Scientific Journal of Silesian University of Technology. Series Transport
Zeszyty Naukowe Politechniki Śląskiej. Seria Transport

Volume 119 **2023**

p-ISBN:: 0209-3324

e-ISBN:: 2450-1549

DOI: https://doi.org/10.20858/sjsutst.2023.119.14

Journal homepage: http://sjsutst.polsl.pl

Article citation information:
Savchenko, L., Ovdiienko, O., Boichenko, M., Mostenska, T. Assessment of the relationship between corporate social responsibility environmental goals implementation and financial and operational indicators of airlines. *Scientific Journal of Silesian University of Technology. Series Transport*. 2023, **119**, 235-256. ISSN: 0209-3324.
DOI: https://doi.org/10.20858/sjsutst.2023.119.14.

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ASSESSMENT OF THE RELATIONSHIP BETWEEN CORPORATE SOCIAL RESPONSIBILITY ENVIRONMENTAL GOALS IMPLEMENTATION AND FINANCIAL AND OPERATIONAL INDICATORS OF AIRLINES

Summary. The main idea of the article is assessing the feasibility of introducing Corporate Social Responsibility (CSR) for airlines. Moreover, the authors think that the environmental aspect in CSR is the most important, which predetermined the focus on this CSR component in the article. The article provides several examples of airlines that actively use CSR to improve their image, attract new, and increase the loyalty of existing customers. Environment indicators of the flight operations group on the performance indicators were established.

Keywords: Corporate Social Responsibility (CSR), environmental indicators, financial and operational results, correlation, airline

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1. INTRODUCTION

The concept of CSR has been actively developing as a practical activity of companies and a direction for research since the middle of the 20th century. This is a period when the consumer is playing a more active role in the market of goods and services, and goods' producers of and service providers are rebuilding the pattern of relationships with their customers. Thus, the commercial companies have started to voluntarily take responsibility for several social aspects [1]. The consumers have become more and more conscious of their rights and power to influence the behavior of the commercial companies [2]. Further development of the theory and practice of corporate social responsibility by companies has gone through the strengthening of control by environmental activists and social control, as well as globalization processes that have strengthened the presence of corporations in different parts of the world.

The most important and most used definition is set by the European Commission, which defines Corporate Social Responsibility (CSR) as the voluntary combination of corporate, social and environmental concerns in the business processes and the interaction of these with stakeholders [3]. CSR is essential for businesses because "it is in business's self-interest to have a healthy climate in the environment" [4]. In such a way, the interrelatedness of business, society, and the environment becomes the crux of CSR.

The priority of economic, environmental and social development in harmony and balance is currently supported by the basic postulates of the concept of sustainable development, which is recognized by the UN member states (193 countries) as the direction of development of all mankind. It's a world's shared plan to end extreme poverty, reduce inequality, and protect the planet by 2030 [5]. Accordingly, international conventions and programs are being adopted to implement the goals of sustainable development, which impose obligations on countries in general and on market participants directly. The regulatory framework for environmental issues is particularly actively discussed and developed in the context of the priority and urgency of issues related to the challenges of global climate change.

The pioneering thinker and formulator of CSR theory for business is Peter Drucker. According to his theory, companies have three primary tasks: to increase the financial performance of the company, to increase the efficiency of the employees, and manage social and environmental responsibilities [6]. The aviation industry is no exception. Many airlines are trying to be more socially and environmentally friendly. In fact, such an additional direction in the management of airlines today is more of a necessity than a luxury. The only question is how CSR indicators and financial and operational indicators of airline influence each other.

Thus, the main purpose of the article is to assess the interdependence of the environmental parameters of the CSR policy and the financial and operational performance of the airline.

The second section of the article, Literature Review, consists of an analysis of existing studies on the application of CSR by airlines, in particular, an analysis of the CSR policy of several airlines in the field of the environment. The third section, Methodology and results, examines the relationship between an airline's environmental performance and its financial and operating results. The main mathematical tool is correlation analysis, which made it possible to track correlations between independent variables, which made it possible to reduce the amount of these variables. As a result, numerical results of the relationship between the environmental and financial and operational indicators of the airline were obtained, which make it possible to judge the strength of such a relationship and its direction. Taking into account the obtained results, some important conclusions are made that can be used to form an effective and strategically beneficial CSR policy for the airline. The last, fifth section of the article, named

Summary, contains a concise content of the main results of the article and aspects of their practical application.

2. LITERATURE REVIEW

2.1. Publications concerning CSR of airlines

Several studies show that there is an interest in evaluating the feasibility of using CSR tools in the aviation industry. For example, Phillips [7] evaluates the ethical and social aspects of CSR. He emphasizes that in order to introduce CSR into the work of an airline, it is necessary to pay considerable attention to education in the field of ethics and sociology. Another work [8] was aimed at providing an overview of CSR activities in the aviation industry, and examining how CSR activities influence the corporate image. Having studied a large amount of literature and theories of CSR, the authors came to the conclusion that investment in CSR is an investment in long-term success.

With the growing focus on corporate social responsibility practices, airlines are beginning to wonder if the introduction of CSR will change corporate financial performance in a good side. According to So [9], the financial performance of an airline is mainly measured by the following metrics: Return on Assets (ROA), Return on Equity (ROE), and Cost per Available Seat Kilometer (CASK).

A study of Kuo et al. [10] tracked the environmental, social and governance (ESG) and short-term financial performance of 30 airlines worldwide over five years using data from the Thomson Reuters Eikon ESG database. A multilevel quadratic growth model was used to investigate the impact of airline disclosure of ESG performance metrics. The results showed that at the initial stages of the introduction of ESG practices, airlines show a tendency to reduce the return on assets. However, it starts to increase after the introduction and implementation period.

Empirical studies have suggested that airlines which practices CSR enjoy better profitability. According to Moon et al. [11], the practice of CSR on the employment dimension significantly increased ROA, especially in Delta and American Airlines. CSR initiatives on multiple dimensions enhance an airline's financial performance through enhancing credibility with customers, community performance and employee relations [11, 12]. To illustrate, Alaska Airlines' Charity Miles Program provides air transport for charities and communities in need in the US and is well received by the public and employees [13]. From this example, it is plausible that consequent enhancements from CSR helped the airline attract more customers and increase employee productivity, which in turn increase revenue and ultimately strengthen the airline's financial performance.

2.2. Publications concerning environmental aspects of CSR in the aviation industry

The European Environment and Aviation Agencies report showed increasing European air traffic has surpassed technological and operational improvements over the past 25 years, leading to increased environmental pressures and intensification until 2035 [14]. The work of Kharazishvili et al. [15] assessed the relationship between sustainable development of transport systems and the safety of air transport; authors stated that the environmental aspect is one of the main components of sustainable development of air transport. The harmful impact of global air transport on the environment is evaluated also in [16]. It is established that the most harmful

influence for the ecosystem is done by the air transport during performance of logistics processes and operations at the airport. Thus, it is the environmental aspect in CSR that is the most important, which predetermined the focus on this CSR component.

