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Master in Business Administration (M.B.A.)

Postgraduate Dissertation

"Airport management, New challenges-

The impact of Covid-19 on Airports"

Olympia Karastergiou

Supervisor: Masouros Gerasimos

Patras, Greece, June 2021

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“Olympia Karastergiou”

Supervising Committee

Supervisor:
Gerasimos Masouros

Co-Supervisor:
Dimitris Dimitriou

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"I would like to dedicate this dissertation, with all my love, to my great supporters and miracles of my life, Christiana and Dimitris"

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Abstract

Air transport has become an essential means of mobility in globalised societies. It has developed very rapidly during the last decades. Airports support services with regards to airside and landside operations, while modern airports-hubs have extended facilities, consisting an important part of the economy.

It is well understood that at the same time, its negative impacts on the environment and local societies are visible. It becomes critical to achieve sustainable aviation and thus balance the economic, ecological and social impacts.

The new challenge that is brought is to establish a sustainable airport into the context of a sustainable management approach within the airport's organisation.

The present dissertation examines an efficient airport management into the context of the challenge of "sustainability".

The new challenge referes to the airport management of a sustainable airport.

Though, it will be assessed the importance for an airport organization of having a sustainability vision and a sustainable mission statement that will fuel the development of a sustainability strategy. For achieving a sustainable airport, a holistic and integrated managerial approach should be adopted.

The airport's managerial approach is further analysed, regarding the sustainability goals and objectives and the sustainability strategy within the organization. Case studies are also presented that highlight the different ways of managing sustainable airports, according to each airport's organization and applied management processs.

This report also presents the impact of Covid-19 on airports and discusses how an airport in the post Covid-19 era, will achieve to manage new challenges.

The methodology applied for this report, was based on literature review and its analysis.

Keywords

Airport Management, Sustainability, Sustainable Airports, Corporate Sustainability, Corporate Strategy, Covid-19.

"Διαχείριση αεροδρομίου, Νέες προκλήσεις – Οι επιπτώσεις του Covid-19 στα Αεροδρόμια"

Περίληψη

Οι αερομεταφορές αποτελούν σημαντικό μέσο κινητικότητας στις παγκοσμιοποιημένες μετακινήσεις. Εξελίχθηκε ιδιαίτερα γρήγορα κατά τις τελευταίες δεκαετίες. Τα αεροδρόμια υποστηρίζουν υπηρεσίες τόσο αέρος όσο και εδάφους, ενώ τα σύγχρονα αεροδρόμια-κόμβοι, έχουν εκτενείς εγκαταστάσεις, αποτελώντας ένα σημαντικό κομμάτι της οικονομίας.

Είναι καλά αντιληπτό ότι ταυτόχρονα με το παραπάνω, οι αρνητικές επιπτώσεις του αεροδρομίου στο περιβάλλον και στις τοπικές κοινωνίες είναι ορατές. Καθίσταται έτσι κρίσιμη η επίτευξη της βιώσιμης αεροπορικής δραστηριότητας, η οποία με αυτό τον τρόπο, θα ισορροπήσει τις οικονομικές, οικολογικές και κοινωνικές επιπτώσεις. Οι νέες προκλήσεις, αφορούν στα βήματα για την εγκαθίδρυση και διοίκηση ενός βιώσιμου αεροδρομίου, μέσα στο πλαίσιο της προσέγγισης της βιώσιμης διαχείρισης του οργανισμού του αεροδρομίου.
Η παρούσα διπλωματική εργασία, εξετάζει την αποτελεσματική διαχείριση αεροδρομίου μέσα στο πλαίσιο της πρόκλησης της «βιωσιμότητας». Η νέα πρόκληση αναφέρεται στη διαχείριση ενός βιώσιμου αεροδρομίου. Προς τούτο θα αξιολογηθεί η σπουδαιότητα για έναν αεροπορικό οργανισμό να έχει όραμα βιωσιμότητας και δήλωση βιώσιμης αποστολής, τα οποία θα τροφοδοτήσουν την ανάπτυξη μίας βιώσιμης στρατηγικής. Για να επιτευχθεί η υλοποίηση ενός αειφόρου αεροδρομίου, θα πρέπει να υιοθετηθεί μία ολιστική προσέγγιση διαχείρισης.

Η διαχειριστική προσέγγιση του αεροδρομίου αναλύεται εκτενέστερα, σε σχέση με τους στόχους και τα κριτήρια βιωσιμότητας καθώς και σε σχέση με τη στρατηγική βιωσιμότητας εντός του οργανισμού του αεροδρομίου. Παρουσιάζονται επίσης περιπτώσεις αεροδρομίων μέσω των οποίων τονίζονται οι διαφορετικές δυνατότητες προσέγγισης της βιωσιμότητας των αεροδρομίων, ανάλογα με τη διαδικασία διαχείρισης που έχει εφαρμοστεί σε κάθε οργανισμό.

Στο πλαίσιο της διπλωματικής εργασίας, παρουσιάζονται επίσης οι επιπτώσεις του Covid-19 στη διαχείριση των αεροδρομίων, ενώ επίσης εξετάζεται πως στην μετά Covid-19 εποχή ένα αεροδρόμιο θα διαχειριστεί τις νέες προκλήσεις.

Η μεθοδολογία που εφαρμόστηκε στο πλαίσιο της διπλωματικής εργασίας, βασίστηκε στην βιβλιογραφική ανασκόπηση και ανάλυση.

Λέξεις – Κλειδιά

Διαχείριση Αεροδρομίων, Βιωσιμότητα, Αειφορία, Βιώσιμα Αεροδρόμια, Εταιρική βιωσιμότητα, Στρατηγικός σχεδιασμός, Covid-19.

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List of Abbreviations & Acronyms

WCED	World Commission on Environment and Development
TBL	Triple Bottom Line
EU	European Union
ACI	Airports Council International
ICAO	International Civil Aviation Organisation
IATA	International Air Travel Association
SAGA	Sustainable Airport Guidance Alliance
ISO	International Standards Association
SMP	Sustainability Master Plan
FAA	Federal Aviation Administration
ACRP	Airport Cooperative Research Program
GHG	Greenhouse Gas
GRI	Global Reporting Initiatives GRI
SDG	Sustainable Development Goal
SDGs	Sustainable Development Goals
UN	United Nations
EC	European Commission
KPIs	Key Performance Indicators
GDP	Gross Domestic Product
EONS	Economic vitality, Operational efficiency, Natural resources
CKRG	Corporate Knights Research Group
BCSD	Business Council for Sustainable Development
OHS	Occupational Health & Safety
ILO	International Labour Organisation
CLS	Core Labor Standards
LEED	Leadership in Energy and Environmental Design
CAPEX	Capital Expenditure
OPEX	Operational Expenditure
IFC	International Finance Corporation

1. Introduction

Air transport is essential for the modern economy and society. It supports and facilitates world trade and at the same time is indispensable for tourism. Air connectivity results to a wide range of economic benefits *(Air Transport*, 2015). World Bank During the last years -before the pandemic-, economic development worldwide had been boosted from improved air-transport linkages (IATA, Air Connectivity- Measuring the connections that drive economic growth,)

During the recent decades, air transport has been greatly increased. Classified into two general categories; international and national/domestic flights, air transport constitutes an important part of the transportation infrastructure, having a substantial impact on urbanization and on economic growth.

According to the World Bank (World Bank, Air Transport Annual Report, 2015), "*air transport is an important enabler to achieving economic growth and development. Air transport facilitates integration into the global economy and provides vital connectivity on a national, regional, and international scale. It helps generate trade, promote tourism, and create employment opportunities"*.

As stated by Boons et al, (Klemes et al., 2015) "*air transport comprises a global network system where airlines provide linkages between the nodes constituted by airports. At these places, the economic, environmental and social impacts of air transport culminate, and it is here that the discussion about sustainability frequently emerges"*.

Modern airports have extended facilities divided into landside and airside zones; with the last including all parts of the Airport around the aircraft. Airports have developed over time, being more than terminals, runways and gates. The response to the increasing number of travelers and the time they spend in terminals, created a new airport model. While airports traditionally used to be built outside a city, the increased needs for air-travelling resulted to the development of the new-airport model, which acts as urban micro-center, offering new services and possibilities for amenities. The new airport hubs, attract investments and transport-related businesses around them. This model is an economic generator, providing jobs, revenue and infrastructure development. The new

airport model that has been evolved, is the one of an airport-city. Many of the top-rated airports are mini-cities, where global commuters can now enjoy an experience where almost every need can be satisfied.

The impact of airports on the economy is very important. According to the "International Finance Corporation (World Bank Group)", the sectors of air travel and tourism contribute on average by ten percent (10%) of Global GDP and "support almost 330 million jobs".

Further to the above challenges the increasing number of air-travelers, resulted to the need of the enlargement of airplanes themselves: the big airliners like the Airbus and Boeing are forcing airports to build new terminals, or update existing ones, in order to handle more and bigger planes, (Aci- the aerotropolis lure, 2019).

The socioeconomic benefits deriving from this development and expansion of the airports, affects the environment and society in several stages, in regard to both infrastructure and operation.

It is well understood that while air transport has become an essential means of mobility in globalized societies, at the same time, its negative impacts on the environment and human beings are visible. The combination of these two observations leads to the question of whether "sustainable" aviation is possible, (Klemes et al., 2015).

Airports are economic generators, whereas at the same time constitute a source of anti-environmental activities. Managing an airport is a very complex process; it includes all airport and airline operations. It becomes very important to manage and minimize the adverse impact on the environment and society from the operation and the business activities of an airport. The new challenge is to develop and manage airports in the context of sustainability.

The last can be achieved, through advanced and efficient airport management based on a holistic sustainability strategy, that will lead us to a better future.

2. Airport management-New challenges in the context of sustainability

Airports are big organizations and their management is very complex and very important for the long-term business success. The airport management should set the vision and the mission of the organization, define the corporate strategy of the business, and accordingly set the objectives and plan in order to achieve the objectives. All business activities and needed resources should be focused on achieving these objectives and enhance enhance the airport's international competiveness,

The airport's management according to the strategic objectives should focus on providing high-quality services to its customers, upgrading the airport's infrastructure and continuously improve all the processes. At the same time a close cooperation with stakeholders and local communities is needed, in order to support the regions and communities in the airport's surrounding areas.

The airport's management should have the ability to identify the new challenges and revise its corporate strategy in order to successfully encounter the challenges.

The new challenge for the airport management is to minimize the adverse impact on the environment and society from the operation and the business activities of the airport and continue to have growth and successful financial results. The new challenge is to develop and manage a sustainable airport.

For the development and management of sustainable airports we need to understand the context of sustainability.

