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Green Information Technology in Airline Companies: A Case Study[1]

Şule KAYA ÜNAL [a] **Tuğrul AYYILDIZ** [b]
[a]İzmir Kavram Vocational School, Transportation Services, Izmir, Türkiye, sule.kaya@kavram.edu.tr
[b]Aydın Adnan Menderes University, Tourism Management, Aydın, Türkiye, tugrulayyildiz@gmail.com

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ABSTRACT

Purpose – The aviation industry, and especially airline companies, are some of the critical culprits in terms of green IT due to the negative environmental outcomes resulting from the technology and applications they use. It is crucial for the aviation industry to acknowledge this obligation and for airline businesses to operate in accordance with it. In this study, a case study was conducted to reveal green IT practices in airline companies and the employee's approach to green processes.

Design/Methodology/Approach – In order to examine the current conditions, the "Case Study" method, one of the qualitative research methods, was employed in this study. Purposive and snowball sampling methods, which are non-probability sampling techniques, were used, and semi-structured interviews were conducted with 20 participants, including managers and employees from a low-cost airline company. The interview forms were prepared considering the units and positions within the organization. The interview data were evaluated through content analysis.

Findings – Based on the results obtained, green IT practices in the airline company were identified in terms of knowledge, awareness, policies, investments, human resources practices, and promotional activities. It was determined that the airline company has adopted national and international policies to support green IT and made investments in this direction. However, despite the presence of training programs related to sustainability, it is noteworthy that green IT knowledge and awareness have not been widely disseminated.

Discussion – According to the study findings, it is seen that the airline company has many applications that can be associated with green IT and the activities carried out by departments vary. However, employees believe that the company implements these practices to reduce costs and make profits rather than green IT and sustainability. According to the study's findings, the airline company has several practices that can be linked to green IT, and the activities conducted by different departments vary. However, employees perceive these practices as primarily aimed at cost reduction and profit generation, rather than green IT and sustainability. Additionally, the green IT initiatives within the company are primarily categorized under sustainability and evaluated in a broader context. While this is understandable, to capture the attention of employees, green IT activities could be carried out separately through training sessions and campaigns. It is thought that the results obtained from the study are guiding airline companies and other stakeholders of the aviation industry.

1. INTRODUCTION

Humanity's environmental awareness has begun to increase with global warming and it has had to face the pressure of being green and sustainable regarding environmental pollution, high energy, electricity usage, increasing costs, water scarcity, use of hazardous substances, greenhouse gas emissions and industrial waste (Chou & Chou, 2012). Meeting current requirements without sacrificing the capacity of future generations to meet their own needs is known as sustainability (Anthony Jnr et.al., 2018). Technology-enriched opportunities are used to support sustainability, use clean energy and protect the environment. For this reason, information systems appear as some software that contributes to the solution of environmental problems and supports reducing energy use and CO2 emissions (Sahu & Singh, 2016). However, human beings are faced with a reality that they could not see in the beginning, ignore today, and cannot escape in the future (Domdouzis, 2015). The use of technology also includes activities that negatively affect the environment, cause pollution, and increase

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electronic waste along with excessive energy consumption (Woldu et al., 2019). For this reason, the idea of using some systems to reduce the environmental effects of information technologies has spread (Anthony Jnr, 2020b; Fernando & Okuda, 2009). It's evident that green information technologies are beginning to be suggested as a way to lower greenhouse gas emissions associated with technology use and conserve electricity (Uddin & Rahman, 2012).

Green computing focuses on energy efficiency and sustainability in hardware usage. However, green IT initiatives refer to the implementation of planning, design and implementation by supporting environmental management processes. Green IT investments are an important step to improve economic and environmental performance. For this reason, business managements need to see the great harm that information technologies cause to the business and the environment and to be informed about the benefits and costs of green IT applications (Sarkis et al., 2013). Furthermore, organizations have some financial issues regarding green IT applications. Managers may choose not to pursue green IT projects or may fail as a result of the direct and indirect costs that these applications bring to the company (Jongsaguan & Ghoneim, 2017). However, despite their short-term drawbacks, these costs ultimately increase profitability (Butler et al., 2011). To cope with these problems, all stakeholders, including the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA), which are important aviation authorities, have initiated studies on green air movements for a sustainable world (Sarkis et al., 2013).