In just over a century, commercial aviation has become the fastest, safest, and most far-reaching mode of transportation in the world. The global growth of demand for air travel is continuing. It is imperative that airlines address the significant impact of their operations on the environment. Airlines are cognizant of their environmental footprints and are taking proactive measures to enhance corporate sustainability. One such measure is disclosing historical track records along with current initiatives that make the operations "greener". CSR encourages airlines to go beyond mere self-interest or regulatory compliance in leading the way to meeting increasingly ambitious greenhouse gas (GHG) reduction targets [17]. Cathay Pacific replaced its Boeing 747s with new Airbus A350s as a part of its CSR strategy to increase carbon efficiency in 2016. By the end of 2016, not only has the airline's carbon efficiency increased by 4 g/Available-tonne-kilometer, but also Available seat km by 2.4% [18].

As the public gradually realizes the importance of sustainable development, customers consider CSR. As such, CSR initiatives could increase passenger patronage. In most cases, CSR is beneficial for an airline's performance, financially and operationally, regardless of its business model [9].

The Internet search for airlines using environmental principles of corporate social responsibility in their practice, allowed us to analyze several positive examples.

1. The *Lufthansa Group* has been reporting regularly on its commitment to sustainability since 1995, and its reports have been continuously improved in line with internationally recognized reporting standards such as the GRI Standards 2016. *Lufthansa's* corporate activities have been closely linked to the ten principles of the UN Global Compact since 2002, and since 2015 also to the Sustainable Development Goals of the United Nations. To minimize the environmental impact of flying, the airline has upgraded its fleet, as the new aircraft are significantly more fuel efficient. Thus, the company expanded its commitment to Sustainable Aviation Fuel. *Lufthansa* has set itself ambitious climate protection targets: to halve $C0_2$ emissions compared to 2019 and achieve a neutral CO_2 balance by 2050. Since 2006, *Lufthansa Group* has disclosed its CO_2 emissions in detail in accordance with GHG protocol [19].

2. *British Airways* is known for being part of the first group of airlines (IAG) to set a strategic goal of going carbon-neutral by 2050. The company has invested heavily in new state-of-the-art aircraft, which are 40% more efficient than older aircraft, thus drastically reducing emissions. What is more, *British Airways* has partnered with other companies to develop cleaner aviation fuels, as well as zero-pollution hydrogen-powered aircraft and carbon capture technologies.

Moreover, from January 2020, *British Airways* has been carbon offsetting on all flights within the UK, making all flights within the UK carbon-neutral.

The company partnered with non-profit organisation *Pure Leapfrog* to calculate and offset carbon emissions, making their flying carbon-neutral.

On the waste issue, *British Airways* is continuing its engagement with *Velocys* with plans to build the first commercial plant in Europe capable of converting household waste into jet fuel by 2025. Such a project significantly reduces the volume of waste buried in landfills and reduces carbon dioxide emissions by up to 100% compared to fossil fuels. They also partner with *LanzaJet*, which is contracted to sell them green jet fuel from the end of 2022. Over the next 20 years, *British Airways* parent company IAG plans to invest about $400 million to develop

environmentally friendly aviation fuel. However, in April 2021, they became the first airline group in Europe to announce that by 2030, 10% of all flights operated will be run on green fuel.

To be a Zero emissions airline, *British Airways* supports the development of hydrogen as an alternative fuel source. They have invested in *ZeroAvia* – a leading innovator in decarbonising commercial aviation, which completed the world's first hydrogen-electric fuel cell powered flight of a commercial-grade aircraft in September 2020 [20].

3. *Air China* has established a company-level environmental and environmental protection leading group, and formed a closed-loop energy saving and environmental protection management system that covers all departments and reaches all levels. *Air China* has set up a coordinating working group for the Company's environmental development, implemented the Implementation Rules for the Management of Special Funds for Energy Conservation and Eco-environmental Protection and Implementation Rules for the Supervision over Energy Conservation, Emission Reduction, and Eco-environmental Protection. In 2020, *Air China* was recognized as the exemplary team in the civil aviation industry in winning the Blue-Sky Protection Campaign [21].

Air China sorted the material issues according to two dimensions, "importance to the Company's sustainable development" and "importance to stakeholders", and generated a matrix of own material issues of social responsibility (Fig. 1).

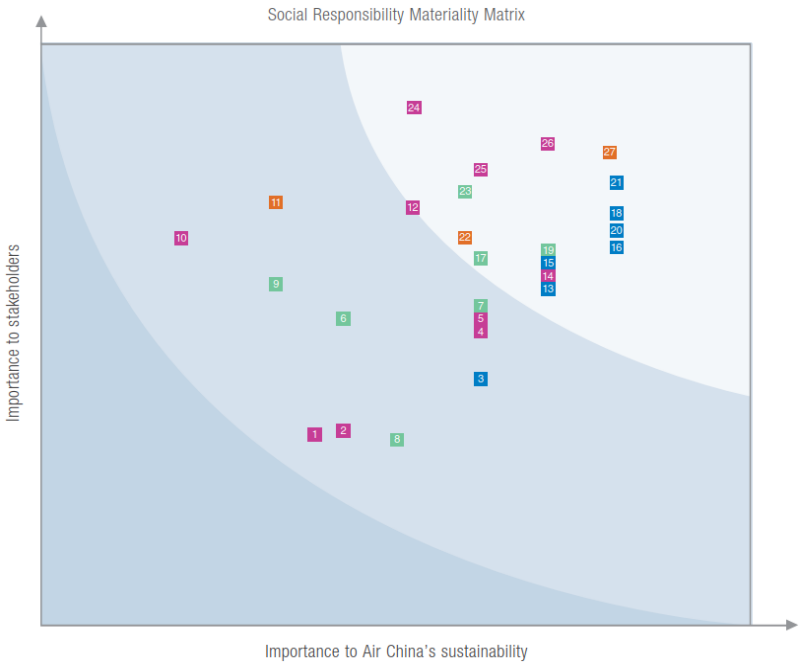

Fig. 1. Air China's social responsibility materiality matrix (blue - corporate governance, red - environment, employees' rights and interests, purple - social services) [21]

Among factors of importance of *Air China*, 3 environmental aspects can be observed, namely 11 - Prevention and control of pollution, 22 - Sustainable use of resources and 27 - Response to climate change (Figure 1). The last two environmental indicators are among the highest priority indicators.

4. *Dassault Aviation*, a major player in the aerospace industry, continues to protect its employees and preserve the environment in terms of corporate social responsibility, based on five core pillars, first of that is concerning environmental aspects, namely:

- reinforce the low carbon Company plan consistent with climatic challenges;
- integrate eco-design in the research of innovative technical solutions;
- reduce the environmental footprint according to the principles of circular economy [22].