The most widely accepted definition of sustainability or sustainable development is attributed to the World Commission on Environment and Development (WCED) published in the report in 1987. Into this Report, known also as Brundtland Report,"Sustainability" is described as *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*.

This definition clearly defines sustainability on a larger timescale by alluding to the future (Arowoshegbe et al., 2018). The Burndland commission definition (World Commission on Environment and Development, 1987) of sustainability originated from the concerns that

the current trends in population and economic developments are not sustainable, (Arowoshegbe et al., 2018).

There are several definitions regarding the term "sustainability".

According to Boons (Boons et al., 2010), the term "sustainability" is perceived as a concept that denotes the way in which actors in a specific place and time strike a balance between the economic, ecological and social impacts. This allows to examine the ways in which actors involved with airports operate by coordinating their activities.

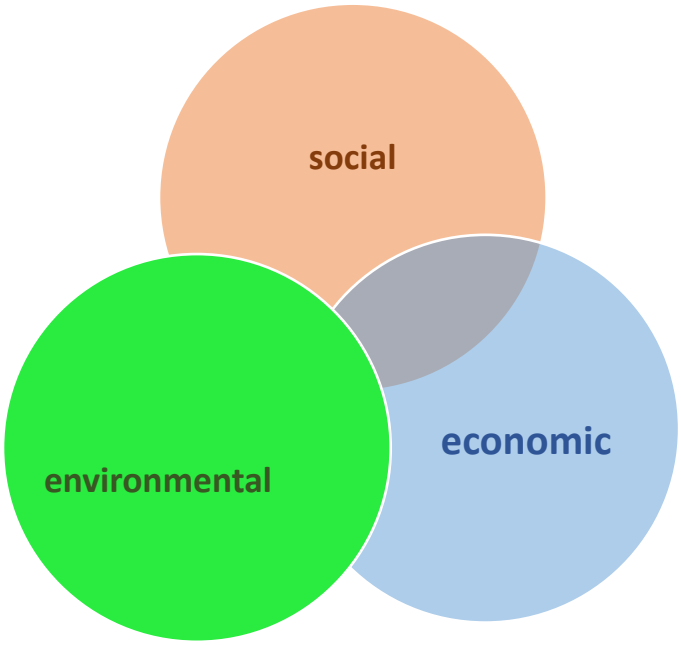


FIGURE 1

Sustainability is more than the consideration of ecology and environment. It also refers to the need for economic growth and social development. Sustainability should be perceived through the prism of a holistic approach, where the axes of environmental, social and economic dimensions are considered altogether, aiming to achieve enduring health, wealth and success, while respecting and preserving those rights for our future generations.

"Sustainability is applicable to a framework consisting of three elements: Environmental protection and stewardship, economic or financial considerations, community and well-being. Hence, sustainability is about to improve the economic and social quality of life

while limiting impacts on the environment to the carrying capacity of nature." (Arowoshegbe, 2016).

A new framework was introduced by John Elkington in 1990s, "Sustainable business" is the new managerial paradigm.

Elkington introduced the concept of "Triple Bottom Line" (TBL), by which the business success defined as the consideration of the impact of an organisation's activities on society, environment as well as regional and national economy. Only profitability of an organisation was in consideration before the TBL framework.

Three measures of TBL are: (a) Economic line, (b) Social line and (c) Environmental line.

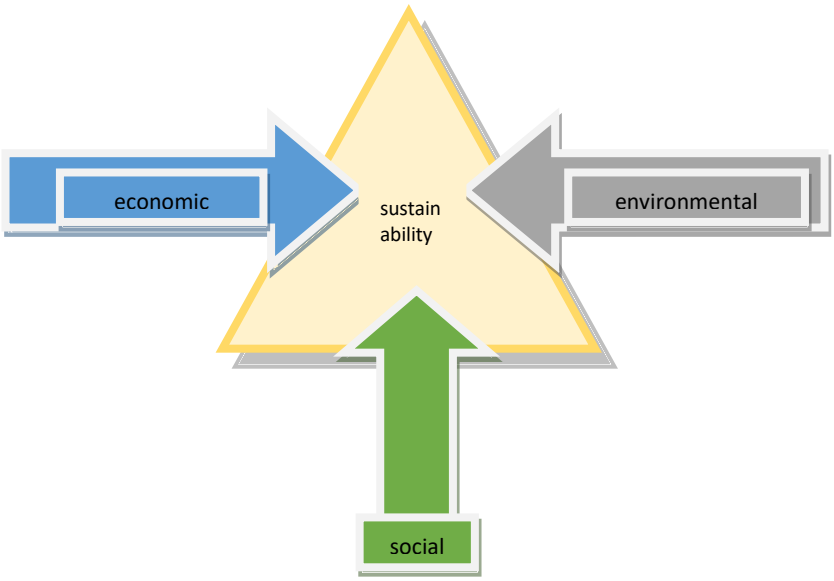
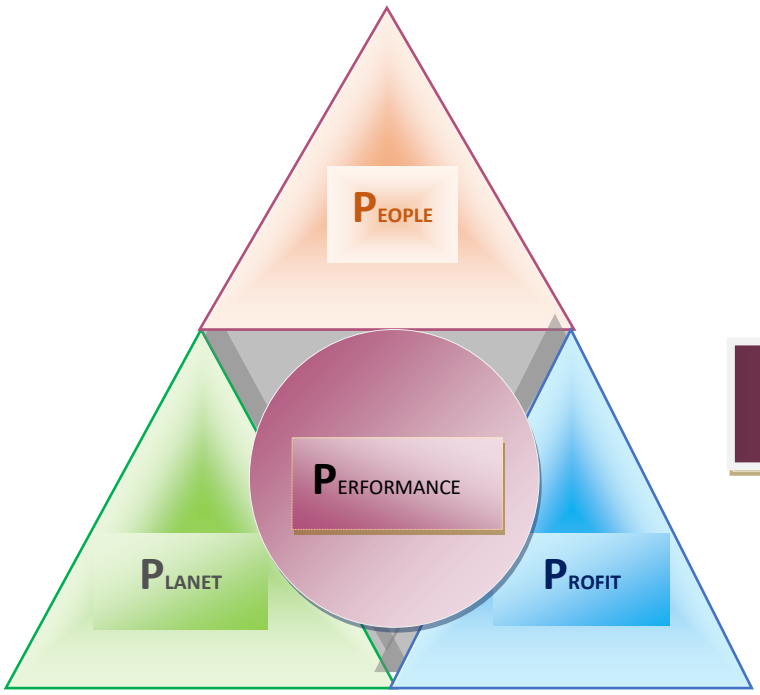


FIGURE 2

The concept of the Triple Bottom Line is alternatively known as Triple P (Profit, Planet, People) reporting. In Elkington's terms, the three dimensions of organizational performance are economic prosperity, environmental quality, and social justice/equity, as presented by Sherman, W. Richard. (2012).



TRIPLE P
the alternative of the Triple Bottom Line

FIGURE 3

The Triple Bottom Line by John Elkington will be analysed below (Avin S. et al, 2020):

- "Economic line of TBL is defined as the consideration of impact of an organization's business practices on the regional and national economy (Elkington, 1997). It measures how business activities of an organization contribute to economy growth. Some variables affecting the economic line are incomes, expenditures, anti-competitive behavior, GDP contribution, job growth, revenue generation, employment sharing, underemployment rate, procurement practices, and indirect economic impacts".
- "Social line of TBL is defined as the consideration of organization's business practices to the workforce, laborers, human capital and the community (Elkington, 1997). Fair and beneficial business practices should be employed. It measures the profits of the organization in terms of human capital due to business activity. Social sustainability is related to the impact of the company's business on employees, suppliers, investors, customers and local and global communities".
- "Social variables refer to social dimensions. These include education, health and well-being, equity and access to social resources, and quality of life.

Global Reporting Initiatives (GRI) have developed guidelines to measure social impact with different variables such as: employment design, industrial safety, medical facilities at work site, provision for training and education, labour management, staff and labour welfare, fair business practises, implementation of human rights, local resident, supplier/vendor management, public policy, unbiased social activities, safety, customer discretion, customer satisfaction".

- "Environmental line of TBL is defined as the impact of an organization's business practices on the environment. The less impact on the environment and the minimum natural resources consumed by the company's business, the longer and more successful is the business. The Environment sustainability can be managed and monitored".
- "Environmental variables measure the impact of business practices on the environment. Important indicators are: air pollution, water pollution, noise pollution, waste management, solid waste, toxic waste, waste management, water quality, ground water recharge, air quality, energy consumption, electricity consumption, use of renewable and non-renewable resources, land transformation, depletion of natural resources, unwarranted nutrients, electricity consumption, waste management, water treatment, ground water recharge".

Further, Elkington (1994) has addressed the "Sustainable Development" which involves the simultaneous pursuit of economic prosperity, environmental quality and social equity. Term Sustainable Development is identical to Sustainable Growth. However, Sustainability and Sustainable Development are not identical. Sustainable Development is a "development" that needs to be sustainable in term of economically, environmentally and socially. The same may be measured with TBL.

Thus, it is profound that for aiming the sustainable development, there must be accountability not only for the financial bottom line but also the social development and environmental protection, (Chourasia et al., 2021).

As highlighted by Sherman, W. Richard. (2012), *"at its narrowest, the term triple bottom line is used as a framework for measuring and reporting corporate performance against economic, social and environmental parameters. At its broadest, the term is used to capture the whole set of values, issues and processes that companies must address in*

order to minimize any harm resulting from their activities and to create economic, social and environmental value. This involves being clear about the company's purpose and taking into consideration the needs of all the company's stakeholders (Elkington, 1997)". (Jeurissen, 2000).

United Nations in 2015 defined Sustainability according to the 17 Sustainable Development Goals (SDGs) which are presented below (SDGs and music: agents of change in action, 2021).

FIGURE 4
(UN SDGs)

When referring to business, as described by John Elkington, (1994) in "*Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development"*, "it has become increasingly clear that business should play an important role in achieving the goals of sustainable development strategies. In a recent Report of the

Business Council for Sustainable Development (BCSD), entitled "Changing Course", it was introduced that "Sustainability" requires that "we pay attention to the entire life cycles of our products and to the specific and changing needs of our customers", it is about a new trend in the business world corporate environmentalism*".*

Special reference should be made to the UN SDG13, which is about Climate Action. Climate Action "is of undisputed importance worldwide, especially after the adoption of the Paris Agreement (December 2015), which sets the objective of limiting Global warming to 2º C, (Airports Council International Europe | ACI EUROPE, 2018). SDG 13 (about climate action) and SDG 7 (about clean energy), are quite related.