There are many studies in the literature on green computing, its adaptation and implementation. These studies focus on business managers, personnel and practices (Anthony Jnr, 2020a; Ojo et al., 2020; Asadi et al., 2019; Fernando and Okuda, 2009; Jongsaguan and Ghoneim, 2017; Molla et al., 2009; Gholami et al., 2013; Mishra et al., 2014; Sarkis et al., 2013). These studies in the literature also show the increasing interest in green IT. However, although this interest has begun to increase and be adopted, green IT initiatives are still unclear in businesses in many respects (Molla et al., 2009). All stakeholders of the aviation industry must adopt green IT for both their operations and strategies. However, airline companies' policies and practices regarding green IT are not fully known. In addition, it should also be clarified whether the airline personnel have green IT knowledge, awareness and behavior that will support the business in this regard.

In this study, semi-structured interviews were conducted with managers and personnel in an airline company and it was aimed to determine green IT knowledge and awareness, policies, investments, human resources practices and promotional practices. Besides evaluating the knowledge and awareness of managers and employees in the airline company, policies and investments have been considered to reveal the company's perspective. Additionally, human resources practices, which play a significant role in shaping employee approaches, and marketing strategies, which contribute to the formation of the company's image, have also been taken into account. For this purpose, answers to the following questions were generally sought in the study;

- How much knowledge and awareness do managers and employees have about green IT?
- How green IT policies are implemented in the airline company?
- How green IT investments are being made in the airline company?
- How human resources practices for green IT are used by the airline company?
- How marketing strategies are used for green IT in the airline company?

2. LITERATURE REVIEW

2.1. Green Information Technology

The literature is reviewed, it is evident that the concept of green IT is addressed from various perspectives, including ecological, practical, social, and managerial aspects (Lei & Ngai, 2014). This can be explained by the statement, "Green IT is an umbrella term encompassing multiple initiatives." In its broadest sense, Molla et al. (2008: 669) view green IT as a part of the green movement in the business world. Green technology is also used in the literature alongside terms like environmental technology and clean technology (Iravani et al., 2017: 272). Additionally, conceptually, the terms "green technology" and "sustainable technology" diverge at a certain point. While green technology generally refers to environmentally conscious and energy-saving solutions, sustainable technology refers to the planning of technologies that can serve all needs while conserving resources that would otherwise be wasted (Molla, 2008; Woldu et al., 2019: 85).

In general, the concept of green IT appears with terms such as "green computing," "green information technologies," "sustainable computing," "sustainable information technologies," "environmentally sustainable information technologies," and "eco-friendly information technologies" (Pattinson et al., 2015: 225). Green information technologies are also considered in terms of energy efficiency and equipment. However, green information systems are defined as facilitating business processes and improving decision-making by supporting sustainability with a focus on planning and implementation (Warith, 2019).

Green IT refers to environmentally conscious practices and processes related to the production, use, and disposal of devices such as computers, servers, monitors, printers, storage devices, and network and communication systems (Murugesan, 2009: 25-26). According to the IEEE Computer Society definition, green information technologies focus on strategies aimed at reducing the energy consumption and environmental impact of products, equipment, services, and systems (Pattinson et al., 2015: 225). According to Akhgar et al. (2015: 301), green IT is associated with cloud computing. They argue that, in terms of sustainability, green technologies contribute to the environment by reducing the use of machines.

