

# Critical Review of Innovative Greenhouse Gas (GHG) Reduction Strategic Development of Air China Limited

Haoyi Yang<sup>1,\*</sup>, Zezheng Xu<sup>2,a</sup>, Mingyan Gu<sup>3,b</sup>, Mengyuan Chen<sup>4,c</sup>

<sup>1</sup> Investigation College, People's Public Security University of China, Beijing 421007, China

<sup>2</sup> Department of Diplomacy, China Foreign Affairs University, Beijing 100037, China

<sup>3</sup> School of Business and Management, University of South Wales, Cardiff CF37 1DL, UK

<sup>4</sup> School of Tourism and Hospitality, Management Development Institute of Singapore, Singapore

\*Corresponding Author E-mail: yhy2442939401@gmail.com, <sup>a</sup> benjaminxzz@163.com,

<sup>b</sup> gumingyan@outlook.com, <sup>c</sup> cmy677@126.com,

**Abstract.** As a rapidly developing airline company in the international market, Air China has lived up to expectations and worked hard to develop its uniqueness in terms of policies and regulations, economic conditions, operating environment, social factors, and scientific and technological levels. Since 2021, Air China has been promoting pollution reduction and low-carbon development, leading green aviation and building a better home", and fighting the battle against pollution has become the key task of the company's 14th Five-Year Plan. This paper reviews the background, vision, and innovative greenhouse gas (GHG) reduction strategic plan for the Air China Limited. The innovative aspect and impact analysis of the GHG business in terms of services and/or products have been critically reviewed within the paper via SWOT method.

**Keywords:** Greenhouse Gas (GHG) Reduction; Air China; Strategic Development; Carbon Emission.

## 1. Introduction

Entering the 21st century, the new era, Air China has established the Belt and Road, the Overland Silk Road and the maritime Silk Road to carry out friendly cooperation with our neighbors. Air China has been exploring new development paths since its founding. Air China has lived up to expectations and worked hard to develop. Now it has a strong domestic and international transport capacity and is in a leading position in China. This project will take Air China as an example to provide reference for other airlines to develop the international market.

In the process of trade, it made money and promoted the development of our country. Meanwhile, other countries also accelerated the process of reform and opening up and economic progress under the influence of China. China's outbound and inbound tourism has exploded within the stage. The starting point of this project is to make good use of the population flow and inbound and outbound tourism market to promote the international market development of airlines. Taking flights is the most direct way to travel in and out of China (Eric 1981). With the development of globalization, grabbing the international market and shaping the global brand image are the strong impetus for airlines to compete in the international market. At the same time, how to firmly control the value of the whole process of passengers in their own hands is the strategic development direction of airlines (Zolmax.com 2021a).

## 2. Main Business & Mode of Operation of the Air China and Main Call of GHG Reduction Development

### 2.1 Overview of the Air China's Main Business and Mode of Operation

The Air China Limited is principally engaged in international and domestic scheduled and unscheduled air transportation of passengers, cargo, mail and baggage; domestic and international

business aviation; aircraft management; aircraft maintenance; inter-airline business agency; ground services and air courier services related to its main business. In recent years, Air China has closely focused on the development principles of quality and efficiency enhancement, innovation and change, synergy and sharing, and efficiency leadership, accelerating the transformation of the company's business model, optimizing the network layout, and strengthening the main air transportation business (Say 1963; Liu 2013).

In 2020 and 2021, the global airline industry was hit hard by the epidemic. The aviation industry, especially international air transport, has been on the front line of the epidemic leading to increased pressure on the operations of companies in the aviation industry chain. According to CIRIUM, a global aviation data company, scheduled passenger flights worldwide will decline by 49% in 2020 compared to 2019, with the number of international flights dropping by 68% and domestic flights by 40% [(Air China 2021a). The International Air Transport Association (IATA) further revised its industry forecast for 2022, with global net losses for carriers expected to reach US\$118.5 billion. According to IATA data for November 2021, cargo traffic is expected to reach 54.2 million tonnes in 2022 (Air China 2021b).