The leading sources of the greenhouse gas savings that countries need to focus on in order to realize their commitments under the Paris Agreement are switching fuels to renewable energy and enhancing end-use energy efficiency. Following to this, the global call for deep emissions reductions in all sectors, in order to reach Net Zero by 2050 motivated the European Commission (EC) to announce the objective for Europe to become the first climate neutral continent by 2050, supported by a new policy strategy, The European Green Deal.

"The success of the European Green Deal depends on our ability to make the transport system as a whole sustainable", is one of the central statements by European Commission in 2020 (Fasone et al., 2012).

In 2017, the European airport industry committed to have 100 carbon neutral airports by 2030. In a further step change in their climate actions ambitions, this morning Europe's airports also formally committed to net zero carbon emissions by 2050 (Carlucci et al., 2018).

The trade body serving and leading European airports, ACI EUROPE, launched Sustainability Strategy developed on the basis of work on climate action. That began with the establishment of the independent, institutionally endorsed *Airport Carbon Accreditation programme* (2009).

With this in mind, it is important for an Airport to launch a Sustainability Strategy according to the 17 Sustainable Development Goals (SDGs).

3. Airport Management:The challenges of developing an organizational culture for a sustainable Airport

Under the continuing practice of globalisation, the aviation (air transportation) can be considered an essential part which needs to be considered as sustainable development (Carlucci, Cira, & Coccorese, 2018) (Airport Cooperative Research Program, ACRP)

According to ACRP (Freestone, 2009), with regards to airports sustainability, it can be perceived from the point that it results not only to stable growth of economy and employment generation but also to focus on societal progress by recognizing the needs of airport management (staff, managers, vendors, suppliers, etc.), other stakeholders and public. Plan for societal development and environmental protection may be different for different airports. It depends upon airport's size, geographic as well as corporate management of the airport.

The challenge is about how to achieve airport sustainability through efficient airport management.

A good coordinated managerial approach can lead the airport to achieve sustainability at both levels; business and infrastructure, hence improve the economic and financial performance along with infrastructural competitiveness. "Sustainable development" practices in the airport, improves the financial and operational benefits of the airport.

Sustainability is concerned with the impact of present actions on the ecosystems, societies, and environments of the future. Such concerns should be reflected in the strategic planning of sustainable corporations. Strategic intentions of this nature are operationalized through the adoption of a long-term focus and a more inclusive set of responsibilities focusing on ethical practices, employees, environment, and customers, (SAGA HOMEPAGE, n.d.).

Every sustainability effort is unique and organizations use varying definitions of what sustainability means to them. The majority of definitions of sustainability are driven from the principles set in the TBL "Triple Bottom Line" approach; environmental responsibility, social responsibility and economic growth. According to airport "sustainability.org" (2021), the airport industry in particular has adopted the "EONS" approach to sustainability; Economic vitality, Operational efficiency, Natural resources,

Social responsibility, which expands the concept of the Triple Bottom Line, by introducing operational efficiency

A systemic approach is needed for sustainable development (Roome, 2001). In this systemic approach, the aim is to understand the whole and not only the parts. The total airport organization should be involved in promoting sustainability.
According to Wilson (2019), lately, there is an increasing interest in business, academics, and organizations with regards to "corporate sustainability." The term is very often used as a synonym for "sustainable development" and "corporate social responsibility."

Corporate sustainability is often perceived as a new paradigm for corporate management, creating an alternative to the traditional growth and profit-maximization model. While corporate sustainability recognizes that corporate growth and profitability are important, it simultaneously requires the corporation to pursue societal goals, specifically those relating to sustainable development; *environmental protection, social justice and equity, and economic development.*

The concept of corporate sustainability is based on the following concepts:

- sustainable development
- corporate social responsibility
- stakeholder theory
- corporate accountability theory

The contributions of these four concepts are illustrated in the following Figure, introduced by Mel Wilson (2019).

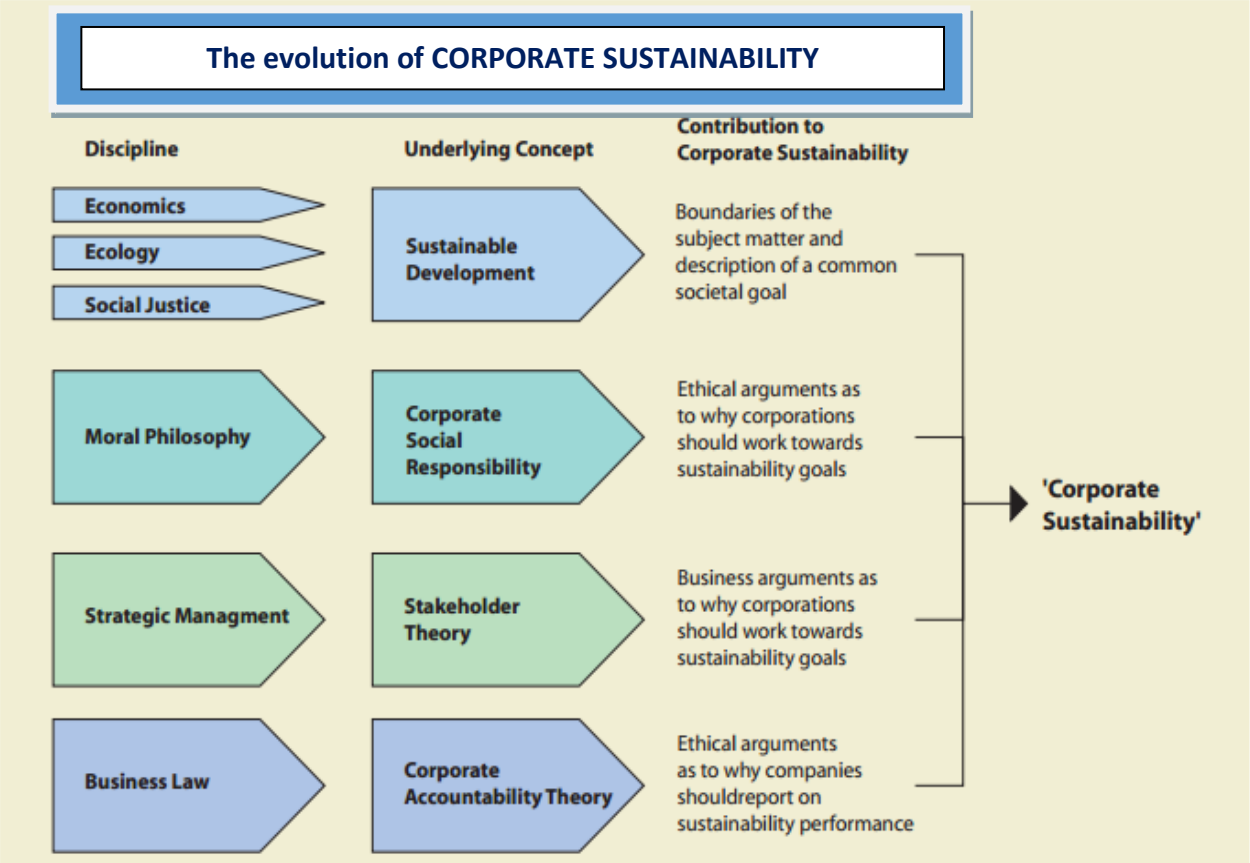


FIGURE 5
(Wilson, 2019)

The above concepts and their relationship to corporate sustainability, are further analysed (Mel Wilson, 2019).

1) Sustainable Development

Sustainable development is a broad concept that balances the need for economic growth with environmental protection and social equity. Corporations need to be more proactive in balancing this drive with social equity and environmental protection, partly because they have been the cause of some of the unsustainable conditions, but also because they have access to the resources necessary to address the problems.

The contribution of sustainable development to corporate sustainability is twofold. First, it helps set out the areas that companies should focus on: environmental, social, and

economic performance. Second, it provides a common societal goal for corporations, governments, and civil society to work toward: ecological, social, and economic sustainability. However, sustainable development by itself does not provide the necessary arguments for why companies should care about these issues. Those arguments come from corporate social responsibility and stakeholder theory.

2) Corporate social responsibility

Corporate social responsibility deals with the role of business in society. Corporate management should have an ethical responsibility, so that it considers and addresses the needs of society, not just the interests of the shareholders.

3) Stakeholder theory

The basic concept of stakeholder theory is that the stronger your relationships are with other external parties, the easier it will be to meet your corporate business objectives; the worse your relationships, the harder it will be. Strong relationships with stakeholders are those based on trust, respect, and cooperation, and is still primarily, a strategic management concept. The goal of stakeholder theory is to help corporations strengthen relationships with external groups in order to develop a competitive advantage.

One of the first challenges for companies is to identify their stakeholders and consequently develop new "win-win-win" strategies, which simultaneously benefit the company, its customers, and the environment through sustainable development.

It should be a core decision of the airport management by involving key stakeholders which are crucial to achieve goals and eventually, maximise efficacy and reduce waste in the developments (Chourasia et al., 2021).

4) Corporate Accountability

Accountability is the legal or ethical responsibility to provide an account or reckoning of the actions for which one is held responsible.

For example, companies that receive environmental permits and approvals from regulators to operate facilities are often held accountable by the regulators for whether the terms of the approval are being met. The corporations should be accountable to society for their performance, and companies should report on their environmental, social, and economic performance, not just financial performance. In of the UK consultancy, Sustain Ability, called this type of accounting on environmental, social, and economic performance as 'triple bottom line' reporting (John Elkington, 1997).

The above concepts should be applied when developing an airport corporate sustainability framework. The sustainability strategy will be in line with the airport company's commitment to the United Nations, SDGs, and adopt the related sustainability principles for human rights, labour relations, environmental impact and anti-corruption.
Regardless of size, all airport organisations can contribute to the achievement of SDGs, by carrying business in a responsible way, while pursuing opportunities to address societal and environmental challenges through innovation and collaboration.

According to, ACI EUROPE, Sustainability Strategy is based on the following shared vision of the sustainable airport of the future*: "Every airport builds local and global partnerships to accelerate the journey towards fair, prosperous and environmentally responsible societies". It also relates to the UN Sustainable Development Goals (SDGs) and the Global Reporting Initiative. ACI EUROPE will regularly review and update it, to ensure continued relevance and credibility,* (Carlucci et al., 2018).

Airport management should be based on a corporate responsibility policy approach, in an integrated way, deployed at a cross-departmental among the organization level, will promote sustainability at all aspects of everyday operation and future development.

The challenge is to adopt a corporate responsibility policy that will allow the development, update and implementation of a strategy where practices will be aligned with international standards, accountability, transparency, ethical behavior, respect for law and respect for stakeholder interest. For that it is important to establish a unanimous sustainable development strategy.