Lei and Ngai (2014) define green IT as a systematic implementation process that involves the creation, procurement, use, and disposal of IT infrastructure to meet ecological sustainability criteria. According to Chou and Chou (2012: 447-448), the green IT effort is the practice of designing, producing, and using computers, servers, and various technologies efficiently, with the goal of minimizing environmental harm. Molla et al. (2008) define green IT as a holistic and systematic approach that includes challenges related to IT infrastructure, such as data center space and energy efficiency. Additionally, the researchers evaluate green IT in terms of reducing the environmental impacts of IT activities (through the adoption of green technologies), promoting environmentally sustainable business practices, and the role of IT in a low-carbon economy. According to Jenkin et al. (2011: 18), green IT is the development and use of information systems to support environmental sustainability initiatives. Asadi et al. (2019: 36) define green IT as the design, production, use, and disposal of computers and servers in a way that minimizes their environmental impact. Gartner Group describes green IT as the "optimal use of information" for the sustainability of the environment, corporate operations, and supply chains, emphasizing the proper evaluation of technology across the product, service, resource, and lifecycle. Therefore, green IT is considered the most efficient information and communication application (Gotay, 2020: 2).

According to Arulrajah et al. (2020), green IT is a critical organizational capability necessary to achieve sustainability goals. The researchers view green IT as the first step toward sustainability, referring to the efficient and environmentally friendly use and implementation of information technology. According to Zheng (2014), green information systems are part of a strategic information system, consisting of computer-supported tools, which function as an energy management system through organized procedures and methods to increase and improve efficiency within an organization. Iravani et al. (2017: 272) define the concepts of green processes and technology as environmentally friendly processes and technologies that are developed in a way that does not harm the environment and ensures the transfer of natural resources to future generations.

Additionally, some sources in the literature distinguish between the concepts of green information systems and green information technologies. Green information systems support the improvement of information flow and management, while green information technologies support hardware and infrastructure that can be managed and designed with a green perspective (Sarkis & Zhu, 2008: 209; Sarkis et al., 2013: 695). For example, according to Ryoo and Koo (2013), green information systems refer to information technology management developed to support environmental sustainability.

Today, the adoption of green IT practices is driven by organizations' motivations to reduce high costs and energy consumption (Anthony Jnr, 2020a: 14). Therefore, from a business perspective, Akman and Mishra (2015) define green information technologies as the use of resources under conditions that ensure energy efficiency and cost-effectiveness. Green IT encompasses areas such as design, energy-efficient computing,

power management, data center design, server virtualization, responsible disposal and recycling, regulatory compliance, green metrics, evaluation and methodology, environmental risk reduction, the use of renewable energy sources, and eco-labeling of information technology products (Murugesan, 2009: 26). Green IT includes the following various applications (Mishra et al., 2012):

- **Energy Efficiency:** It is believed that next-generation technologies such as virtualization, consolidation, and power management can minimize the energy consumption of IT equipment and data centers. The addition of efficient data storage and network applications to the system should also be included in the process.
- **Recycling and Waste Reduction:** Waste management, minimizing electronic waste, and preventing harmful substances from polluting the environment are also part of the process.
- **Sustainable Purchasing:** This involves ensuring that businesses consider the environmental impact of the technological products and services they purchase. For example, businesses can choose energy-saving products, products made from sustainable materials, and those with minimal packaging.
- **Remote Work and Virtualization:** The remote work method reduces travel frequency, leading to a decrease in carbon emissions.
- **Cloud Computing:** Cloud computing helps reduce organizational on-premise infrastructure needs while supporting reduced energy consumption.
- **Green Data Center Design:** Green data centers enable the design of advanced cooling systems, server arrangements, and the use of renewable energy sources.
- **E-Waste Management:** Proper management of electronic waste, including IT equipment, in accordance with environmental regulations is essential.

The adoption and implementation of sustainable green information technologies are based on the strategies of small, medium, and large-scale organizations targeting the future (Woldu et al., 2019: 86). Due to the critical importance of green technologies, a majority of governments today prioritize green initiatives and promotions. In this context, companies that generate electricity from renewable sources are financially incentivized (Iravani et al., 2017: 272). Indeed, as the costs of unsustainable and environmentally harmful fuels increase, both governments and the private sector are facing growing commercial pressure (Singla & Singh, 2020: 363). According to the "2009 Green Information Technology" report, which surveyed 1,052 businesses globally and 426 in North America, 86% of the included businesses in the IT sector prioritize green IT initiatives. Furthermore, the report shows that 97% of these businesses are considering at least one green IT strategy (Symantec, 2009).