In such a way, the three pillars of sustainable procurement combine economic, social and environmental aspects (Fig. 2).

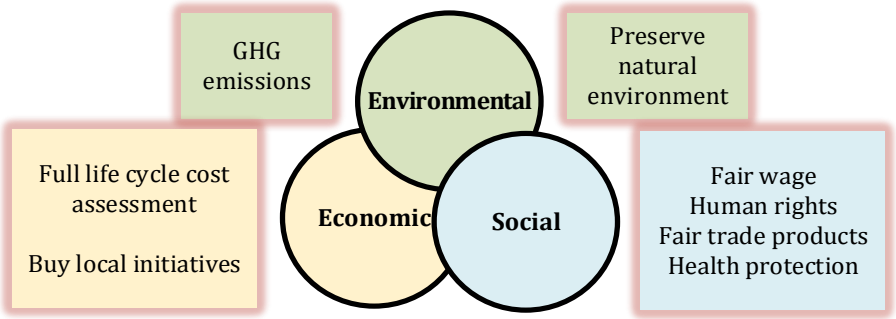

Fig. 2. Sustainable procurement pillars [23]

As an active member of the International Civil Aviation Organization (ICAO) Committee on Environmental Protection, Dassault Aviation also supports CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation). It actively promotes the use of Sustainable Alternative Fuel (SAF) to replace conventional kerosene. The Falcon range is already sustainable fuel compatible. Their Falcon Service Advisory document sets out best practices for reducing the environmental footprint of Dassault Aviation's aircraft. The development of flight path optimization technology also offers quick solutions for reducing carbon emissions [22].

5. *Xiamen Airlines* reported 78 energy saving and emission reduction projects and programs:
- APU reduction;
- aircraft drag and weight reduction;
- aircraft/engine performance maintenance;
- air route straightening;
- intelligent flight planning and
- in-flight fuel savings.

The airline has invested money and effort in the creation of "green" aircraft cabins, which involved the abandonment of paper and plastic components with environmentally friendly and various types of completely biodegradable materials. In addition, *Xiamen Airlines* used its resources by holding themed events to encourage as many people as possible to lead a healthy lifestyle. In 2020, *Xiamen Airlines* created a Sustainability Committee within its structure, which was part of the Sustainable Development Plan [24]. The relevant Committee includes four divisions that are responsible for 1) sustainable security, 2) low-carbon operations, 3) sustainable travel and 4) overall growth (Fig. 3).

6. The pursuit of environmental sustainability and a high level of corporate social responsibility form an important basis for other big cargo airline, *Qatar Airways Cargo*. It is at the forefront of industry e-initiatives such as e-cargo. In the context of environmental responsibility, the company intends to expand the use of electronic air waybills (e-AWB) as part of efforts to reduce paper printing and reduce waste [25].

7. *Air Malta*'s corporate social responsibility is committed to carrying out all their activities responsibly and in ways that make a positive difference to people's lives and the environment. Among other initiatives, an energy-efficient business that strives to reduce its impact on the environment. To achieve this, in recent years, the airline has moved towards a more fuel-efficient Airbus fleet, and have introduced electrically powered vehicles at the airport, and are moving rapidly towards 'paper-less' offices. *Air Malta* works together with its partners - Airbus, the Association of European Airlines and the International Air Transport Association - to reduce emissions and fuel wastage [26].

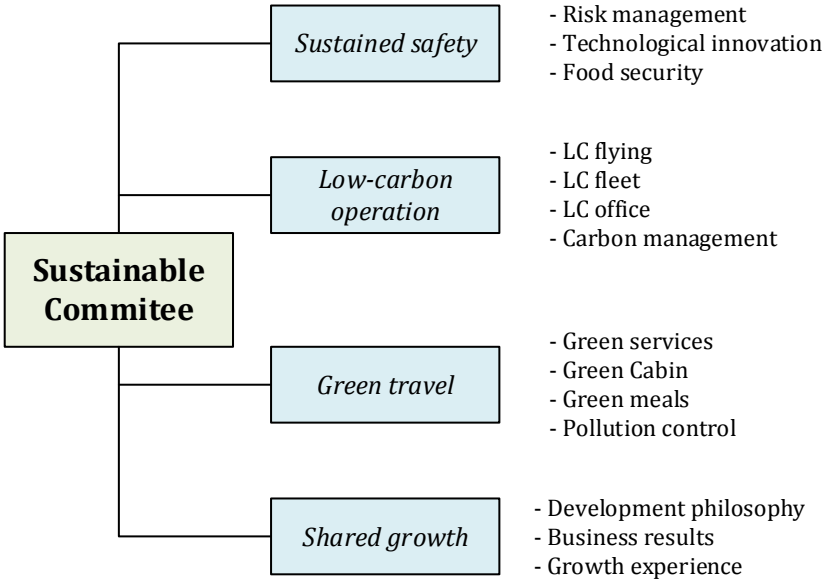

Fig. 3. Xiamen airlines' sustainable committee [24]

Some airlines declare their corporate social responsibility in their websites, however, declaratively, without specifying the actions carried out within the framework of this responsibility [27].

2.3. Objects of the article

The main objects that the authors plan to reveal in this article are:

1) to investigate the importance and inevitability of the environmental aspect of CSR in modern conditions;
2) to analyze the experience of the flagship movement with corporate social responsibility in the aviation industry, to find connections between the key parameters that characterize the company's corporate social responsibility, and indicators of financial condition and operating activities;

3) provide recommendations based on research – how to build a long-term strategy for air company development facing challenges of sustainable goals.

3. METHODOLOGY AND RESULTS

3.1. Choice of flagship airline in the field of CSR

The modern concept of CSR implies compliance of the company's activities with the requirements and needs of its stakeholders, both external and internal. Corporate Social Responsibility is the way how to create value for all stakeholders of the company for the long term. And accordingly takes into account the following areas: education sector, environment, employees and donations [28].

One of the most urgent and widely discussed type of humans' environment impact is global climatic change, which is closely linked to air pollution in general, and CO_2 emissions into air in particular [29]. Air transport emissions account for more than 2.5 to 3% of global pollution per year. However, the specific weight per 1 ton-kilometer is 560-867 g of CO_2, which is ten times even higher than road transport, which is recognized as the main transport polluter (almost 2/3 of transport emissions come from road vehicles) [30]. Therefore, the study is focused on the environmental component of CSR for airlines, which is based on three important principles of the UN Global Compact: 1) businesses should support a precautionary approach to environmental challenges; 2) undertake initiatives to promote greater environmental responsibility; and 3) encourage the development and diffusion of environmentally friendly technologies.