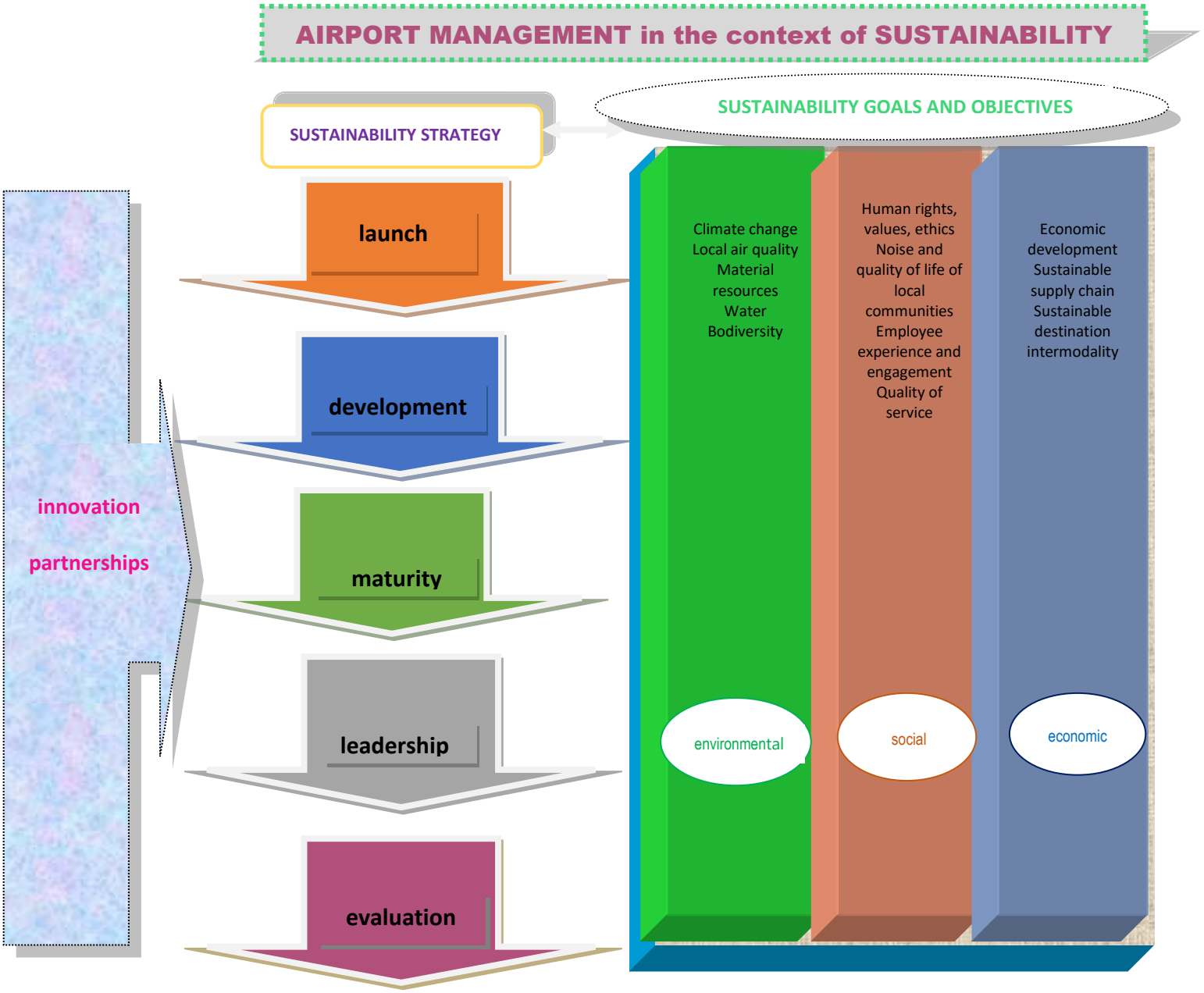

AIRPORT MANAGEMENT in the context of SUSTAINABILITY
SUSTAINABILITY STRATEGY
SUSTAINABILITY GOALS AND OBJECTIVES
launch
development
maturity
leadership
evaluation
innovation
partnerships
Climate change
Local air quality
Material resources
Water
Bodiversity
Human rights, values, ethics
Noise and quality of life of local communities
Employee experience and engagement
Quality of service
Economic development
Sustainable supply chain
Sustainable destination
intermodality
environmental
social
economic

FIGURE 6

In order to have an efficient airport management into the context of sustainability, the organizational culture must be based on a sustainability vision.

That will set the development of the sustainability goals that will form the chart of the sustainability mission of the airport. According to this, a strategy and a pathway will be proposed.

Some pathways are built around performance objectives in alignment with the UN SDG framework, having 2015 as the baseline and 2030 as the target year. In addition according to ACI, "*this strategy has two major enablers that support airport's efforts towards enhanced sustainable management":*

- ***Innovation***
  Develop potential innovative solutions or processes in different sustainability areas

- ***Partnerships***
  Establishing partnerships, creates opportunities for airports develop their role as the operational interface between stakeholders

It is important to assess the current position regarding sustainability and identify the target of the organistaion's future position. The need to clarify the direction of the organization vision by considering the position, the needs, the corporate identity and culture of the airport organization, is of great importance. Creating a sustainability vision, is about setting the goals that the airport organization will endeavour to achieve.

The sustainability vision will set the foundation for establishing the sustainability mission of the airport's organization. For that, a sustainability mission statement is created. This is the framework that provides the understanding of the values of the organization, and enables the development of a sustainability strategy towards the achievement of financial, ecological and social balance. The current position versus the future position of the airport's organisation is depicted throughout the sustainability mission statement.

The airport's sustainability mission statement is the foundation for managing airport's sustainability efforts. It provides airport's organization and its stakeholders with the

understanding of all the important goals and long-term plans that are intended to be accomplished.

The process of preparing the sustainability mission statement is a useful exercise that demonstrates the benefits of sustainability to all the involved teams; airport leadership, employees and stakeholders, local priorities. Also it is important to focus on initiatives that achieve objectives with low implementation costs, while making best use of all airport resources (U.S. Department of Transportation, 2019).

Overall, the mission statement, reflects the organizational culture; usually is a short text, communicated to all employees throughout the organization.

Based on airport's sustainability mission, setting and implementing sustainability strategy will lead the airport's organization to achieve its sustainability goals. Based on this, the Strategy concerns how the total process will be defined; in more details, the process of setting the strategic objectives, developing polices and standards, setting action plans and identifying the required needs and activities, advancing initiatives, respecting environment, respecting communities, setting financial vitability goals, creating motives, educating, undertaking compliance audits, performing studies and analyses, evaluating and finaly reengineering and remaping the process.

To achieve these, the employment of a Sustainability Master Plan is important. According to U.S. Federal Aviation Administration, the "Sustainable Master Plan" (SMP) was initiated in 2010, helping airports incorporating sustainability into a long-term strategy. The (SMP) incorporates the following:

(i) ***Sustainability goals and objectives***

(ii) ***Sustainability categories***

(iii) ***Baseline assessments***

(iv) ***Financing sustainability measures***

(v) ***Educating for sustainability***

4. The challenges of Managing the process of developing a sustainable airport

The Sustainable Aviation Guidance Alliance (SAGA) was formed in 2008 which motivates each airport operator to analyse, define, plan and implement its own sustainability program, by acknowledging the need of an engagement of all key stakeholders of the airport. The implementation of this strategy, will lead to the development of a sustainable airport.

According to Boons et al. (2010), there seems to be a large discrepancy between the theoretical concept of sustainability, which allows for the inclusion of economic, ecological and social issues over a large spatial and temporal scale, and the current debate about the airports' "licence to operate" in many Western countries in which sustainability is reduced to a balance between the interests of the citizens and the further growth of the airport (Klemes et al., 2015)

Airports relate their sustainability action within the frame of 17 SDGs, as defined by United Nations. According to their local characteristics and specificities airports have different priorities, although, SDG 13-Climate Action as already mentioned, "is of undisputed importance worldwide". Moreover, the European Green Deal places an important responsibility especially on aviation sector, for a new sustainable strategy. Emissions of aviation in Europe presented an increase of 10% during the years 2014-2017, and based on pre-Covid projections, they were expected to further increase 20% by 2040. (Bulc & Delli, 2019).

In order to face the challenge of the climate emergency, Airports Council International ACI Europe and its members, issued the May 2019 Commitment, "European Airports Committing to Net Zero Carbon Emissions by 2050". The last comes additionally to the launch in June 2009 of Airport Carbon Accreditation as the tool and standard for carbon management at airports (Airports Council International Europe | ACI EUROPE, 2018).

According to Airport Carbon Accreditation, there are six levels of accreditation:

1. Mapping *(carbon footprint measurement)*
2. Reduction *(carbon management towards a reduced carbon footprint)*
3. Optimization *(third party engagement in carbon footprint reduction)*

4. Neutrality *(carbon neutrality for direct emissions by offsetting)*
5. Transformation *(transforming airport operations and those of its business partners to achieve absolute emissions reductions)*
6. Transition *(compensation with residual emissions with reliable offsets)*

- Following to the launch in June 2009 of Airport Carbon Accreditation as the tool and standard for carbon management at airports, one hundred seventy (170) European airports have been certified under the program to date (ACI-europe.org/netzero, 2019).
- Following to the launch in December 2015 commitment of ACI Europe, one hundred (100) carbon neutral airports in Europe, will have been certified under Airport carbon Accreditation (ACI-europe.org/netzero, 2019).

4.1 Aspects of sustainability at airports

In the following table are presented aspects of sustainability at airports, according to Bons (Boons et al., 2010).

Fit into the larger context of sustainable mobility and sustainable aviation (as one of its modalities)		— connect to other transport modes — provide infrastructure for sustainable airplanes
Strike a balance between:	Economic value	— direct and indirect contribution to regional and national economic growth in the long term — adequate service provision to customers — contribution to profitability of involved firms
	Ecological value	— buildings with minimal ecological impact — minimal resource use (building materials, fossil fuel use) — minimal use of ecosystems as waste sink (generation of solid waste, emissions to air and

	water) — minimal disruption of ecological cycles at local and global scale (biodiversity, global warming) — land use
Social value	— quality of life for local communities (including eliminating noise and health effects from local emissions) — fair distribution of economic revenue — fair distribution of access to air transport

TABLE 1
(Bons et al.,2010)

Traditionally, airports' sustainability efforts have mainly focused on the minimization of the environmental impacts of their operations. The last although being a critical problem to confront, in particular under the global warming context, requires immense and continuing efforts. Nevertheless, the airport industry needs to embrace the three sustainability dimensions: environmental social and economic in a comprehensive and efficient way (Airports Council International Europe | ACI EUROPE, 2018)

In the process to make the airport sustainable, some major issues that are presented hereunder, are faced by the airport operators. Management challenge is how they can be efficiently managed.