2.2. Green Information Technology in Airline Companies

Air transportation is one of the rapidly growing sectors, both in terms of the type of service it offers and the social benefits it provides. It has an indisputable role in creating the global economy. The aviation sector also has significant economic power over various sectors it is related to, such as aircraft and technology production, operations and tourism (Abdi et al., 2020). Information technologies cannot be separated from commercial activities as it is a tool that supports the presentation of information to customers in products, processes and services in the aviation industry (Theis and Schreiber, 2020). For this reason, the aviation industry stands out by following technological developments and triggering new developments (European Aviation Safety Agency [EASA], 2022). The use of high technology is effective in increasing the trust and demand for air transportation (Köse, 2020).

The aviation industry increases global climate change by burning fossil fuels and releasing dirty gases into the atmosphere (Abdi et al., 2020). Therefore, the increase in demand for air transportation, also brings global and local environmental problems. Although the expansion of the aviation industry is in line with the sustainable development goals, there are inconsistencies between the objectives and actual outcomes (Whitelegg & Cambridge, 2004:39). Because although technological developments have improved human life in many aspects, they result in environmental degradation related to greenhouse gases and global warming caused by humans and technology (Kumar & Gupta, 2020). In addition to greenhouse gas emissions from aviation

activities, concerns have also increased on issues such as noise pollution, waste management and energy saving (Ferrulli, 2016). Thus, the continuous development in air travel triggers environmental sustainability concerns, which is a bigger bubble (Cowper-Smith & Grosbois, 2011).

According to estimates, the IT sector contributes 2% of the world's CO2 emissions, which is equal to the amount the aviation sector produces (Akman and Mishra, 2015). In this instance, it might be argued that technology serves to amplify the harm brought about by aviation industry operations. Zero-emission technologies developed within the scope of sustainable aviation practices have significantly reduced greenhouse gas emissions over the years. However, with this decrease, international travel increased and the aviation industry developed significantly with increasing air traffic. The aviation industry has halved its carbon footprint compared to its operations in the late 1990s. In addition, the introduction of sustainable fuel alternatives and new technologies such as zero-emission engine designs during this period is evidence that it strengthened the environmental awareness of stakeholders (Elhmoud and Kutty, 2020).

Investing in and using new and sustainable technologies will help reduce the energy consumed by aircraft and operations, while also reducing the emission burden. The damage caused by the aviation industry to the environment is not only the greenhouse gas and noise pollution caused by the fuel it uses. There is also environmental pollution caused by operational activities at airports. Heating and cooling systems, aircraft engine gases and all electronic devices used in airports also increase environmental pollution. For this reason, it is necessary to use green technologies in service delivery at airports (Aksoy et al., 2022). It has become necessary to support green and sustainable movements to carry out aviation activities, which are seen as one of the causes of global problems such as climate change and carbon emissions (Jongsaguan and Ghoneim, 2017: 3). The aviation industry has consistently pursued technical advancements that bolster flight management in terms of economy, operations, and ecology. This technological target stands out in the 2050 zero emission target determined by international authorities (Mrazova, 2014: 109). With projected aviation demand increasing, achieving these ambitious targets poses a significant challenge. In this case, a significant responsibility is placed on all stakeholders of the industry (World Economic Forum, 2011). CO2 reduction opportunities for the aviation sector relate to the application of new technologies and improvement of processes. In short, all environmental measures must be technologically feasible and economically reasonable (Mrazova, 2014: 113).

The airline industry is still expanding through technology. As airline companies increase their productivity with information technologies, they become part of the larger environmental sustainability problem (Jenkin et al., 2011; Weir, 2013), 2050 targets are crucial as a result. The adoption of green IT applications is of critical importance for technology to be perceived as more beneficial than harmful in the aviation sector (Warith, 2019). This situation further increases the importance of environmental awareness and environmentally friendly practices in air transportation (Mayer et al., 2012).