UN Global Compact is a special initiative of the UN Secretary General and the world's largest corporate responsibility association, which encourages companies to build their activities and strategies in accordance with the sustainable development goals and on the basis of ten universal principles in human rights, labor, environment and anti-corruption [31]. The organization has more than 12,000 commercial companies and 3,000 non-business organizations in 69 local networks located in 163 countries. Joining this initiative requires annual reporting to stakeholders in a transparent and public manner, which is fundamental for companies committed to sustainability (Communication on Progress). Thus, these type of reporting shows the level and changes in corporate social responsibilities of the companies and could be used for analyze to the frames of this paper.

Members of the UN Global Compact seek to mobilize a global movement of sustainable companies and stakeholders. To this end, the UN Global Compact helps companies:

- conduct business responsibly by aligning our strategies and operations with the Ten Principles of Human Rights, Labor, the Environment and Anti-Corruption;
- take strategic action to achieve overarching social goals, like the UN Sustainable Development Goals, with a focus on collaboration and innovation.

More than 10,000 business participants and 5,000 non-business participants in the UN Global Compact are already changing the world [32].

To conduct the study, the base of participants of the UN Global Compact was analyzed in order to find aviation companies. According to the "air" search criterion, 18 companies were selected, among which, in addition to air carriers, there were also representatives of the Media sector, Support Services, Chemicals and others (Table 1).

Tab. 1

Participants of UN Global Compact, whose profile connected to air activity [32]

Company	Sector*	Country	Joined on
Pan Air Travel Service Co., Ltd.	TL	Thailand	09.08.2021
Air-e	E	Colombia	29.04.2021
Air Creative Associates	M	Belgium	30.03.2021
AIR SUPPORT	IMM	France	18.12.2019
Réunion Air Sureté	SS	France	18.12.2019
Air Canada	TL	Canada	26.07.2019
SHIN NIPPON AIR TECHNOLOGIES CO.	CM	Japan	22.01.2019
Via Air	TL	Central African Republic	04.10.2017
Air New Zealand Limited	TL	New Zealand	01.09.2015
Air Liquide	C	France	10.09.2014
Air Techniques Ltd	IE	Kenya	26.04.2013
Almond Air & Logistics Ltd.	SS	Kenya	29.01.2013
Air Greenland	TL	Denmark	14.09.2010
Water Air Food Awards	NA	Denmark	17.07.2008
Korean Air	TL	Korea, Republic of (South)	16.07.2007
Rhenus Air B.V.	IT	Netherlands	04.05.2006
Air France - KLM	TL	France	03.06.2003

* Travel & Leisure - TL, Electricity - E, Media - M, Industrial Metals & Mining - IMM, Support Services - SS, Construction & Materials - CM, Chemicals - C, Industrial Engineering - IE, Not Applicable - NA, Industrial Transportation - IT

Unfortunately, in this large number at the moment there are only 5 airlines in the world that have assumed corporate social responsibility obligations and have passed the United Nations verification procedure (Table 2).

Tab. 2

Current list of airlines involved in UN Global Compact [32]

Company	Sector*	Country	Joined on
Air Canada	TL	Canada	26.07.2019
Air New Zealand Limited	TL	New Zealand	01.09.2015
Air Greenland	TL	Denmark	14.09.2010
Korean Air	TL	Korea, Republic of (South)	16.07.2007
Air France - KLM	TL	France	03.06.2003

Actual air carriers from the list are only *Air Canada*, *Via Air*, *Air New Zealand Limited*, *Air Greenland*, *Korean Air* and *Air France KLM*. The French company *Air France KLM* was selected for further study because it was the first in the industry to join the agreement (2003-06-03), it's a world-famous company, one of the leaders in the French aviation market. *Air France KLM* declared in theirs most recent Communication on Progress environment as an addressed principle and global goal (together with human rights, labor and anti-corruption).

Therefore, their practical experience of taking into account the environmental factor of corporate social responsibility can serve as an example and an action plan for other major airlines.

3.2. Environmental indicators of *Air France KLM*'s CSR policy

The last officially published *Air France's KLM* Communication on Progress is for the year 2020 [33]. It includes 28 different environmental indicators related to both the flight operation and the ground operation (Table 3).

Tab. 3

Air France's KLM environmental indicators [33]

Parameters	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020
Carbon emissions flight operations										
GHG emissions from Conventional aviation fuel	ktons CO_2	28.21	27.58	27.58	27.57	27.34	27.51	27.57	28.23	14.0
CO_2 savings from sustainable aviation fuel	ktons CO_2								N/A	0.5
GHG emissions from ground operations	tons CO_2	85.68	88.88	78.84	76.81	63.26	64.46	62.3	60.7	49.0
GHG emissions from electricity	ktons CO_2							46.2	7.6	6.8
Upstream emissions from fuel production	ktons C O_2				N/A	N/A	5.239	5.685	5.917	3.034
Total carbon emissions	ktons C O_2							33.37	34.20	17.09
Mandatory carbon offsets	ktons CO_2 credits							3.106	3.253	111
Voluntary carbon offsets	ktons CO_2 credits								24	623
Customers' carbon offsets	ktons CO_2 credits								98	51
Flight Operations										
Consumption of conventional aviation fuel	ktons	8.95	8.956	8.755	8.752	8.681	8.733	8.753	8.961	4.43
Consumption of sustainable aviation fuel	ktons								6.9	0.2
Specific CO_2 footprint for passenger transport	g, CO_2/pax km								79	102

Specific CO_2 footprint for cargo transport	g, CO_2/100 kg cargo km								44.5	57
NO_x low altitude (<3,000 ft)	ktons	9.2	9.5	9.9	10.2	9.8	9.8	9.3	9.5	4.8
SO_2 low altitude (<3,000 ft)	ktons	0.7	0.8	0.89	0.88	0.93	0.9	0.88	0.8	0.3
Global noise energy indicator	10-12 kJ	1.69	1.62	1.54	1.70	1.65	1.64	1.68	1.69	0.82
Ground Operations										
Electricity total consumption	MWh	392.223	383.6	374.1	366.2	297.8	284.8	278.7	267.6	236.6
of which renewable	MWh								102.4	92.9
Other energies total consumption	MWh	513.6	534.4	451.6	446.3	376.0	375.3	358.3	350.9	285.4
Fuels	MWh								159.7	123.6
Natural gas	MWh								111.1	95.79
Steam / other heating / cooling	MWh								80.14	66.04
of which renewable	MWh								24.84	16.10
Water consumption	m^3	812	825	792.8	806.0	546.6	549.9	542.6	481.6	464.5
Non-carbon emissions, NO_x	ktons	0.773	0.675	0.638	0.622	0.511	0.523	0.495	0.445	0.322
Non-hazardous industrial waste, total quantity	tons	57.06	54.966	57.895	55.259	19.896	21.529	23.221	20.456	13.482
Non-hazardous industrial waste, percentage recycled	%								38	39
Hazardous industrial waste, total quantity	tons	7.009	7.073	5.808	6.291	6.445	5.699	5.427	4.305	3.811
Hazardous industrial waste, percentage recycled	%	58	61	51	58	69	64	71	54	58