(i) Reducing greenhouse gas emissions

A clear commitment of the European Green Deal is that "transport should become drastically less polluting", highlighting in particular the urgent need to reduce greenhouse gas emissions (GHG) in aviation In aviation, traffic volumes are expected to double by 2050 and the sector is already generating 15% of the global GHG emissions from transport.

"Net Zero" is the new destination, the "Destination 2050" for the European aviation. According to this, there has been set a commitment for *"net zero CO_2 emissions from all flights within and departing from the EU, that can be achieved by 2050 through joint, coordinated and decisive industry and government efforts"* (Sman, et al., destination2050.eu, 2021).

In general the concept of "net zero" refers to the balance between the amount of greenhouse gas produced and the amount of greenhouse gas removed from the atmosphere. We reach the point "net zero", when the added amount does not exceed the amount taken away.

Greenhouse gases and other emissions are produced during the aircraft operation on ground as well as sky which lead to numerous undesirable impacts on air quality. (Sameh & Scavuzzi, 2018).

According to ACI Policy handbook *"Airports should assess, minimize and mitigate greenhouse gas emissions under their direct control, while guiding and influencing other aviation stakeholders at the airport to assess, minimize and mitigate theirs. An airport operator's ultimate goal should be to achieve carbon neutrality"*.

- Emissions from the aircraft movement can be managed by adopting the procedures and technologies to reduce aircraft emission at landing and take-off, by using alternative fuel source for ground support vehicle/equipment, power heating, adopting hybrid, electric or solar powered vehicles for airport operation, by deploying sustainable alternative fuels by promoting the development of sustainable alternative fuels production facilities on-site (or close to) the airport, to facilitate the conversion of airport waste to sustainable alternative fuels and the delivery of the fuels to the airport (e.g. by pipeline).

It is well-known that 21st-century aviation has seen increasing interest in fuel savings and fuel diversification, as well as low cost airlines and facilities.

- Zero-emission large aircraft will become ready by 2035
- Sustainable renewable and low-carbon fuels must be deployed on a large scale without delay
- the production of sustainable aviation fuels

The "Net Zero" European Aviation Report (Sman, et al., destination2050.eu, 2021), identifies measures based on four pillars:

"1. Aircraft and engine technology
2. Air traffic management and aircraft operations
3. Sustainable Aviation Fuels
4. Smart economic measures"

(ii) Reducing energy consumption

ACI Policy handbook mentions that: *"Airports should minimize the energy demand of their infrastructure and operations, and move towards less polluting modes of energy and fuel use including generating and using energy from renewable sources".*

Reducing energy consumption can be reviewed at the connections

- from city to the airport (access and multimodal)
- from the airport to the aircraft (airside)
- At the airport landside (logistics, ground handlings and operations.

(iii) Reduced noise impacts

"Airports should strive to minimize or mitigate the adverse effects of aircraft noise on communities" is stated in ACI Policy handbook.

In spite of technological and operational advances, many airports have responded to community pressure by introducing noise-related charges on aircraft. In accordance with the ICAO Balanced Approach, "*airport noise should be addressed in the most cost-effective manner and noise-related charges only introduced as part of a broader noise management program. Charges should not overlap with other national or regional environmental charging schemes. Any income from noise-related charges should be used to fund noise alleviation or prevention measures for pollution from noise".*

(iv) Local Air Quality

According to ACI, *"Policy Airports should assess and understand emissions from all airport-related sources, their contribution to the local air quality and their effect on*

compliance with local air quality regulations. Airports should take the lead in working with stakeholders to adopt measures to reduce emissions in all areas – aircraft, ground support, airport infrastructure and landside access traffic".

(v) Waste management

In the ACI Policy Handbook is referred that*: "Airports should promote the culture of avoiding solid waste generation and, where possible, extracting value from remaining waste with the ultimate goal of sending zero waste to landfills. The waste hierarchy is to avoid, reduce, reuse, recycle waste with the goal of eliminating the waste going to landfills. Value may be recovered, for example, by recycling valuable materials, or by converting waste to energy, biofuels or compost".*
Waste management consists another challenge for every airport. That can be succeeded, by applying and cost-effective and efficient management practices.

However, the circular economy is a broader concept and provides a holistic approach on elevating waste management into new economic business model,

The positive impact of a successful airport waste management process is undeniable. The impact extends far more than at the airport organization itself, to positively results related to airport authorities, customers, stakeholders and the local communities.

(vi) Water management

"Airports should work to minimize the use of potable water, to process waste water (de-icing and sewage) in the most efficient way possible, reuse of treated water and to manage the quantity and quality of storm water run-off" is stated at the ACI Policy Handbook.

Regarding water supply, airports for their activity rely on local availability. According to ICAO, *"Airports are encouraged to put in place responsible water consumption policies as well as water efficiency measures. Simple technologies like aerators, low-flush toilets and rainwater capture systems can significantly reduce overall water use".*

Airports Council International (ACI) has a specific policy statement on water management: "*Airports should work to minimize the use of potable water, to process wastewater (de-icing and sewage) in the most efficient way possible, reuse of treated water and to manage the quantity and quality of storm water run-off".* It is important to take into consideration early at the stage of planning and of the construction of an airport's facilities, the implementation of good storm water practices.

Airports can minimize their water consumption, by developing new facilities, new design practices and the use of smart building.

The idea of planning "Water Sensitive Airport" based on the framework of "Water Sensitive Cities", is advised. The last is applied at Amsterdam Airport Schiphol (Airports Council International Europe | ACI EUROPE, 2018).

The issues of water use and conservation are also considered by the certification systems for green building designs and sustainable infrastructure such as: ISO 14001, Boma Go Green, BREEAM, LEED, ENVISION.

(vii) Wildlife management

The safety concern of commuters, flora and fauna are also elemental for the airport authority. Wildlife can cause serious incidents and accidents (Sameh & Santos, 2018). Wildlife hazard management plan can be adopted to avoid serious accidents and incidents and to protect flora and fauna. On the other hand, it is important to enhance biodiversity.

(viii) Green construction management

The basic concepts of green construction of airports concern how to develop the green built environment (construction/demolition) and procurement processes, the green land planning and use, as well as the circular economy and recycling.

(ix) Sustainable connectivity

Planning a sustainable airport shall be a part of integrated transport planning. It shall be fit into the sustainable mobility and have interfaces with other means of transportation, connecting with the urban city center and other regions.

(x) ***<u>Monitoring and Reporting the ecological footprint.</u>***

"Airports should monitor their ecological footprint and its inputs, outputs and impacts, and provide the information for planning and managing purposes as well as a basis for comprehensive reporting, according to ACI." (Airports Council International Europe | ACI EUROPE, 2018)

For the development of sustainable airports, (Freestone, 2009) has provided some fundamental principles towards planning for "*sustainable aerotropolis"*.

4.2 Airport Management: The development of a sustainability map

According to Boons (2010), *"Planning for sustainable airports or incorporating the sustainability into an existing airport can be functional in development of Greenfield or brownfield airports and also to the operation of existing airports (BIB26). It may be applied to different components of airports like Runway, Taxiway, Apron, Terminal building, Control tower, Hanger and Parking, all such components can contribute to sustainability planning and can help an airport to achieve its ultimate goals of sustainability. Plan for sustainable airports can be divided into two phases: Construction phase and Operation phase".*

In the following airport map (SAGA Sustainable Practices, 2015), are shown the airport operations and infrastructures that can be planned incorporating sustainability goals.

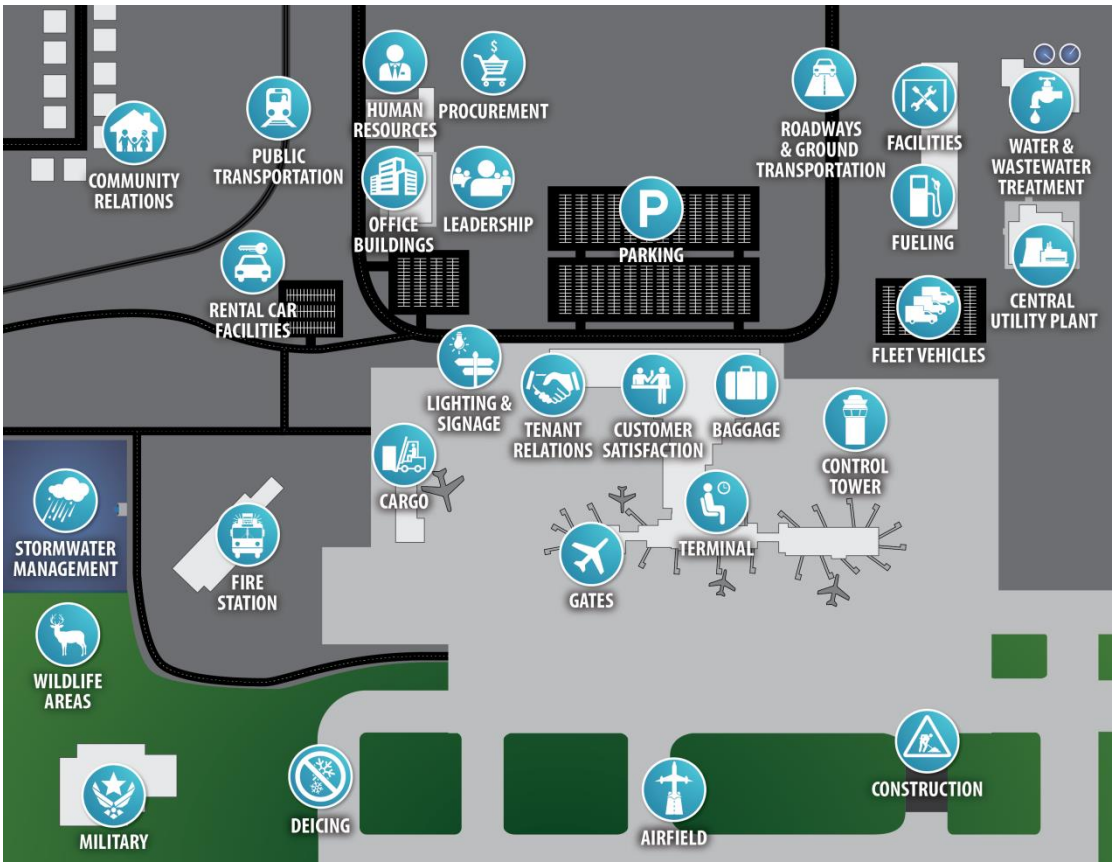


FIGURE 7

The above-mentioned steps may be similar or differ for each airports but the results will be unique. Various options are available with airports about how they proceed their sustainability planning and how they achieve it. However, the common point is that all airports are focusing to increase the efficiency.