According to the European Aviation Safety Agency (EASA) report, 3.2 million people were exposed to 55dB aircraft noise levels in 98 major airports in Europe in 2019. 1.3 million people are exposed to more than 50 chemicals per day. In addition, CO2 emissions of all aircraft departing from EU27+EFTA reached 147 million in 2019, increasing by 34% compared to 2005 (EASA, 2022: 9). It is well known that 24% of global CO2 emissions are attributable to the transportation industry. Aviation is held responsible for 11% of the energy consumption of the transportation industry. In this case, more than 3% of global C02 emissions originate from aviation activities. Taking all these impacts into account, it is aimed to introduce alternative technologies such as carbon neutral growth, increasing fuel efficiency and electricity/hydrogen to prevent and reduce negative environmental impacts in national and international aviation activities (Amicarelli et al., 2021).

New norms must be evaluated and adopted by businesses to enable future generations to survive and live greener. For this reason, it is important for businesses to develop a win-win relationship by establishing a system that will benefit from green while supporting green (Sarkis et al., 2013). Green IT is an important alternative for reducing environmental damage in terms of increasing the efficiency of smart technology management and energy consumption, as well as reducing the costs of airline businesses (Melville, 2010; Theis and Schreiber, 2020). The aviation industry and its stakeholders are under social, political and legal pressure due to all environmental damage, which is important for them to act more environmentally friendly (Hagmann et al., 2015; Llach et al., 2013).

In general, information technology manufacturers are responsible for 50% of the environmental damage and sustainability impacts of technological devices. The remaining responsibility largely covers the usage phase. Attention should be paid to the greenhouse gas it emits and the energy it consumes during use. The decision to dispose or recycle the device is also a matter of end-user preference. At this point, it can be said that 50% of the responsibility belongs to the people and organizations using technological devices (Engel, 2015). In short, the fundamental benefits of green computing are individual and institutional. Businesses can gain satisfaction, performance and economic value with information technology investments (Scott and Watson, 2012; Simon et al., 2012; Voderhobli, 2015).

Environmental investments are supported by the authorization policy of international authorities that forces airlines to use a certain amount of SAF. Gaining the state's support on this matter guarantees the policy's clarity and the accurate calculation of the investment period. In addition, states need to encourage the use of sustainable aviation fuels and take steps to develop new-generation technologies that secure the future (International Air Transport [IATA], 2021). In order to achieve the goal, all stakeholders of the industry must act together and take individual responsibility for sustainable product, service and technology development (IATA, 2022b). International cooperation is of key importance in overcoming global environmental and sustainability challenges in the aviation industry (EASA, 2022: 15). Businesses, especially airline companies, should develop a comprehensive green information technologies strategy (Murugesan, 2009).

Despite being a knowledge-, technology-, and economic-based industry, aviation's most crucial element is its human component. In today's settings, human resources are essential for using technology, running operations, and making improvements (Tiftik and Yakupoğlu, 2022: 140). Human resources management is one of the most necessary steps to become an environmentally friendly business (Harvey et al., 2013). Developing an environmental management system as an operating policy for airline companies will help all personnel devote themselves to efforts to increase sustainability and efficiency (Kotze, 2017). This system involves encouraging staff to adopt green IT practices and volunteering for environmentally friendly activities to increase the environmental performance of the organization (Ojo et al., 2019).

The process is not only about tracking the environmental footprint, but also involving all stakeholders of the business (suppliers, sellers, users, recyclers, etc.), creating a marketing channel about the green and ethical virtues of the business, continuing environmentally friendly activities with community cooperation, and It is expected to be carried out by ensuring standardization and creating uninterrupted communication (Rondeau et al., 2015: 35). Corporate executives' adoption of green technologies helps their company's social image grow. Establishing a culture of environmental responsibility within the organization and having leaders who support practices that promote environmental regulations shape the behavior of institutional staff, which in turn helps to create a positive and powerful image (Esty and Winston, 2009).

3. METHODOLOGY

In order to conduct an in-depth analysis and assess the current situation, the "Case Study" method, which is one of the qualitative research methods, has been used. The study area consists of a low-cost airline company. In the study, semi-structured interviews were conducted with managers and employees of an airline company. A qualitative data collection and analysis method was used, including questions about green IT awareness and approaches, general management practices, and policies. The semi-structured interview method was preferred for this reason providing the researcher with the opportunity to be flexible. In this method, obtaining specific data from each participant is generally possible. The number and order of questions were shaped according to the interview in this study (Merriam, 2018).