As Air China Limited enter the 14th Five-Year Plan period, China's civil aviation will enter a period of transition in development, improvement in quality and expansion of the development pattern. Based on the achievements of the 13th Five-Year Plan (Zolmax.com 2021a), CAAC will adhere to a systemic approach, a combination of inheritance and innovation, and follow the overall work plan of "practicing one concept, promoting two wings, adhering to three bottom lines, building and improving three systems, and opening up four new horizons" in accordance with the laws of industry development and the stage characteristics of civil aviation development.

## **2.2 GHG Reduction Main Call by Civil Aviation Administration and Ecological Vision**

The specific Intergovernmental Panel on Climate Change (IPCC) 2019 is based on an emissions cap of 97% of the average of the total emissions generated by global airlines flying in and out of the three years 2004 to 2006, of which 85% is a free allowance for each company (Adler 2013). From 1 January 2012, airlines that exceed their free allowances will have to buy them on the IPCC Emissions Trading Market or through an auction. If the allowances are not used up, they can also be sold. One tonne of carbon allowances can be sold for between 10 and more than 30 Euros, fluctuating with international market prices. If this scheme were to operate, it is estimated that China's civil aviation industry would pay around RMB 800 million in 2012 alone and over RMB 3 billion in 2020, for a cumulative expenditure of around RMB 17.6 billion over nine years. An increase of one flight per day from China to Europe would add an additional cost payment of RMB 15 million a year (Zolmax.com 2021b).

The Civil Aviation Administration has also set up a Civil Aviation Energy Conservation and Emission Reduction Office, established a system of "statistics, monitoring, assessment, rewards and punishments" for energy conservation and emission reduction to improve the mechanism for supervision and management of energy conservation and emission reduction in the industry; air traffic control has shortened flight distances by optimizing flight routes. In 2009, the entire civil aviation industry shortened flight distances by 15.8 million kilometres, saving fuel consumption by 88,000 tonnes and reducing carbon dioxide emissions by 280,000 tonnes; and promoted "bridge-mounted equipment instead of APUs" to reduce carbon emissions on the ground. The design and construction of airports, energy-saving and emission reduction solutions are actively adopted to create a good foundation for energy-saving and emission reduction during operation.

As the leader among all the airlines in CAAC, Air China has also embraced the change to replace old aircraft; implemented reforms to reduce the vertical separation layer so that aircraft can fly at the most economical altitude layer; and actively carried out research work to support and encourage civil aviation enterprises to adopt advanced energy-saving and emission reduction technologies and equipment. Under the CAAC's strong promotion, Air China have launched operational improvement and carbon offsetting initiatives under the theme of "Green Flight".

## 2.3 Ecological Vision and GHG-Reduction-Mission Statement

As the only flag carrier in China, the company has the historic responsibility of building a national aviation company's name card and implementing the "civil aviation strengthening strategy". The company now has a wide range of international routes, a balanced domestic and international network, the most valuable customer base and the strongest brand influence; its fleet has basically been rebuilt and is one of the youngest in the world; its profitability has long been among the industry leaders; and it has been ranked among the top air carriers in the world (Liu 2012).

In 2021, Air China formulated the 48-word environmental policy of "maintaining strategic determination, strengthening the mission, complying with laws and regulations, protecting the ecological environment, promoting pollution reduction and low-carbon development, leading green aviation and building a better home", and fighting the battle against pollution became the key task of the company's 14th Five-Year Plan. The company's "14th Five-Year Plan" green development plan focuses on the task of environmental management to reduce pollution and carbon emissions.

## 3. Identification and Evaluation of Air China's Implementation of Innovative GHG Reduction Plan

**Table 1.** Air China's SWOT Analysis in innovative GHG development.

<p><b>Strength</b></p> <ul style="list-style-type: none"> <li>• Political advantages in traffic route, procurement, and technical support</li> <li>• Advantage in tangible asset</li> </ul>	<p><b>Weakness</b></p> <ul style="list-style-type: none"> <li>• Low aircraft utilization rate and high punctuality rate</li> <li>• Cost efficiency</li> </ul>
<p><b>Opportunity</b></p> <ul style="list-style-type: none"> <li>• Strategic initiatives</li> <li>• Business expansion</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Differentiated responsibilities between developing and developed countries</li> </ul>

On the new journey of ecological civilization construction, Air China will continue to take reform and innovation as the driving force and take carbon reduction and pollution control as the grasp and make new contributions to promote the construction of ecological civilization to achieve new progress. The following chapters will conduct the identification and evaluation of air china's implementation of innovative GHG reduction plan via SWOT analytical methods (Schumpeter 1992). And its four-aspect impacts from strength, weakness, opportunity, and threats will be discussed based on the summary table as indicated above (Table 1).

