in reducing water usage, as it identifies leakages and considers water consumption patterns (Lawton *et al.*, 2015) [50]. This initiative will detect if there are any pipe leaks and help the airport to take corrective measures to repair and control water use. In addition, water metering will also monitor the demand for use of water, such as drinking water and dishwashing in the airport precinct (Sánchez *et al.*, 2021) [51]. The water consumption metering will be monitored regularly, with software that uses data from metering points that will assess leaks and water consumption as expected, as well as, identifying irregular consumption patterns. This water consumption diagnosis then generates a report, which makes it easy for an airport to adopt specific policies and

corrective measures to reduce water use at the airport (ICAO, 2016) [52]. This initiative has been adopted by Sydney Airport and London Heathrow International Airport and has helped them to reduce water through water efficiency measures, for instance, developing a real-time water demand monitoring system and running a complete leak detection program (de Castro *et al.*, 2013) [22]. Hence, implementing water metering at an airport is a recommended method for airports to implement a water usage sustainability management strategy.

4.2.2. Water-Saving (Low-Flow) Fixtures

Airports should adopt water efficiency programs by replacing their conventional sanitary fittings with low-flow water-saving fixtures, which will help them reduce water consumption significantly. As, water consumption at airports majorly comes from washroom fixtures such as washbasins, urinals, and toilets (ICAO. 2019) [5]. Moreover, the Sustainable Airport Management Plan confirms this in its report, which states that replacing all water fittings with efficient low-flow fixtures improves water usage (Carlini, 2013) [53]. Thus, airports should consider this method to improve water usage. An airport can achieve its water reduction goal with Water Sense models, by installing low-flow taps and showerheads, as well as, upgrading toilets, urinals, faucets, and aerator fixtures. Airports can replace toilets that use 6.05 L or 3.8 L to news ones with 4.84 L or 1.9 L per flush with dual flushing mechanism or half-flush systems to reduce water usage de Castro *et al.*, (2013) [22]; (Somerville *et al.*, 2015) [54]. Atlanta Airport is an example of implementing this water-saving fixture. Several airports that adopted this method have achieved significant results, such as Frankfurt Airport which installed waterless urinals, saving approximately 4.2 million litres of drinking water, as well as cost savings each year, and Dubai International Airport installed all toilets with sensor-operated washbasin faucets, saving 163,000 m^3 of potable water per year de Castro *et al.*, (2013) [22]. The limitation of water-saving fixtures is that the installations will be costly ((Baxter, 2021) [24], but on the other hand, they will save an airport thousands of cubic meters of water annually, which will be advantageous in sustainably reducing water consumption at the airport, thereby achieving the reduction of water usage strategic goal.

4.3. Methodologies for Green Infrastructure Strategy

4.3.1. Utilisation of Polyethylene Terephthalate (PET) in Construction

According to (Mishra *et al.*, 2016) [55], there is significant use of polyethylene terephthalate (PET) in society daily, which has given rise to the issue of disposal of the material. Thus, the solution to it is reusing or recycling plastic waste, which many construction industries are doing, by using PET to harden concrete or make furniture, as a cheap and effective use of material. Airports are also using PET within asphalt for road construction and surfacing. For instance, Carlisle Airport in the UK used PET as a sustainable alternative for resurfacing runways and taxiways (Sasidharan, Torbaghan & Burrow, 2019) [56]. Using PET waste in concrete is not only a method to solve environmental issues but also a

strategic method of producing more economical and sustainable infrastructure in the future (Mushtaq, 2018) [57]. Auckland Airport receives approximately 9 tonnes of PET per day, from the transitional waste facility Auckland Airport (2021a) [3]. By adopting this strategy, Auckland airport could recycle PET waste and use it for constructing new runways, taxiways, or creating sustainable furniture within the airport precinct. This would help reduce the usage of polymeric material in building infrastructure, which has a substantial effect in polluting the environment, such as carbon emission and issues with waste disposal (Sulyman, Haponiuk & Formela, 2016) [58]. Furthermore, using PET can be advantageous as well, as it has good mechanical properties, chemical resistance, and has dimensional stability under flexible load (Mishra *et al.*, 2016) [55].

Christchurch Airport has installed new furniture, which has the seating fabric made from recycled PET waste, as its sustainability initiative (Christchurch Airport, 2021) [31]. Thus, using PET in this way will help airports develop environmentally sustainable design and construction, ensuring a reduction in the carbon footprints of the airport significantly, hence, achieving its green infrastructure strategic goal towards green infrastructure.