But a certain part of the indicators began to be recorded and reported only during the last 2-3 years, which makes it impossible to collect reliable statistical information on them. For instance, CO_2 efficiency per pass-km which shows specific CO_2 footprint for passenger transportation has increased in 2020 compared to 2019 by almost 30%, but the *Air France KLM* target till 2030 is 50% reduction compared to 2005. It looks like efforts connecting to CO_2 footprint for passengers are inefficient. According to Universal Registration Document 2020 (*Air France KLM* Communication on Progress report for 2020), the year 2020 had influenced significantly on the results of company activity, as a consequence of closed borders, additional health and quarantine measures, changing the traditional routes. The results on mentioned indicator are worse in 2020, but *Air France KLM* still oriented on their obligations in long-term plans and desired indicators on environmental impact [34]. At the same time, were reported significant outcome in reduction of the percentage change in absolute CO_2 emissions from

the ground operations between 2019 and 2020 (on 17%), upstream emissions from fuel production (on 49%). According to provided statistics, the company implemented stable and effective corporate social responsibility and focused on long-term development, its activities meet modern conditions and ensure readiness for future challenges. Accordingly, it is necessary to conduct further research on changes in these factors and their impact on the level of corporate social responsibility, when there will be a representative statistical base of airlines.

Introducing the principles of sustainable development in passenger air transport is the task of *Air France KLM* 's CSR programs. Aviation accounts for about 2.5% of all CO_2 emissions, so *Air France KLM* is aware of the responsibility and need to reduce emissions, so it is constantly looking for environmentally friendly solutions for its work. Due to that company is going to realize carbon neutrality by 2050 likened to 2019, moreover they are planning to reduce CO_2 emissions per passenger kilometer by 5,6% compared to 2005, also to diminish noise by 39% likened to the year 2000 and to produce non-recycled waste in the volumes, that 56% lower than in 2011. To do this, the company began to partially refuel its aircraft with bio aviation fuel, serve food on board in packaging made from recycled materials, use less electricity and fuel. Also, *Air France KLM* and Delft Institute of Technology are jointly creating the aircraft of the future - Flying-V. It will consume 20% less fuel than the Airbus A350, while accommodating about 314 people in the cabin. In September 2020, the Flying-V model made its first flight [35 To achieve the goals and ambitions mentioned, the main directions of the companies' activity were identified, which will lead to the planned indicators. Among them participation in development and research with the aim to renewing the fleet, further implementation and popularization of sustainable aviation fuel usage, changes in everyday operation procedures, compliance with requirements and goals of global climate agreements, offsetting programs (both for clients and for the company by itself) and involvement into different environmental programs.

It can be observed that as a consequence of the Covid-19 pandemic, specific CO_2 emissions of *Air France KLM* per 1 passenger-kilometer increased from 79 (2019) to 101 (2020) grams, which is accompanied by a linear increase in fuel costs per 1 pass-km from 0.032 to 0.042 (Fig. 4).

An analysis of traffic and CO_2 emissions of *Air France KLM* from 2005 to 2020 reveals a clear trend towards the decarbonization of air transport. Over the last 15 years, the number of flights has increased by 20%, while emissions, on the contrary, have decreased by 2-3%. Unfortunately, the pandemic has made its own adjustments, and traffic in 2020 has fallen by 70% compared to 2019. In 2020, emissions decreased by about 60%, that is, the ratio "traffic-emissions" has ceased to show positive environmental dynamics (Fig. 5).

3.3. Relationship and interaction of *Air France KLM's* environmental indicators and its financial and operational performance factors

In order to research the practical experience of the flagship in Corporate Social Responsibility in *Air France KLM*, we studied the relationship and interaction of environmental indicators and financial and operational performance factors by building multiple correlations. As a result, we chose data, officially published in Communication on Progress reports in frames of participant obligations in the United Nations Global Compact (Tab. 4), which represents all sectors and has full data information from 2012 to 2020 (depended on variables, Y):

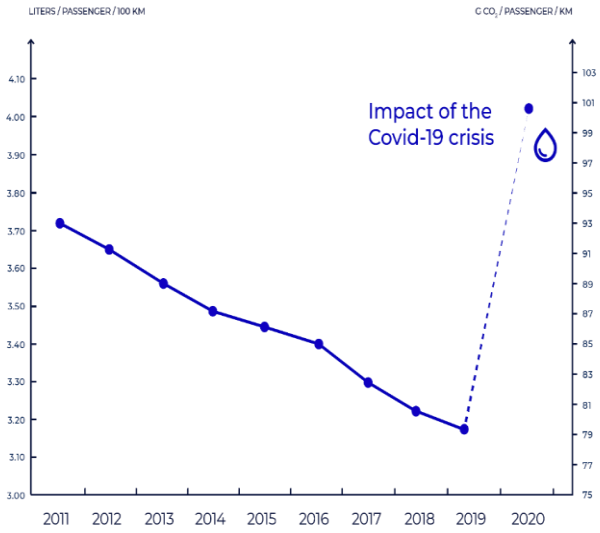

Fig. 4. *Air France KLM* linear increase in fuel costs per 1 passenger-kilometer because of Covid-19 [35]

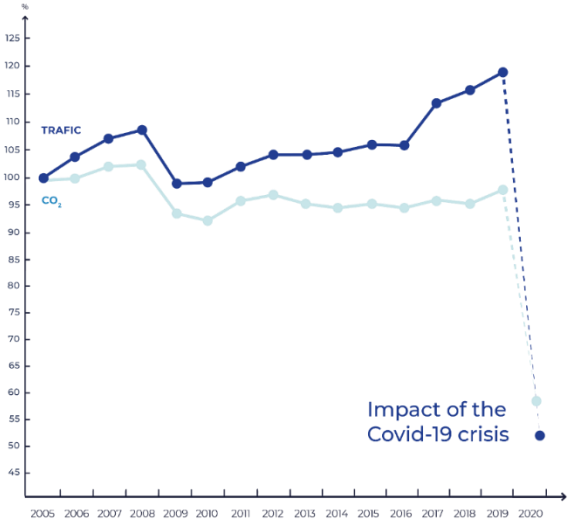

Fig. 5. An analysis of traffic and CO_2 emissions *Air France KLM* from 2005 to 2020 [35]