### 3.1 "S" WOT - Strength

#### 3.1.1 Political advantages in traffic route, procurement, and technical support

Air China's historical predecessor, the Beijing Civil Aviation Administration, was the strongest of the five major civil aviation administrations in China. Most of the new airplanes and large aircraft with new fuel-saving technology were purchased and allocated to its Beijing Administration. Besides, most of the major domestic routes were always taken by the Air China, such as the "Roof of the World" Lhasa route in the 1970s. These unique conditions have contributed to the growth of Air China. Currently, Air China is the only national airline in China that flies the flag of the People's Republic of China and undertakes special flights for Chinese leaders on their overseas visits. These are political advantages that other domestic airlines do not have (Krugman 2011; An 2016).

Moreover, Air China has a more professional and standardized technical guarantee. Air China's engineering and technology company, headquartered in Beijing, has nine maintenance bases in Chengdu, Chongqing, Hangzhou, Tianjin, Hohhot, Shanghai, Guiyang, Wuhan and Guangzhou, with more than 150 domestic and international maintenance sites, forming a worldwide maintenance network (Wu 2012). Meanwhile, Air China's aircraft maintenance system holds maintenance licenses

issued by the Civil Aviation Administration of China (CAAC), the Federal Aviation Administration (FAA), the European Aviation Safety Agency (EASA) and 18 other countries.

### **3.1.2 Advantage in tangible asset**

Air China has certain capital advantages in the GHG innovation projects. 2013 Air China semi-annual report shows that Air China's total capital is 196.916 billion yuan, much higher than the 130.83 billion yuan of China Eastern Airlines and 150.906 billion yuan of China Southern Airlines, and its capital advantages in China are very obvious; among them, in the first half of 2013, Air China Group achieved a total profit of 1.512 billion yuan, an increase of 1.89% year-on-year; attributable to The net profit attributable to the parent company was RMB 1.119 billion, an increase of 7.31% year-on-year. Air China's assets are operating well, and the strength of its assets and strong operational capabilities provide strong support for the expansion of Air China's international business, giving Air China the strength and ability to compete in the GHG reduction development with worldwide airlines (IDG News 2012). The specific Intergovernmental Panel on Climate Change (IPCC) 2019 is based on an emissions cap of 97% of the average of the total emissions generated by global airlines flying in and out of the three years 2004 to 2006

## **3.2 S“W”OT - Weakness**

### **3.2.1 Low aircraft utilization rate and high punctuality rate**

Air China's daily aircraft utilization rate is relatively low, which might become a key factor for the high consumption of the fuel as well as high release factor of GHG emission. Compared with advanced international airlines, the daily utilization rate of Air China's aircraft has a large gap, and the difference in the daily utilization rate of the main wide-body aircraft is even more significant, which directly affects the reduction of average costs and the improvement of productivity. According to statistics, the daily utilization rate of Air China's aircraft is less than 9 hours, while the average daily utilization rate of the world's advanced airlines is more than 10 hours comparing with Singapore Airlines reaching 13.41 hours (Chen 2006).

Air China's flight punctuality rate is also another certain gap. According to the 2010 Civil Aviation Administration's ranking of domestic airlines in terms of punctuality, Air China ranked 6th after China Eastern Airlines, Xiamen Airlines, Shan Airlines, China Southern Airlines and Shanghai Airlines, with a punctuality rate of just over 70%. There is a positive correlation between on-time performance and operational efficiency, with lower on-time performance not only affecting customers' perceptions of the airline and their switch to other airlines, but also reducing operational efficiency across the company, creating a cascading effect. All these flight punctualities may also end up with long waiting time for other aircrafts and high consumption of fuels during waiting (Brett 2004).