5. Airports Management: A new tool for financing Airport Sustainability

Airports across the world are facing challenges to arrange funds for the development and then to make it profitable in operation stage.

Regarding financing airport sustainability, all the possible financing options must be traced. Airport management should develop a plan for financial support and identify possible funding sources.

Below, it is presented the case of the financing mechanism developed by Rome Airports.

Green Financing mechanism

The case of Rome Airports working towards sustainability

(source: www.aci-europe.org)

According to the 26-04-2021 ACI Europe announcement, "Aeroporti di Roma", operator of Rome – Fumicino and Rome-Ciampino airports, *"secured €500 million Sustainability-linked Bond (SLB). This was led by a syndicate of banks, acting as "Structuring Banks", which involved Credit Agricole CIB and BofA Merill Lynch and as joint bookrunners, Barkleys, Goldman Sachs, IMI Intensa, Mediobanca, Societe Generale and UniCredit. This is a significant support of the financial markets to airports' strategic sustainability and to the decarbonisation of the airport industry.*

It is a green-financing mechanism, which "will link the availability of funding to the airports' carbon management performance and will be focused on investment in projects with a positive environmental impact". The bond is directly connected to several environmental commitments that should be met from Aeroporti di Roma. The success of Aeroporti di Roma to meet the environmental achievements, or on the contrary the failure to achieve the commitments, will influence the financial characteristics of the Sustainability-Linked Bond.

The commitments include:

- *The reduction of CO_2 emissions relating top access to the airports by 10% by 2030 on per passenger basis. That can be achieved through the installation of more than*

500 charging stations for electric vehicles and enhancing the capacity of the railway station at the airport. There are also plans for investment in the availability of sustainable aviation fuel for airlines by 2024.

- *The achievement of net zero for CO_2 emissions under its control; by 2030. This ambitious target is designed to be achieved, by the following main projects: the construction of two (2) photovoltaic parks for a total capacity of 60MW, the electrification of the entire ground-vehicle fleet, the phase out of the fossil fuel-powered cogeneration plant and the switch to bio-methane for boilers from 2029.*

The overall performance will be measured and evaluated annually, based on a set of key performance indicators, including the maintenance of the certification at level 4+ under the Airport Carbon Accreditation programme.

The above measurement through Airport Carbon Accreditation enhances the credibility of this investment, which embraces sustainability"(ACI Europe, 2021).

6. Assessing Airport Sustainability Performance

Assessing sustainability performance is a new challenge. (SAGA Sustainable Practices, 2015).

The evaluation of the performance of sustainable practices could be realized by developing Key Performance Indicators (KPIs). During evaluation, is important to determine which KPI make sense for each sustainability goal.

Identifying existing KPIs and metrics that can already be measured and that can apply to the sustainability goals or practice. If for example a goal is to reduce energy use, and the airport is already tracking electricity, natural gas and petroleum use, these can be useful indicators.

Determining metrics that will contribute to the customization of the results as facility-specific is an important step. Common airport factors include "per passenger", "per operation", "per project", "per square meter/foot".

6.1 Sustainability evaluation organizations

Below are presented sources that evaluate commonly used performance indicators and metrics:

- ISO 26000 (Social Responsibility)
- LEED
- Global Reporting Initiative(GRI) Reporting Guidelines
- The GRI Airport Sector Supplement
- Envision Infrastructure Sustainability Rating System
- The CDP (Carbon Disclosure Project)
- The Global 100
- Boma Go Green
- BREEAM

6.2 The use of KPIs

The development of the KPIs presented below, as a tool for assessing sustainability, has been realized by the Corporate Knights Research Group

(CKRG), after research design that combines both quantitative and qualitative methods, with input from the Global top 100 sustainable global companies (the names of these companies can be obtained from http://www.global100.org.) Priority indicators are chosen and there are a maximum of 12 KPIs used in the ranking, they are: (Ameer & Othman, 2012)

Sustainability Practices and Corporate Financial Performance

as analysed by Ameer & Othman,2012

(source: Ameer & Othman, 2012)

- *"1. Energy productivity*

  Sales (US$) divided by total direct and indirect energy consumption

- *2. Carbon productivity*

  Sales (US$) divided by total CO2 and CO2 equivalents emissions

- *3. Water productivity*

  Sales (US$) divided by total water use

- 4. *Waste productivity*

  Sales (US$) divided by total waste produced

- 5. *Leadership diversity*

  Female representation on the corporate board (%)

- 6. *CEO-to-average worker pay*

  Ratio of highest paid officers compensation to average employee compensation (3 years average);

- 7. *Percentage Tax paid*

  % Tax paid Reported tax obligations paid in cash (3 years average, %)

- 8. *Sustainability leadership*

  Composite score of whether there is a sustainability committee in the company and whether a director is on it;

- 9. *Sustainability pay link*

  Mechanism to link senior management compensation to sustainability

- 10. *Innovation capacity*

  R&D divided by sales (3 years average)

- 11. *Employee turnover*

  Number of departures/average total employees

- 12. *Safety performance*

  Number of fatalities and number of lost time incedents"

The measurement of specific KPIs, enables to undertake a benchmarking study, in order to evaluate the current position in terms of sustainability performance. As a result of the evaluation, a learning curve will be created. Based on this, new plans can be made, that will include people responsible for implementation of the sustainability program. New milestones and goals after the evaluation will be set and the process can be reengineered, so that a new sustainability strategy will be possibly implemented, in order to achieve continuous improvement.

Audits, issuing of annual Performance Reports, answering of sustainability benchmarking questionnaires and official eco-labeling, can help to promote the continuous improvement regarding achieving sustainability goals.

7. Barriers to airport sustainability

Barriers to Airport's sustainability	**Measures to eliminate barriers to achieve airport's sustainability**
Financial barrier (Nagle & Klauber, 2015; Olawuyi, 2016)	• Government to include fiscal incentives • Government to provide rebate on taxes and duties • Government to provide the technology on reasonable price • Government to offer subsidy on purchase of advanced technology which is must for emission control • Government to introduce the provision of technology bonus
Regulatory and institutional barrier (ICAO, UNDP, & GEF, 2017; Olawuyi, 2016)	• Developing simplistic regulations and laws for technology transfer • Integration of different permit channels by developing single window permit system • Adoption of national regulations that facilitate the environmental sustainability of airports • Involvement of the local authority in all stage of development as well as implementation of the regulations and laws
Resource availability (Nagle & Klauber, 2015; Olawuyi, 2016)	• Scarcity of the experts may be managed by conducting number of training and learning session to the local eligible professionals by the experts • Research and development for the alternate resources

Barriers to Airport's sustainability	**Measures to eliminate barriers to achieve airport's sustainability**
	• Critical resources are to be made available by the government at reasonable price
Contract agreement (Haseman, 2013)	• Effective practice and tools to integrate the environmental sustainability into the airport contract agreements • Scope of works and technical specifications shall be mentioned distinctly in the contract agreement • Contract agreement shall be made in a way that all contract conditions and specifications shall be stringently followed (Chourasia et al., 2021)

TABLE 2
(Chourasia et al.,2021)

8. Management of Sustainable Airports - Case Studies

Below are presented Case Studies of airports that have incorporated sustainability in their strategy. The sources of the data that is presented are the professional sites of each airport.

(A) Frankfurt Airport

(source: www.fraport.com/cms/sustainability)

"According to "Frankfurt Airport", Fraport AG, operator of Frankfurt Airport, has been systematically implementing climate targets for many years (since 2008), when the airport operator first defined these goals. For the eleventh consecutive year, Fraport has now received climate certification for Frankfurt Airport (FRA) under the Airport Carbon Accreditation (ACA) program. Launched by the Airport Council International (ACI) Europe, the ACA program assesses how successful airports are in decreasing their carbon footprint.

ACI Europe's Airport Carbon Accreditation program comprises four climate certification levels for airports:

Mapping, Reduction, Optimization, and Neutrality.

Assessments for granting the certification are carried out by independent experts. For 2020, Fraport again achieved the "Optimization" level for Frankfurt Airport.

Frankfurt Airport during the last 20 years, cut its CO2 emissions by more than 40% (the equivalent of some 127,000 metric tons).

The goal is for Frankfurt Airport's power requirements to be met almost entirely by renewable energy sources" .

(B) Athens International Airport - AIA

(source: www.aia.gr/company-and-business/corporate-responsibility/sustainability-governance).

"According to "AIA", the Athens International Airport has approached sustainability across all aspects of its operation and development, as a structured governance system. It has acquired international best practices which follow the scheme of planning, implementing, measuring, reporting. AIA acknowledges its role of acting as a responsible airport, that creates sustainable value for its stakeholders, while at the same time is creating a balance between organisations' objectives of operational and environmental responsibility, corporate citizenship, employer's responsibility and sustainable governance.

The corporate sustainability policy is regularly revised in order to incorporate the latest sustainability standards".

(C) Fraport Greece

(source: www.fraport-greece.com/eng/sustainability)

"According to "Fraport Greece", the organisation is focusing on a sustainable future, which is understood as a continuous process for shaping the future in a responsible way. This affects employees, stakeholders and local communities. Its daily operations are based on the corporate value of sustainability.

Hereafter is presented the analytical sustainability management approach of Fraport Greece".

(D) Aeroporti di Roma

(source: www.adr.it/web/aeroporti-di-roma-en-/sustainability)

"Aeroporti di Roma is involved in the efficient management of the airport system to effectively respond to the increase in traffic volume, while taking into account the quality standards of the service provided, safe conditions for aerodrome operations, health protection and safety in the workplace, environmental safeguards and efficient use of energy resources.

An Integrated Management System for Health, Energy, Safety, Environment and Quality allows the Group to work towards shared objectives.

Aeroporti di Roma states its commitment towards sustainability through the certification by third parties of its management systems, according to international standards:

- *Quality-ISO9001*
- *Environment-ISO14001*
- *Energy-ISO 50001*
- *Safety-OHSAS18001"*

(E) Top Greenest Airports in the World that apply sustainable initiatives.

(source: www.airport-technology.com)

"One of the significant problems related to airports, as already discussed, is action in order to make the air journey more sustainable and how the existing airports will steps in the direction of reducing the carbon footprint and start taking green' initiatives. Here are some airports that have gained positive reviews for their sustainable initiatives and some of them hold LEED certifications .