- GHG emissions from the combustion of aviation fuel. This indicator is deemed as the total volume of kerosene used in the company during flight operations. For calculation used the emission factor of 3.15 kg CO_2 per kg kerosene according to the EU Emission Trading System recommendations or of 3.16 kg CO_2 per kg kerosene corresponding to ICAO practice (Y_1, ktons CO_2);
- GHG emissions, generated from the ground operations (testing bench, runway vehicles, etc.). It includes emissions from the various origins and is calculated according to national standards or energy supplier official documentation (Y_2, tons CO_2);
- consumption of raw materials, particularly conventional aviation fuel: the real amount of it, used to perform every flight. It includes also the fuel consumed by the auxiliary power unit usage (Y_3, ktons);
- non-carbon emissions - NO_x low altitude: low-altitude emissions (below 3,000 feet), which depends on the time and characteristics of landing and taking-off time and on engine data, provided by ICAO. But for evaluating taxing time is used different from ICAO's methodology, it is more accurate as considers the real taxing time (Y_4, ktons);
- non-carbon emissions – SO_2 low altitude: reflects the amount of sulfur in fuel. The estimation algorithm based on Amsterdam and Paris platforms and comprises total fuel volumes used by KLM per year (Y_5, ktons);
- noise impact – global noise energy indicator: aircraft noise pollution around airports is often the most important limiting factor for airport development. This marker evaluates on the rules, provided by the Direction Générale d'Aviation Civile or French Civil Aviation Authority (Y_6, 10^{12} kJ)
- consumption – electricity: the total quantity of electricity used (Y_7, MWh);
- consumption – other energies: kerosene, diesel, gasoline and natural gas (calculations are performed according to the gas quality indicators, identified in France) steam/other heating/cooling (for climate comfort) (Y_8, MWh);
- consumption – water consumption: only for actions, made on the ground, it doesn't include any water, needed for flights on board (Y_9, ktons);

- non-carbon emissions – NO_x: connected to engine testing processes. Cover also emissions from the runway equipment and ground vehicles and estimated on European standards (European Directive 97/68/EC), according to which emission norms depend on the power of engine ($Y_{10,}$ ktons);
- waste – non-hazardous industrial waste: includes catering waste, data are provided by the specialized company, who is responsible for such type of waste management ($Y_{11,}$ tons);
- waste – hazardous industrial waste: can take the form of a solid, liquid or compressed gas, data for reporting is provided by specialized companies, responsible for waste management. If there is no given data by the service supplier, used the information from the specification slip ($Y_{12,}$ tons);
- percentage of recovered hazardous industrial waste: ratio between the waste recycled/recovered and the total amount ($Y_{13,}$ %).

Tab. 4

Air France KLM statistical information on environment indicators, 2012-2020

Environment indicators	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020
GHG emissions from conventional aviation fuel, Y_1	ktons CO_2	28.210	27.576	27.57	27.56	27.34	27.50	27.57	28.22	13.99
GHG emissions from ground operations, Y_2	tons CO_2	85.68	88.885	78.84	76.80	63.25	64.45	62.3	60.7	49
Consumption of conventional aviation fuel, Y_3	ktons	8.95	8.956	8.755	8.752	8.681	8.733	8.753	8.961	4.43
NO_x low altitude emissions (<3,000 ft), Y_4	ktons	9.2	9.5	9.9	10.2	9.8	9.8	9.3	9.5	4.8
SO_2 low altitude emissions (<3,000 ft), Y_5	ktons	0.7	0.8	0.89	0.88	0.93	0.9	0.88	0.8	0.3
Global noise energy indicator, Y_6	10^{12} kJ	1.69	1.62	1.54	1.7	1.65	1.64	1.68	1.69	0.82
Total electricity consumption, Y_7	MWh	392.2	383.6	374.1	366.2	297.8	284.8	278.7	267.6	236.6
Other energies consumption, Y_8	MWh	513.6	534.4	451.6	446.3	376.0	375.3	358.3	350.9	285.4
Water consumption, Y_9	m^3	812	825	792.8	806.0	546.6	549.9	542.6	481.6	464.5
Non-carbon emissions, Y_{10}	ktons	0. 773	0.675	0.638	0.622	0.511	0.523	0.495	0.445	0.322
Non-hazardous industrial waste, Y_{11}	tons	57.06	54.966	57.89	55.25	19.89	21.52	23.22	20.45	13.48
Hazardous industrial waste, Y_{12}	tons	7.009	7.073	5.808	6.291	6.445	5.699	5.427	4.305	3.811
Percentage recycled, Y_{13}	%	58	61	51	58	69	64	71	54	58

The next step of the study was checking the hypothesis of interconnection between selected environment indicators with main of company's activities indicators to explore the relationship between different areas of consideration of the environmental component in aviation enterprises' corporate social responsibility.

Independent variables for analyze show the company's financial and operating performance results (Tab. 5) that are common to financial statements in different countries (independent variables, X):

- total revenues (X1, €m);
- operating result (X2, €m);
- net income for the period (X3, €m);
- number of passengers (X4, thousands);
- load factor for passenger network (X5, %);
- total passenger revenues (X6, €m);
- cargo flow (X7, thousands);
- load factor for cargo (X8, %);
- total cargo revenues (X9, €m).

Tab. 5

Air France KLM statistical information on financial/operating results, 2012-2020

Parameters	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total revenues (€m), X_1	25.4	25.5	24.9	25.7	24.8	22.5	22.9	23.3	9.2
Operating result (€m), X_2	-336	130	-129	780	1.04	1.19	994	749	-3.72
Net income for the period (€m), X_3	-1.22	-1.82	-189	127	792	-275	411	293	-7.083
Passengers flow (th. passengers), X_4	75.6	77.4	77.5	79.0	80.2	83.9	85.6	87.6	28.9
Load factor (passenger, %), X_5	83.2	83.8	84.7	85.1	85.4	86.8	87.4	87.9	58.8
Total passenger revenues (€m), X_6	20.0	20.1	19.6	20.5	19.7	20.4	20.7	21.1	6.6
Cargo flow (thous. tons), X_7	1.46	1.38	1.30	1.21	1.13	1.14	1.14	1.11	0.88
Load factor (cargo, %), X_8	64.5	63.2	63.1	60.4	59.3	59.9	60.%	58.0	67.5
Total Cargo revenues (€m), X_9	3.06	2.82	2.68	2.43	2.07	2.09	2.29	2.15	2.568

Using the method of building multiple correlations, the impact of each indicator from the Tab. 4 (dependent variables) were analyzed in their interaction on each environment indicator from the Tab. 5 (independent variables). Results were analyzed on each environment factor as it shown in the Tab. 6 for GHG emissions from conventional aviation fuel (Y_1). The correlation coefficients were calculated and ranged according to strength of their (dark green color shows the strongest positive correlation between variables and dark red color shows the strongest negative correlation between variables).

Depending on the value of the correlation coefficient (r), all interdependencies between dependent variables and independent variables were divided into the following groups: strong positive correlation (strong (+), $r \geq +0.7$), moderate positive correlation (moderate (+), $+0.4 < r < +0.7$), weak positive correlation (weak (+), $0 \leq r \leq +0.4$), strong negative correlation (strong (-), $r \geq -0.7$), moderate negative correlation (moderate (-), $-0.4 < r < -0.7$), weak negative correlation (weak (-), $0 \leq r \leq -0.4$). Depended on variables such as number of passengers (x_4), load factor for passenger network (x_5) and total passenger revenues (X_6) are interdependent

with r ≥ 0.98. That is why we choose for the next steps of the analysis one of them, namely the number of passengers (X_4). The Tab. 7 represents the results of the multiple correlation analysis.