4.3.2. Green Airport Design Evaluation

The use of the Green Airport Design Evaluation (GrADE) method and its tool contributes to achieving the sustainable development goals of airport infrastructure (Ferrulli, 2016) [39]. This should be done by designing a framework to create new prospects for the airport sector of the aviation industry and to monitor and measure overall environmental performance (Ferrulli, 2016) [39]. The GrADE method follows a systematic process linked to sustainability, helping airports to reach sustainable goals and objectives, as well as evaluating and managing sustainability performance. This method will help airports to use the system in a flexible manner, as it prioritises the requirement allowing airports to choose sustainable strategies aligned to their organisation and stakeholder selection, thus adopting it as a comprehensive approach. Similarly, this approach will help the airport to reduce emission, energy, water, and waste usage, which fits into the categories of the GrADE framework of requirement and design specifications (Ferrulli, 2016) [39]. Using this method, an airport can ensure effective measures are taken to guide the sustainable design process of green building requirements. This can be achieved by setting sustainability indicators related to airport design and providing solutions for technology and infrastructure building to minimise environmental concerns (Setiawan & Sadewa, 2018) [59]. Additionally, an airport can use Leadership in Energy and Environmental Design (LEED) as the sustainability indicator to assess its building environmental performance and integrate sustainable development into construction processes (Ferrulli, 2016 [39]; Koç & Durmaz, 2015) [60]. Some airports in the UK use this method, which has helped them reduce emission and environmental performance overall (Carlucci, Cirà & Coccorese, 2018) [61]. Thus, airports can use the GrADE method and tools to categorise, assess, prioritise, and select effective

sustainability practices for their capital projects, agendas, and operations and reduce the airport's environmental impacts through green infrastructure strategy.

4.3.3. Methodology

This study conducted a systemic review of relevant literature on current sustainability management practices in the airline industry, sustainability management strategies and methods of achieving such strategies. To review related academic literature, this study accessed top databases for sustainability research such as JSTOR Sustainability Collection, Elgar Online Ebook, GreenFILE, and Research Rabbit Social Science Research Network among others. The study also reviewed the literature on sustainability theories. In accordance with literature review protocol (Tranfield, Denyer & Smart, 2003) [62], needed information was collected from different academic journal articles and books after reading, reviewing, and analysing. Without bias the information collected was compared and evaluated, and this enhanced transparency, reliability, and evidence-based and justified knowledge examination. Some Predefined terms and keywords such as sustainability strategies, sustainable management practices, climate change, green infrastructure, ecosystem services, air and water management qualities among others were used on Google Scholar, ProQuest, and the Google search engine to access relevant published books and journal articles (Lazar, Klimecka-Tatar & Obrecht, 2021) [63].

5. Conclusion

To sum up, this research paper identified the three most current environmental sustainability practices of airports, as the aviation industry has a significant impact on the environment, which includes climate change issues through various practices. This research is of the opinion that attaining sustainability by the airline industry, especially the airport sector, is of critical importance from the perspective of the three sustainability pillars. It is also necessary for the airport sector to analyse critically the importance of these pillars from stakeholders' perspectives to create an integrated approach suitable for all stakeholders as well as the airport. This study undertook a systemic review of current related literature to analyse some current sustainability management practices of airports. This was done with a view to understanding what is lacking in their current sustainability practice. As a result, this study developed a theoretical framework on the linkage between an airport's current sustainability practices, and three new sustainability strategies proposed to help them improve their sustainability management strategy with six methodologies to implement the proposed strategies. Thus, this research proposed three SMART strategies for airports: reduction of carbon emissions, reduction of water usage and design and attainment of green infrastructure. The research also recommended two effective and sustainable methodologies for each strategy proposed. This was to help airports towards implementing the proposed strategies and to reduce the gap in the literature as

identified.

6. Theoretical Contribution

The study examined three current sustainability management practices of the airline industry, focusing on the airport sector. The study created a theoretical framework that includes three key current sustainable management practices of the airport sector: energy and carbon emission; water usage and water waste conservation. It proposed three sustainable management practice strategies to enhance improvement in the airport sustainable management practices and recommended two sustainable management methodologies for each strategy proposed. Therefore, this study presents a comprehensive and holistic framework that involves identification and analysis on three current sustainability management practices of airports. It proposes additional sustainable management practices and recommends sustainable management methodologies. This conceptual framework was developed to advance the understanding of some sustainable management practices in the airport sector and the challenges associated with the implementation and management of the airport's sustainability practices. The framework represents a novel approach to improving sustainability management practices of the airport sector by proposing strategies and methodologies that will help implement and attain stated goals of the proposed strategies.

7. Practical Contribution

This research contributes to identifying some current sustainable management practices of the airport sector. The research also voices out on the shortcomings of these sustainable management practices. In view of the shortcomings, the research proposed three new sustainable management strategies for the airport sector. Six appropriate sustainable management methodologies were recommended to the airport sector to facilitate application of the sustainable management strategies proposed. This study developed a framework guideline to respond to the need to improve the quality of sustainability management in the airport sector by applying appropriate sustainable management strategies and methodologies in their sustainability management practices. Consequently, this framework will help airport managements' decision makers and other stakeholders to provide appropriate sustainable management practices and policies.

8. Limitations and Further Research

Although this research identified and analysed the current sustainability management practices of the airline industry, especially the airport sector, it does not analyse the importance and need for the airport sector to apply the philosophy of the triple bottom line model to its sustainability practices. In addition, this study does not discuss the need for the airport sector to fully involve its immediate community as well as the stakeholders in its sustainability management

practices.

In view of the above, this study recommends academic research to examine how airports can create sustainability practice awareness in their immediate communities. This is important for building appropriate sustainability practices and behaviour within a community. It will also enable an airport to know the impact its operational activities will have on its immediate community.

Conflicts of Interest

The authors declare no conflicts of interest.

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