In scientific studies, the researcher can't reach the intended population under all conditions (Kozak, 2015). The study questions are about managers and personnel in airline companies. Considering that it is not easy to reach all airline managers and personnel, sampling was conducted. If it is unnecessary, expensive, or impossible to reach the population, generalizable trends regarding the population covered by the research are determined through sampling (Strangor, 2011; Malhotra & Birks, 2007; Kurtuluş, 2010).

This study included senior management, information technology, human resources, public relations, and other department managers as well as one employee from each department as samples due to it is impossible to contact each manager and employee of an airline company. It can be claimed that the study utilized the

purposeful sampling approach, one of the non-probability sampling techniques, in keeping with this goal. Using the purposeful sampling technique, the researcher picks a sample that best matches the goals of the investigation (Rahi, 2017; Fraenkel et al., 2012). Furthermore, references were periodically contacted during the interviews to get in contact with the next participant, and they were asked to recommend them to another manager or employee. Therefore, while collecting interview data, the snowball sampling method, one of the non-probability sampling methods, was also used (Rubin & Babbie, 2011).

The semi-structured interview forms were developed using the qualitative approach as a guide. In order to obtain answers to the main questions of the study, better highlight the processes within the airline company by department, and make evaluations from the employees' perspective, it was necessary to ask department-specific questions in the question forms. Therefore, the question forms differ by department. As a result, various interview forms have been developed especially for the relevant employees and departments. These can be described as follows:

- Senior manager interview form
- IT department interview form
- Finance department interview form
- Human resources department interview form
- Public relations department interview form
- Aviation employee's interview form

Three separate professionals with experience in the sectors of information technology, tourism, and aviation, both in the industry and academia, were consulted over the applicability of the developed interview forms. Interview forms were updated based on professional feedback.

Interviews can also be conducted via e-mail, online, face-to-face, focus group, or telephone (Creswell, 2017). Appointments were requested from senior managers for the interviews. Due to company policy, as they wanted to see the interview questions in advance, the interview forms were sent to senior managers with a high work tempo. The aim was to reach 20 senior managers, but feedback was received from only 7 volunteers. The meeting with senior management was audio-recorded with permission. Interviews via telephone were conducted with the remaining 12 aviation employees, who were contacted using the interviewees' references. The participants gave their permission before any voice recordings were created. Thus, information for the study was gathered through interviews with a total of 20 individuals conducted between September and December 2022. Ethics committee approval was obtained before the interviews. [1]

Content analysis was used to test the study's data. To fully comprehend multiple structures, the information that remains hidden or not immediately apparent, content analysis approaches are utilized (Kurtuluş, 2010). This method reveals the content that first emerges, is clear to understand or is completely exposed in the topic materials, as well as the implicit, hidden meaning (Bilgin, 2014). Sub-codes were obtained from each participant question during the content analysis process by coding the questions. The number of participants for specific codes may differ since not every study participant is asked the same question. The coding process was carried out by the researchers.

Transferability (external validity) and credibility (internal validity) were elements that were considered in order to guarantee the validity of the study (Ravitch & Carl, 2019). In order to enable future researchers to reproduce and build upon this study, all study conditions and surroundings are thoroughly described (Braun & Clarke, 2013). Nonetheless, a purposive sampling strategy was employed, and individuals with a particular experience were included in the sample, to bolster the study's validity (Lincoln & Guba, 1985). Experts in the field were consulted to guarantee the validity of the data collection tools used. While the similarities between the answers of the participants in the study support the validity of the study, this situation alone is not sufficient and it is necessary to examine it with empirical methods in order to make generalizations (Creswell, 2016). In order to ensure credibility during the collection and evaluation of qualitative data, reference adequacy was taken into account and access was provided to participants from different departments representing the practices of an airline company. In addition, the data collection tool was diversified by taking

[1] The ethics committee report for the study was received by Adnan Menderes University Social and Humanities Research Ethics Committee decision numbered 31906847/050.04.04-08-135- decision date is 04.07.2022.

into account the business processes and working areas of the departments, and different questions were asked to the participants in this context. Furthermore, quotes from study participants were used without compromising the views and ideas that were conveyed throughout the interview (Lincoln & Guba, 1985).