Tab. 6

The correlation coefficients between parameters (X_1-X_9) and GHG emissions from conventional aviation fuel (Y_1) (dark green - the strong positive correlation, dark red - strong negative correlation between variables)

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	Y_1
X_1	1	0.114	0.152	0.901	0.923	0.954	0.780	-0.596	0.040	0.971
X_2	0.114	1	0.382	0.343	0.309	0.278	-0.296	-0.562	-0.470	0.196
X_3	0.152	0.382	1	0.213	0.198	0.161	-0.225	-0.464	-0.458	0.144
X_4	0.901	0.343	0.213	1	0.998	0.987	0.526	-0.829	-0.292	0.973
X_5	0.923	0.309	0.198	0.998	1	0.992	0.559	-0.808	-0.260	0.982
X_6	0.954	0.278	0.161	0.987	0.992	1	0.642	-0.754	-0.158	0.995
X_7	0.780	-0.296	-0.225	0.526	0.559	0.642	1	0.002	0.630	0.698
X_8	-0.596	-0.562	-0.464	-0.829	-0.808	-0.754	0.002	1	0.743	-0.705
X_9	0.040	-0.470	-0.458	-0.292	-0.260	-0.158	0.630	0.743	1	-0.092
Y_1	0.971	0.196	0.144	0.973	0.982	0.995	0.698	-0.705	-0.092	1

Tab. 7

Multiple correlation analysis results

	X_1	X_2	X_3	X_4	X_7	X_8	X_9
Y_1	Strong (+)	Weak (+)	Weak (+)	Strong (+)	Strong (+)	Strong (-)	Weak (-)
Y_2	Strong (+)	Weak (-)	Weak (-)	Moderate (+)	Strong (+)	Weak (+)	Moderate (+)
Y_3	Strong (+)	Weak (+)	Weak (+)	Strong (+)	Strong (+)	Moderate (-)	Weak (-)
Y_4	Strong (+)	Weak (+)	Weak (+)	Strong (+)	Moderate (+)	Strong (-)	Weak (-)
Y_5	Strong (+)	Weak (+)	Weak (+)	Strong (+)	Moderate (+)	Strong (-)	Weak (-)
Y_6	Strong (+)	Weak (+)	Weak (+)	Strong (+)	Moderate (+)	Strong (-)	Weak (-)
Y_7	Moderate (+)	Weak (-)	Weak (-)	Weak (+)	Strong (+)	Weak (+)	Moderate (+)
Y_8	Strong (+)	Weak (-)	Weak (-)	Weak (+)	Strong (+)	Weak (+)	Moderate (+)
Y_9	Moderate (+)	Weak (-)	Weak (-)	Weak (+)	Strong (+)	Weak (+)	Strong (+)
Y_{10}	Strong (+)	Weak (-)	Weak (-)	Moderate (+)	Strong (+)	Weak (+)	Moderate (+)
Y_{11}	Moderate (+)	Weak (-)	Weak (-)	Weak (+)	Strong (+)	Weak (+)	Strong (+)
Y_{12}	Strong (+)	Weak (-)	Weak (+)	Moderate (+)	Strong (+)	Weak (-)	Moderate (+)
Y_{13}	Weak (+)	Weak (+)	Moderate (+)	Weak (+)	Weak (-)	Weak (-)	Moderate (-)

3.4. Results

Based on the results of the constructed multiple regression, we can form the first important conclusion, that indicators of environmental factors of the air carrier does not depend on net profit and operating result. Therefore, we can question the idea that corporate social responsibility is available only to high-income companies. That is, airlines should not expect a significant increase in profits to begin the process of implementing the environmental component of corporate social responsibility.

The second important conclusion is that the environment indicators of the flight operations group ($Y_1 – Y_6$) depend more on the number of transported passengers, and the indicators of the ground operations group ($Y_7 – Y_{12}$) depend on the transported cargo. The detailed analysis of all relations of these factors is provided below.

The volume of GHG emissions generated by the combustion of aviation fuel (Y_1) depends directly on total revenues (X_1), passenger flow (X_4) and cargo flow (X_7). But at the same time, it has an inverse relation to load factor for cargo (X_8). Thus, higher cargo flow, transported with the higher load factor (more efficient usage of aircraft's capacity) could lead to decreasing of CO_2 emissions compared to the same cargo flow, transported with worse load factor (lower).

Another factor connected with GHG-emissions is ground operations (Y_2). It has a strong direct relation to total revenues (X_1) and cargo flow (X_7). So, to decrease the CO_2 emissions in this sector, the carrier should pay attention to ground cargo handling, optimize it in order to minimize the quantity of operations and distance to transport as well as usage of the green fuel and renewables.

Consumption of raw materials (conventional aviation fuel) (Y_3) directly related to total revenues (X_1), passengers flow (X_4) and cargo flow (X_7). Therefore, the only way to improve this indicator is to use other types of fuels, safer for the environment.

Other environment indicators connected to the flight operations (NO_x low altitude (Y_4), SO_2 low altitude (Y_5) and global noise energy indicator (Y_6) have direct relation to total revenues (X_1) and number of transported passengers (X_4). But it also has an inverse correlation to the load freight factor (X_8), that means freight optimization freight and effective utilization of aircraft capacity has shown positive influence on decreasing of the non-carbon emissions and noise impact.

Electricity consumption (Y_7) is the first analyzed indicator in ground operation sectors. It shows the strong positive correlation only with the cargo flow (X_7). That's why to improve this indicator, it is important to switch to renewable sources.

The consumption of other types of energy (Y_8), the amount of non-carbon emissions (NO_x namely) (Y_9), total water consumption (Y_{10}), the amount of hazardous (Y_{11}) and non-hazardous industrial waste (Y_{12}) directly related to total revenues (X_1), number of transported tons of cargo (X_7) and total cargo revenues (X_9). Hence, it is important to optimize the cargo handling processes in the airport.

The last analyzed environment indicator, the percentage of recovered hazardous industrial waste, has not shown any strong direct or inverse correlation with studied independent variables, so further investigation of it is impractical.

All analyzed environmental indicators are part of sustainable aviation, which is not an option anymore. *Air France KLM* showed the scope of its efforts during almost the decade to consider the impact on the environment impact while building a long-term development strategy for the company. According to the results of the study, there is no strong and unambiguous relationship between environmental indicators and company's profitability or operating results in the previous period. But the global community's efforts to combat global climate change (Paris

Agreement, European Prospectus Directive Regulation, Clean Skies for Tomorrow coalition, The Task Force on Climate-related Financial Disclosures IATA and ICAO documents regulation, climate agreement CORSIA and others) will create new barriers and risks from year to year for companies that do not react on the real needs of their stakeholders. Such risks include: reduction in operations (to decrease the number of transported passengers and cargo if there is no other ways for reduction emission), more restrictive regulations (to monitor the environment impact of companies' activity and to lessen it), growing pressure from civil society (to follow sustainable goals), financial impacts (additional procedures which will increase the operational costs), discrediting the reputation of companies and the aviation industry in general (decline in customer demand as a result). And last but not the least, offsetting, which could lead to a misrepresentation in carriers' competition.