(source :https://greendiary.com/top-6-greenest-airports-world.html)"

- **Chicago O'Hare International Airport**
- **Galapagos Ecological Airport**
- **Denver International Airport** (LEED Gold certified)
- **Toronto Pearson International Airport**
- **San Diego International Airport (**LEED Platinum certified)
- **East Midlands Airport, England**
- **Zurich Airport, Switzerland**
- **Logan International Airport, Massachusetts**

9. COVID-19: Impact on Airports

9.1. Introduction

On March 2020, the World Health Organisation (WHO) declared the Covid-19 outbreak a pandemic. Along with the human tragedy, the pandemic damaged unexpectedly the global economy. There was a disruption of all aspects of activities and an unprecedented change of everyday life across the planet. Among other industries, air transport was severely damaged by the Covid-19 crisis. During the last decade before the pandemic, the sector experienced an increased growth which was disrupted and replaced by the struggle to survive.

In view of the massive impact of Covid-19 pandemic, including travel bans, potential risk of exposure to the virus from travelling, and congregating in shared spaces, as well as slump in demand among travelers, airports have experienced a unique massive and systemic shock, as the sudden collapse of air traffic resulted in the minimization of revenues. As a consequence, this has equally affected all segments across the airport industry, except the handful of airports that already specifically focused on the cargo or aircraft parking business. (Airports Council International Europe | ACI EUROPE, 2018).

The pandemic crisis, as Olivier Jankovec, Director General ACI EUROPE has commented, *"adds to the economic disruptions, rising inequality, changing consumer behavior and new dynamics that airport operators at the forefront of a new era, imposing the need for new strategies, around the concept of "Business to People' paradigm"* (ACI-europe.org, 2020).

At this turning point, it is necessary the governmental and regulatory assistance, aiming to help airports to recover past losses and maintain and enhance airports operations in the future. Collaboration from concessionaires and airlines to provide the best customer experience at the airport and drive non-aero revenues (ACI-europe.org, 2020).

Airports will have a crucial role in enabling a global economic recovery post-pandemic. However, they are facing enormous economic challenges of their own.

The return of business travel volumes to pre-pandemic levels is more doubtful still. Spending on business travel fell by 52% globally and 58% in Western Europe in 2020.

The Global Business Travel Association (GBTA) has predicted a full recovery as early as 2025.

It is necessary that the current unusual circumstances of a global crisis should be used to plan carefully for airport's industry recovery, by incorporating lessons learned from this period and by understanding the new challenges that will be successfully managed.

9.2. Passenger Traffic, the effect of Covid-19

Some months before the pandemic outbreak, ACI World director Agela Gittens commented: *"…Passenger traffic remains on an upward trajectory across the globe and airports are responding to demand in both advanced and emerging economies…"*

Indeed since 2010, air passenger traffic has a yearly increase at an average growth rate of 6.2% (Boeing, 2016). That came as a result based on three reasons: the international growth of the middle class, the low-cost carriers and the growth of airport infrastructure investment and spending. The major increase in traffic capacity during the last decade,was in Asia (Mazareanu, 2020).

According to the International Finance Cooperation (World Bank Group), the Covid-19 pandemic caused a reduction of passenger traffic worldwide. Following to the governmental recommendations, the global air-traffic was dramatically reduced. As refered, in 2020, the number of scheduled passengers boarded by the global airline industry dropped to just over 1.7 billion people, due to Covid-19 (Mazareanu). The huge decline of air traffic as a result of Covid-19, is presented below (Table 3):

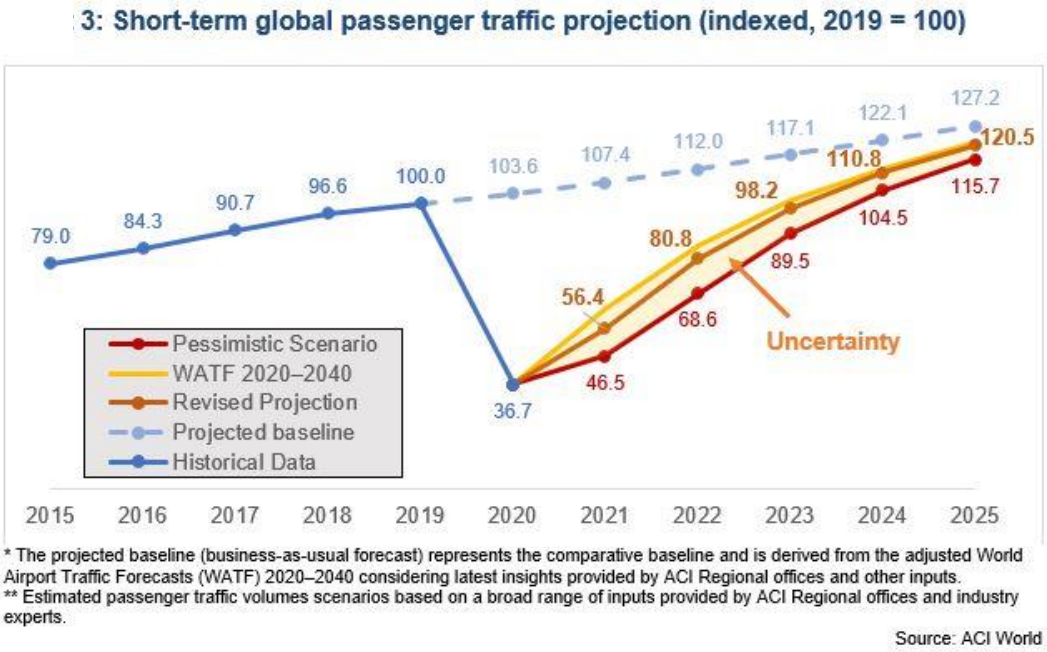


Table 3 (source: ACI World)

(The source that was used for the following information is ACI World).

Year 2020 (ACI World)

- The impact of the COVID-19 crisis removed more than 1 billion passengers for the whole year 2020 compared to the projected baseline (pre-COVID-19 forecast for 2020), thus representing a decline of 64.6% of global passenger traffic
- Europe and the Middle East were the two most impacted regions with similar declines
- Asia-Pacific, being hit first, embarked on recovery earlier and faster than other regions, mostly driven by China's important domestic market.

Year 2021 (ACI World)

- The impact of the COVID-19 crisis is expected to result to an additional decrease of 4.7 billion passengers by year end 2021, representing a decline of 47.5% of

global passenger traffic. As the vaccination evolves, more passengers are expected to return to travel especially in Q3 of 2021 and Q4 of 2021.

- Similar to 2020, Europe and the Middle East are forecasted to remain the two most impacted regions.

9.3. Revenue Streams, the effect of Covid-19

Airports primarily generate revenue from sources directly associated with the aeronautical use of the airport and so are highly dependent on the volume of passengers travelling through the airport.

The main types of revenue streams that generate more than 95% (ACI Europe) of all revenue are:

- Aeronautical services

Revenues from all regulated charges imposed at the airport, paid for the use of airport facilities such as airline landing fees, passenger fees, airline parking and housing fees, usage fees for terminals, gates, services, passenger counts. These revenues are paid by airlines and passengers. According to the International Finance Cooperation (World Bank Group) *aeronautical revenues contribute for about 55% in airport's 2017 revenue* (IFC, 2020).

- Non-aeronautical services

Revenues derived from retail activities such as duty-free, car-rental, food and beverages, vehicle parking, entertainment, news, gift, specialties, brand-names, advertising, kiosks, automated retail units. According to the International Finance Cooperation (World Bank Group), *the above revenues accounted about 45% in airports 2017 revenue* (IFC, 2020).

During the last years in the pre-Covid-19 period, according to ACI North America, "Airports have taken the approach that the customer is king, thus providing a high level of customer service". This resulted in more investments and an increase in concessions regarding new elaborated retail activities in airports, and in a multiplication of retailing such as small businesses, kiosks, automated vendors. The strategic vision was about "transforming the passenger experience".

The target is to make the passenger to spend more time and subsequently more money in the airport. In general, airports strategic management had focused on increasing non-aeronautical revenue from passengers and also from airport visitors, aiming to the enlargement of the airport business cycle.

During the past years before the pandemic, there was an increasing "spending tendency", as depicted in the following table (ACI North America)

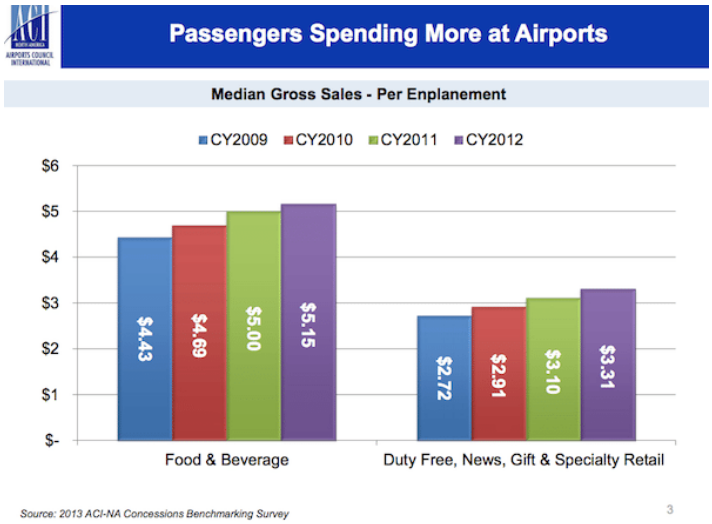


Table 4. Source ACI North America

How airport revenues worldwide broke down in financial year 2017

Table 5. Source:ACI World

The effect of Covid-19 on passenger traffic worldwide was enormous. The passenger traffic volume has been dramatically reduced. This resulted to the almost collapse of the aeronautical and non-aeronautical revenues. The lost capacity of the airlines, resulted to an intensive drop of aeronautical revenues, since fees from landing charges and securities charges collapsed. The subsequent fall of non-aeronautical revenues was unavoidable, since passengers almost disappeared from the airports. The crisis that will possibly follow the pandemic will further decrease airport traffic and thus the ability of generating income (IFC, 2020). According to ACI (2021), it is estimated that "the Covid-19 crisis will result in the loss of almost 51% of jobs, as well 51.5% in economic activity supported by aviation (Aviation: Benefits Beyond Borders, ATAG 2020)."

The months after travel bans, presented difficulties for most European airports, despite the fact that passengers and traffic levels started again to increase. The cost of re-opening terminals and general restart results in greater cash burn for airports, that had managed to

reduce expenses by the imposed closures during the quarantine periods, according to governmental instructions. The reopening of the terminals after Covid-19 demanded a bunch of new measures related to passengers' health and security, which increased airport operational costs. The new measures regarding frequent decontamination, the required distances that results to the need to resize the infrastructures, the essential safety measures at the entrance and the expenditure for digitalization installation for touchless check in, boarding, food and beverage orders, duty-free purchases, robotics in baggage handling, the implementation of biometric solutions for a paperless process, require the investment of extra capital. It remains extremely difficult for airports to decrease their fixed costs in proportion to reduced revenues. Most airports have been successful in renegotiating key contracts and reducing thus the cost of major contracts; car park management, maintenance, and cleaning. Major contracted and supplier costs have been reduced by around 25% on average (ACI-europe.org, 2020).