The dependability and confirmability aspects were taken into consideration during the process to assure the study's reliability (Ravitch & Carl, 2019). Transcripts were created and interview records were kept up until the very last minute to guarantee uniformity. All interview transcripts were taken into account during data analysis. Additionally, interview records are stored in a virtual environment. However, when the consistency of the data obtained from the study is evaluated, the existence of practices that overlap with the work of international associations such as ICAO and IATA makes the participants' answers consistent. The data collected from different departments, the fact that this data supports each other and the similarity of the examples given by the participants prove the confirmability of the study (Christensen, et al.2015; Creswell, 2017). All data and analyses in this study were published openly, and the methodology used was suitable for the study's objectives. In addition, the steps recommended in Arslan (2022) study to ensure reliability were also taken into consideration. Consequently, the investigations carried out over the course of the research demonstrate that validity and reliability were attained.

4. RESULTS AND DISCUSSIONS

4.1. Detail about Demographics

It can be seen that 12 of the participants in the study were men and 8 were women. Additionally, three managers who participated in the study did not indicate their age. 2 of the participants have associate degrees, 11 have bachelor's degrees and 7 have master's degrees. Examining the experiences in the field, it is found that the participant with 3.5 years of experience working in the lost and found section has the least experience in the field. It is evident that the flight operations manager, with 35 years of experience, has the longest tenure in the sector. The length of time that participants have spent at the institution ranges from three years to fifteen years. In the interviews conducted between September and December 2022, the shortest interview lasted an average of 5 minutes and 8 seconds, while the longest conversation lasted 17 minutes and 32 seconds.

Table 1. Detail about Demographic Information of Participants (Source: created by the authors)

	Gender	*Age*	*Education Level*	*Industry Experience*	*Institution Experience*	*Position in the Institution*
1	Male	-	Master's Degree	20 years	12 years	Associate General Manager
2	Male	-	Bachelor's Degree	35 years	10 years	Flight Operations Manager
3	Male	-	Bachelor's Degree	9 years	9 years	Sustainability Leader and General Secretary
4	Female	38	Master's Degree	12 years	3 years	Project Development and Planning Manager
5	Male	42	Bachelor's Degree	14 years	4 years	GM&CM&SMS Manager
6	Male	41	Master's Degree	18 years	15 years	Station Manager
7	Male	39	Bachelor's Degree	15 years	15 years	Senior Analysis and Reporting Specialist
8	Female	45	Master's Degree	20 years	15 years	Human Resources Specialist
9	Male	48	Bachelor's Degree	14 years	14 years	Captain Pilot
10	Female	29	Bachelor's Degree	6 years	6 years	Pilot
11	Female	33	Master's Degree	7 years	7 years	First Officer

12	Male	30	Bachelor's Degree	5 years	4.5 years	Operations Coordination Officer
13	Male	36	Bachelor's Degree	10 years	9 years	Dispatcher Unit Supervisor
14	Male	29	Bachelor's Degree	5 years	4 years	Air Traffic Specialist
15	Female	39	Master's Degree	14 years	14 years	Purser
16	Female	34	Master's Degree	10 years	10 years	Cabin Attendant
17	Female	37	Bachelor's Degree	12 years	12 years	Passenger Services Team Manager
18	Female	30	Bachelor's Degree	6 years	6 years	Passenger Services
19	Male	32	Associate Degree Graduates	7 years	7 years	Operations Officer
20	Male	23	Associate Degree Graduates	3.5 years	3 years 2 months	Lost and Found Officer

When the roles of the participants are examined, it is seen that they answered the questions as Associate General Manager, Flight Operations Manager, Sustainability Leader and General Secretary, Project Development and Planning Manager, GM&CM&SMS Manager, Station Manager, Senior Analysis and Reporting and Human Resources Specialists in the airline business. In addition, as airline employees, Captain Pilot, FO, Operations and Coordination Officer, Dispatcher Unit Supervisor, Air Traffic Specialist, Purser, Cabin Attendant, Passenger Services Team Manager, Passenger Services Officer, Operations Officer and Lost and Found Officer participated in the study.