Since the transportation of passengers and cargo is the basic operation of airlines, it is illogical and impractical to reduce their amount to reduce emissions, for instance. But there are other actions that will indirectly but effectively affect the improvement of environmental performance without operating restrictions, including:

- carbon offsetting programs for customers with further targeted use of funds received for tree planting, investment in aeronautical research to find new technological and design solutions in aviation to make it more sustainable;
- fleet modernization, which gives the opportunity to reduce strongly the influence on the environment due to principally new or modernized technical and technological decisions;
- using sustainable aviation fuel and renewable energies not only inside the company but in the whole supply chain;
- efficient but not always obvious operational measures, such as aircraft weight reduction to use less fuel during the flight (Air France KLM, for example, are diminishing the weight of the aircraft by reducing seats' mass, changing on board equipment to lighter one, replacement of paper documents with electronic ones, designed to reduce the weight of the required staff on board);
- optimization of route and flight path (including maximization of load factor, especially for cargo, as it showed strong negative correlation to environment indicators) and a reduction in aircraft waiting times, speed adjustments and optimized trajectories, artificial intelligence tools and others.

By using these tools, which are part of CSR, it is possible to influence the direct positive dependence of environmental impact and the total revenue (together with passenger and cargo turnover) of the airline. Such experience is also known as decoupling, i.e. growing profitability without corresponding increases in environmental pressure. One more worldwide known airline, *Lufthansa*, shows efficiency increase together with gradually increased parameter ton-kilometer (Fig. 6).

According to officially published reports [19], performance indicators of *Lufthansa Group* have been growing gradually since 1991 till 2019, for instant the quantity of ton-kilometers were 450% in 2019 compared to 1991. But what is important, at the same time, the total quantity of used fuel for the same period of time has increased only by 230%. The results of operation activity have risen twice as quickly as the volumes of consumed fuel. It is a clear example of efficiency.

Air France KLM follows the same path of decoupling, successfully planning and implementing such CSR tools as contributing to aeronautical research and fleet modernization as a result, participating in research into renewable energies, proactive offsetting and others. Therefore, we emphasize the importance and topicality of research and analysis of various

variants to reduce environmental impact. And this is extremely important to understand and study further, as zero carbon emissions by 2050 are universally recognized and mandatory, including for airlines.

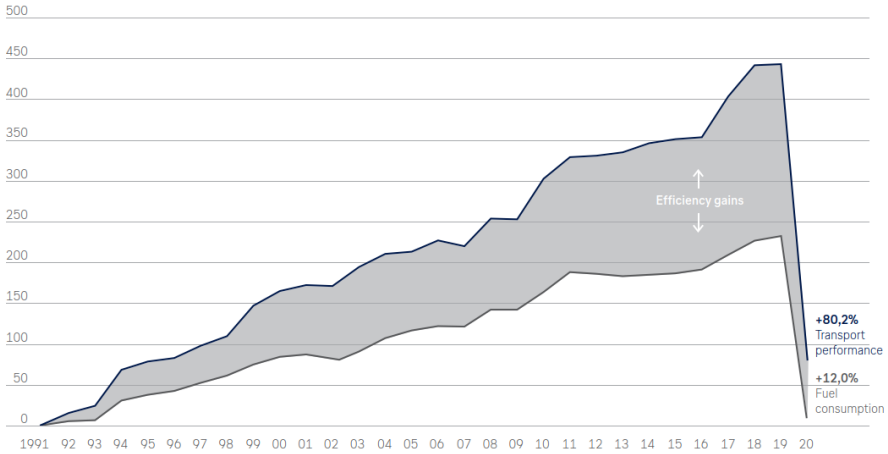

Fig. 6. Decoupling of *Lufthansa*'s transport performance and fuel consumption [19]

4. SUMMARY

Corporate Social Responsibility (CSR) in modern conditions is becoming an important element in the management of commercial enterprises in the perspective of their strategic development. It is the answer how to create a long-term value for all stakeholders of the company; how commercial enterprises should form their own development strategies to meet the Sustainable Development Goals, and thus meet the real needs of their consumers in an environmentally safe, socially just and economically secure future for themselves and their children. Environmental security, which is currently the focus of all countries' efforts by agreeing on joint actions to reduce the negative impact on the environment, is thus one of the priority components of CSR. An analysis of the aviation companies' activities that claim to have CSR, has shown that they all take into account the impact on the environment, and to be more precisely, measures to neutralize the negative impact on it with a simultaneous positive impact on profitability. That is why it was analyzed whether there is a relationship between the company's environmental indicators and its financial and operational results.

Detailed study of CSR reports of *Air France KLM*, as one of the most experienced companies in this sphere, provided to identify the relationships between environmental indicators and financial and operational results, gave the following results. There is no strong relationship between environmental indicators and the company's profitability. In other words, the company's strategic decision to implement the environmental component of CSR should not depend on profit. Conversely, if a company intends to become more environmentally friendly, plan such activities as part of CSR, and is eager to monitor implementation of such activities and report on their results, it is not necessary to expect the moment of receiving extra profits.

It was also investigated that the environment indicators of the flight operations group (GHG emissions from conventional aviation fuel and from ground operations, consumption of conventional aviation fuel, NO_x low altitude emissions, SO_2 low altitude emissions, global noise energy indicator) have depended more on the performance indicators, connected to

the number of transported passengers, and the indicators of the ground operations group (total electricity and other energies' consumption, water consumption, non-carbon emissions, non-hazardous and hazardous industrial waste) depend on the performance indicators, connected to the transported cargo. These relationships are very important for deciding on the most effective and appropriate measures to reduce the negative impact on the environment from the operation of the air carrier.

Making up a long-term strategy for the development of the airline is impossible without considering the current challenges facing humanity and which the entire international community is working to overcome, including reducing the negative impact on the environment. Since the level of such impact is directly related to the growth of airlines' operating activities (number of transported passengers and cargo), it is recommended to use such a tool as decoupling, i.e., to reduce the negative impact on the environment while increasing the quantity (passenger and cargo turnover). It is possible to achieve this by using measures to improve the performance of companies' activities in the long run. Investing in research to develop new technological and design solutions for future fleet modernization and sustainable aviation fuel usage, offsetting programs, both for the company and for service end consumers, energy-efficient technologies and renewable solutions to reduce the total amount of energy and resources consumed by airlines and others.

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Received 10.12.2022; accepted in revised form 29.03.2023