### **3.2.2 High fleet costs may limit the development of GHG reduction project**

Air China's fleet costs are relatively high. Fleet costs account for a significant portion of the total cost of the civil aviation transportation industry. Such cost may delay the net flow of the development of GHG reduction projects. At present, Air China's aircraft types are too complicated, with 451 aircraft involving a total of 12 types, and a disproportionate number of multiple models. In terms of fleet operating costs, it faces three outstanding problems: First, the high order price of aviation materials, due to the weak position of the domestic aviation market, it is difficult for domestic airlines to obtain discounts for bulk orders. Second, the high import tariff of aviation materials, China's tariff and VAT rate on imported aircraft superimposed on 5.04%-22.85%, the import of aviation equipment in addition to tariffs and VAT of 17%, for aircraft, engines and aviation equipment sent outside the repair business as imports, repeatedly levied tariffs and import links VAT. Third, the high cost of personnel training, a variety of types of aircraft will require separate training of pilots, flight attendants, aircraft maintenance and other professionals, which in turn consumes a lot of costs (Gao and Pan 2004).

### **3.3 SW“O”T - Opportunity**

#### **3.3.1 Support of national carbon neutral policy**

By 2020, China's civil aviation service sector will be significantly expanded, service quality will be significantly improved, international competitiveness and influence will be significantly enhanced, and the demand for sustainable development will be higher, and a modern civil aviation system that is safe, convenient, efficient, and green will be initially formed. According to the "14th Five-Year Plan", the scale of investment in the civil aviation industry in the next five years will be more than RMB 1.5 trillion. At the same time the related requirement of carbon emission reduction is also on the agenda.

At present, the Chinese government is pressing ahead with measures to address IPCC emissions trading and to protect the healthy growth of China's civil aviation industry. At the same time, the CAAC will also conduct research on further promoting energy conservation and climate change, to map out the situation, identify problems and determine targeted policy measures. International cooperation will be sought in aviation alternative fuels to further reduce carbon emissions (Liu et al. 2017).

#### **3.3.2 International carbon emission control trend**

In the second half of 2021, the global economic situation has basically started to rebound, and a new economic cycle is coming. If Air China can seize this favorable macro GHG environment and strengthen the strategic layout of enterprise globalization, it will surely achieve better results. Air China launched the environmental management system certification project follow the ISO worldwide standard. After five stages of efforts, including on-site research, system document design and preparation, training, internal audit and management review, Air China passed the on-site audit by China Quality Certification Center on December 9, 2021 and was awarded the environmental management system certification on December 28.

### **3.4 SWO“T” - Threat**

#### **3.4.1 Differentiated responsibilities between developing and developed countries may speed up the pace of change**

Developing countries such as China, which adhere to the principle of 'common but differentiated responsibilities' and their respective capabilities as defined by the IPCC Framework Convention on Climate Change and its Kyoto Protocol in limiting GHG emissions, deserve to enjoy a policy of differentiated treatment. The civil aviation industry in developing countries is developing at a rapid pace and developing countries should be treated 'differently' in terms of carbon emission limits. And one of the direct results would be to restrict the development of the civil aviation industry in developing countries. This is neither fair nor reasonable for developing countries and is not conducive to promoting the development of the global civil aviation industry (Cui and Li 2021).

Under the current technical conditions and development situation, fuel efficiency targets would be the best goal to balance development with emission control. Still, measures should be country-specific and should be fully studied and assessed to clarify the prerequisites for their implementation, and more importantly, the agreement of all parties should be obtained before implementation, and they should not be unilaterally enforced (Hemingson, 2010). Technical emission reduction measures are the main work and preferred paths to reduce emissions in the current phase, and the study of the establishment of a global, integrated carbon emissions solution is endorsed.

## **4. Critical Analysis of the Innovative Strategy of GHG Reduction by Air China**

### **4.1 Innovative Implementation GHG Reduction by Air China Still Has Long Way to Go**

Air China's energy conservation and GHG reduction work has started well, but in the face of the new situation and requirements at home and abroad, the problems of a weak foundation, weak

capacity, and insufficient motivation for green and low-carbon development in the industry are still prominent. The main problems are: Firstly, the awareness of the importance and urgency of green development is not in place, the awareness of active adaptation is weak, the lack of endogenous motivation and the mechanism of responsibility and pressure transmission, and the work is not systematic. Secondly, the basic work is still weak, the industry's green standard system is not sound, the measurement, statistics and monitoring system of energy consumption and emissions needs to be strengthened, and the industry's management capacity can hardly adapt to the needs of low-carbon development. Thirdly, there is a lack of professional talents in energy conservation and emission reduction in the industry, insufficient innovation capacity, high external dependence of technology and products, and the research capacity on basic and strategic issues needs to be improved. Fourthly, the industry's fuel efficiency is already at a high level, and it is difficult to sustainably improve, lacking a reserve of effective technology and policy measures.