During the reopening of the airports, the recent tendency of the increased presence of automated retail units was very helpful, because they contributed to the increase of non-aeronautical revenues (from small spaces), whilst there was the possibility of a rapid and safe -without human contact- transaction.

The Covid-19 crisis still exists and affects airports' revenues. Although after the beginning of vaccination, there are positive signs and prospects for recovery from the pandemic; still there is a long path for the full recovery of the sector. It is necessary to underline the importance of efficient and airport management with a vision and effective strategy that will lead the airport to its recovery.

It is well understood that the decreased airport revenues impose uncertainty and there is a need to focus on how to raise capital. Thus, the airport management should evaluate all potential funding sources and successfully obtain liquidity. Apart from the solution of credit, airport management can raise cash through issuing shares and bonds. Also there exist governmental decisions for state-aid help regarding Covid-19, in order to support the sector (Armas Maes,R., 2018, blog.aci.aero).

9.4. Airport in the post Covid-19 era - Managing new challenges: the context of Sustainability

Airport management has many challenges to face in the post Covid-19 era.

According to Rene Armas Maes (2018), (ACI blog.aci.aero), "the airport survival strategy as a response to the pandemic should be based on seven pillars":

- "*Match airport operations with terminal and flight activity*
- *Focus on liquidity and raising cash*
- *Negotiate special concessions with governments and valued partners*
- *Manage capital expenditure*
- *Redraw the budget*
- *Continue building a commercial strategy and brand even during uncertain times*
- *Invest in technology, digitalization and innovation"*

The Covid-19 crisis stimulated the view that if there had been more investment in the sustainable development agenda proposed by the United Nations, the world would have been better prepared for the pandemic. Airports recovery is very important for the world economy and the industry should be rebuild in a more sustainable and resilient way than before, by implementing all the necessary transition to the "net-zero" aviation, where there is balance between the amount of greenhouse gas produced and the amount of greenhouse gas removed from the atmosphere. Action should be taken the soonest possible (ACI Europe, 2021).

Following to the abovementioned, airports' management can build the airport's commercial strategy and brand around sustainability.

An efficient airport's management has also to face the challenge of financing the "project of sustainability". Apart from the state-aid financial support, the airport management should secure funds for the development of a sustainable airport. A successful example is the "Aeroporti di Roma", operator of Rome – Fumicino and Rome-Ciampino airports, that secured €500 million Sustainability-linked Bond. (This case is presented in chapter 6).

Airport management that will succeed to incorporate sustainability in the airport's organization and its operations is expected in the long term to have positive results in reducing operational expenditure costs (OPEX). Currently, in order to face Covid-19 financial impacts, airports are reviewing their budgets, reducing and reallocating resources and focus on costs reduction.

According to Serrano, F., & Kazda, A. (2020), there is an effort towards cost optimization and cost reduction. *"COVID-19 is a unique opportunity for airports to adapt their current operation with a focus on improved processes and planning and could ease the change of management effort"* (Serrano, F., & Kazda, A., 2020). This is a new challenge for airport management, in order to intensify its efforts and to embed sustainability in all its components, as part of the required evolution of its business, facing the post Covid-19 era. The support of Regulatory Bodies, States, Aviation associations becomes crucial. This global challenge drives the transformation of previous business models and demands the adoption on business activities of the 17 Sustainable Development Goals (ACI-europe.org, 2020). Towards this direction airport stakeholders and lenders should also be committed to implement environmental sustainability for a green recovery and innovative future revenue streams (ACI-europe.org, 2020).

Airports have the unique opportunity to effectively incorporate sustainability, in terms of using green energy, reducing energy consumption, acquiring an effective water management, so that there will be a positive effect on the reduction of running costs and a reduced OPEX (operational expenditure).

To reduce operational expenditure of airports, in order to deal with the financial obstacles resulted from the pandemic, is the use of renewable energy. The reduced price during the last decades of renewable energy, signifies lower pay-back periods for an airport and planning for a possible independence from electricity. That is very critical for airports business that needs to operate continuously. Some airports have also developed business models that sell their energy surplus produced on-site. The appropriate policies to enhance this, should be implemented.

As underlined at the ACI Europe report (2021), *"the transition of the airports to renewable sources of energy, demands combined action by different sectors; governments and financial institutions, especially if the proposed solution positively impacts multiple*

actors. In order to promote overall sustainable mobility, airport operators need to identify new opportunities to coordinate action towards sustainable recovery with other stakeholders even from different modes of transportation in order to achieve an overall sustainable mobility. More specifically, the last can be interpreted as an action -for example- to support the commercial deployment of sustainable aviation fuels onsite airports to the development of sustainable ground access infrastructure for this."

There exist airports that have successfully managed to sell the surplus energy produced onsite, at times that they do not operate in full capacity. That contributes to the airport's revenues.

Sustainable airports have also developed water treatment plants that are resilient enough to support a city's (depends on the size) drinking water supply during periods with adverse weather events (ACI World Blog, 2020). The last can generate income to an airport organization.

The challenge is to accelerate the efforts to decarbonize by establishing "net zero" goal at a global level in airports and linking that with incentives. At the same time governments should provide the necessary support; financial and legislative. The development of new trade policies, sustainability guidelines and standards and receiving governmental financial support towards this direction, is more than necessary.

It is well understood that climate change is an important factor regarding the outbreak and the risk that zoonotic diseases pose to population, according to the WHO. As it is stated in ACI Europe report, *"wildlife trafficking prevention is one element that many airports have taken under their sustainability umbrella and ACI Europe has added to its Sustainability Strategy, as part of biodiversity protection"* and the need to reduce the carbon footprints of the airports.

The airport ownership model constitutes an important parameter for the implementation of strategic decisions that will be focused on sustainability. The last years the private sector has been playing an important role in the industry. At this turning point, the action for sustainable solutions, should come rapidly, otherwise the chance will be lost. Governmental regulation for public airports must be focused on sustainability. At the same time, the models of airports operated by private companies or with a mixed ownership will seek ways to reduce operational costs. For example designing and making a plan for the

utilization of renewable energy, at an airport operating by a public-private partnership or by a concessionaire, will have more flexibility regarding the decision-making, the scope, the choice of the strategic partners for the development of the renewable energy project and for financing it.

The abovementioned sustainability solutions, in combination with innovation and with the enhancement of digitalization (e.g. e-commerce on board) and the use of advanced I.T. technology, (e.g. for controlling emissions from the aircraft) will also contribute to the operational efficiency and to the improvement of the financial viability of airports.

As ACI World's director general, Luis Felipe de Oliveira said *"The sustainability of the whole aviation sector is crucial for the present and future of the industry, it is our passport to a return to growth, and the industry has invested billions in measures and practices which have made significant progress in reducing its environmental impact"* (ACI-europe.org, 2020).
As highlighted before, for the achieving sustainability, support from professional bodies and from the government, is more than necessary. The challenge to change after Covid-19 is important to be empowered by governmental support.

The following, is a short reference of the statement following the first bilateral meeting between U.S. President Joe Biden and Canadian Prime Minister Justin Trudeau, (issued on 23-3-2021, by Airports Council International – North America), (ACI-NA): "*The longstanding relationship between Canada and the United States is an important economic driver for both countries. For decades, our airports, airlines, and governments have worked together to find new ways to steadily improve the cross-border flow of travelers and goods. We welcome the renewed commitment from President Biden and Prime Minister Trudeau to further strengthen our historic bilateral relationship with the new 'United States/Canada Partnership Roadmap' and our continent's leadership around the world in the areas of health, safety, security, and sustainability".*

The airports should build a strategy for a sustainable recovery from the crisis, based on the three dimensions: environmental-social-economic. This is possible only by having long-term plans, otherwise a full recovery will not be sustained.

10. Conclusion

Airports are economic generators, whereas at the same time constitute a source of anti-environmental activities. Airports operation results to negative environmental impacts relating to aircraft emissions, greenhouse gas, solid waste, noise, waste-treatment, ground congestion, energy, power consumption. Therefore, there is an imperative need to manage and minimize the adverse impact on the environment and society from the operation and the business activities of an airport. The way to succeed is through a managerial behavior enabling the above.

The challenge is to develop advanced airport management based on a holistic sustainability strategy that will at the end lead to sustainable aviation.

The goal of the triple bottom line, can be achieved by acquiring a comprehensive sustainability program, empowering all key actors; management, employees, customers, tenants, stakeholders, visitors (SAGA, 2015).

An airport's organization should acquire a vision of sustainable development and growth. Following to this, the sustainability mission should be developed and accordingly a sustainable corporate strategy can be constructed. Setting the corporate strategy approach is very critical, since, based on this, the total process will be defined; in more details, the process of setting the strategic objectives, developing polices and standards, setting action plans and identifying the required needs and activities, advancing initiatives, respecting environment, respecting communities, setting financial vitability goals, undertaking compliance audits, performing studies and analyses, evaluating and finaly reengineering and remaping the process, in order to achieve continuous improvement.

For the efficient implementation of a sustainable strategy, all the resources available to support the development must be identified and managed. Base all daily operations on corporate values driven from the sustainability management approach, that affects employees, stakeholders, local communities focusing on a sustainable future, as Elkington introduced at the concept of "Triple Bottom Line". Very important is to engage into the sustainability strategy all the airport's organization stakeholders under a win-win approach and to establish long-term partnerships with them. Also important is to involve communities and airport's customers and maintain interrelationships with them, targeting

to the "end-user satisfaction". As John Elkington (1997) discussed, *"Companies able to engage their stakeholders with a clear vision of their shared future and, in the process, to outperform their competitors against the triple bottom line will be much better placed to win people's hearts and minds –along with their money".*

Finally, the development of a well structured sustainability strategy and its efficient implementation, can only be obtained as a result of an efficient airport management that will face the new challenges and will be based on the concept of "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).*

What is required, is an organizational culture that will enable a sustainable airport management, creating added value in terms of environment, economy, society, through the holistic sustainable approach of: *"Carrying on business in a caring way*".

FIGURE 8

Management in the context of Sustainability
is
CARRYING ON BUSINESS IN A **CARING** WAY

(the above LOGO of sustainability is created by the author, all rights reserved)

11. Proposals

A proposal for further research regarding the airport management is the identification of new financial mechanisms and especially green financial mechanisms in order that an airport will successfully manage new challenges.

Financial mechanisms suitable to support the management of new challenges; regarding the incorporation of sustainability in the airport, the support in the case of an external crisis like the pandemic Covid-19, the support for developing a resilient airport.

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