#### **4.2 Critical Analysis of Development Situation of Air China**

During the 14th Five-Year Plan period, the resource and environmental constraints faced by China's civil aviation industry will become increasingly obvious. At the national level, to achieve the binding target of reducing carbon intensity by 40%-45% by 2020 and the goal of peaking carbon dioxide emissions around 2030, with efforts to reach the peak as soon as possible, the construction of the national ecological civilization system will reach a new height, and the hard constraints in the field of environmental protection and energy conservation and emission reduction will be continuously strengthened.

Internationally, the international climate governance process has entered the implementation phase of political agreements, and the game around climate change and economic development has become more intense. On the one hand, the process of setting standards and rules under the international multilateral mechanism is advancing rapidly and developed countries have already gained the upper hand by virtue of their technological advantages. On the other hand, the green economy and low-carbon development are widely recognized globally, and major economies are increasing their investment to support the innovative development of energy conservation and environmental protection, new energy, and low-carbon technologies, etc. The competition to seize the high ground for future development is becoming increasingly fierce.

In a comprehensive judgment, Air China will face unprecedented challenges and opportunities in energy conservation and emission reduction. It is necessary to correctly understand and grasp the law of industry development and the relationship between development and emission reduction, enhance the awareness of crisis and responsibility, build a solid foundation, follow the trend, properly deal with various risks and challenges, and continuously create a new realm of green development in civil aviation.

### **5. How Should Air China Respond to The Trend of Energy Saving and Emission Reduction**

Strive to improve the fuel efficiency level of the fleet.

Air China shall clarify the objectives and tasks, promote technological transformation, strengthen supervision and management, and push airlines to integrate energy conservation and emission reduction into the entire chain and all aspects of operational management to control aviation fuel consumption and emissions. Air China should accelerate the establishment of a multi-departmental management structure for energy saving and emission reduction, use new technologies such as big data to carry out energy saving management based on flight, performance and market data throughout the process, continuously optimise route network layout and capacity provision, improve flight and maintenance procedures, and enhance fuel efficiency.

Invest in promoting energy conservation and emission reduction at airports.

Promote the construction of airport energy management systems, strengthen airport energy and resource consumption measurement and statistics, and complete the airport's terminal energy consumption monitoring system and gradually improve the system's intelligence and visualization. The comprehensive use of new energy sources such as solar energy and geothermal energy will be carried out in accordance with local conditions, and the proportion of new energy sources in the airport's energy consumption will be gradually increased.

Strengthen the efficiency of air traffic control operations and the ability to guarantee them.

Scientific and rational planning of airspace, optimization of airspace and route structure, enhancement of route network capacity and decongestion of routes. Promote the efficient use of airspace, improve the flexible airspace use mechanism, promote the designation and use of temporary routes, and shorten flight distances.

Strengthen the synergy of work among industry bodies.

Establish a systematic concept of energy conservation and emission reduction and focus on promoting energy conservation and emission reduction projects involving airports, airlines, air traffic control and other industry players, encouraging joint planning and comprehensive measures. Striving to solve the deep-seated conflicts and problems that restrict coordinated operation may help to achieve overall energy conservation and emission reduction in the industry.

Promote energy saving and consumption reduction in the offices of administrative organs and enterprises and institutions.

Administrative organs at all levels should play a leading role in promoting energy saving and emission reduction. Define energy-saving targets, actively take measures to reduce emissions and consumption, and strictly control the total consumption of water, electricity, fuels, and gas.

## 6. Conclusion

As a rapidly developing airline company in the international market, Air China has its uniqueness in terms of policies and regulations, economic conditions, operating environment, social factors, and scientific and technological levels. In the development of the innovative GHG reduction implementation, Air China should pay more attention to China's positioning in the aviation field in the international market, combining their own situation and unique national conditions to clarify their development direction in the aviation field.

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