4.2. Benefits and Harms of Information Technologies

All participants were asked, "What are your views on the environmental benefits and harms of information technologies?" When the participants' answers about the benefits and harms of information technologies are examined, it is seen that four sub-codes are formed: "Environmental Benefit", "Non-Environmental Benefit", "Environmental Harm" and "Non-Environmental Harm".

Table 2. Benefits and Harms of Information Technologies (source: created by the authors)

Question Asked to the Participant	*What are your views on the environmental benefits and harms of information technologies?*	
Environmental Benefit	Workflows carried out electronically	1
	Paper saving	3
	Solar panels	1
	Less use of transportation vehicle	1
	Reducing carbon emissions with technology	1
Non-Environmental Benefit	Providing fast and easy transportation	1
	Providing fast and easy communication	1
	Making life easier	5
	Speeding up business processes	2
	Providing opportunities in various fields	1
Environmental Harm	Depletion of the ozone layer	1
	Global warming	2

	Melting glaciers	1
	Increased electricity consumption	3
	Radiation	3
	Increased technological equipment waste	1
	Environmental pollution	2
	Air pollution	1
Non-Environmental Harm	Technology addiction	2
	Uncontrolled shopping	1
	People getting lazy	1
	Information pollution	1
	Theft of information	1

The participants highlighted several environmental benefits of information technologies, including reduced usage of vehicles, electronic processes, solar panel utilization, and technology-assisted carbon emission reduction. However, paper reductions were identified as the most significant benefit. The evaluation of information technology's non-environmental benefits typically falls under the area of making life easier; this is followed by the speeding up of business processes. In addition, fast and easy transportation, fast and easy communication, and opportunities in various areas are also examined in this structure. The harms of information technologies were discussed by the participants in two subcategories: environmental and non-environmental. While the most environmental damage is increased electricity consumption and radiation, these structures are followed by environmental pollution and global warming. In the sub-code of environmental harms of information technologies, depletion of the ozone layer, melting of glaciers, increase in technological equipment waste and air pollution factors also attract attention. Factors including technology addiction, compulsive purchasing, sluggishness, information pollution, and information theft are highlighted in the non-environmental harm sub-code. Furthermore, to the coding mentioned above, the following is a summary of the noteworthy responses provided by the participants to the questions:

- Participant 2: It would not be wrong to say that information technologies affect almost all dimensions of individual and social life. I am one of those who think that technology causes more damage to the environment. But environmentally friendly technologies are becoming widespread. Aviation is also one of the sectors that started to use environmentally friendly technologies...
- Participant 12: Technology has indisputable advantages, and as long as it continues to advance and be used, so will we. In this regard, I believe that the best thing we can do is use technology to try and reduce the harm it causes to the environment.

4.3. Participants' Green IT Knowledge, Thoughts and Daily Routines

The question, "Are You Knowledgeable About the Concept of Green Informatics?" was posed to the 20 study participants. Twelve of them responded "Yes" to the question, and eight said, "They learned by doing research before the interview." Examining their responses, some participants admitted that while they knew the general idea of "green informatics," they were unaware of its formal name. A few individuals shared their knowledge of green IT. The following are a few noteworthy participant responses:

- Participant 6: I became aware of it a few years ago. After learning that an airline would cut its carbon emissions measurement by 20%, I investigated. That's when I started learning.
- Participant 11: The practices I read about were available in the company I worked for, but I did not have that knowledge in the name of green IT.

"What do you think about Green IT?" was the question we posed to the twenty study participants (Figure 1). The question prompted the emergence of sub-codings. "Protect the future" and "Support environmental sustainability" were the two subcodes that scored the highest. Then, it can be said that the sub-codes "Use of sustainable technology", "Production of environmentally & human friendly technology" and "awareness of technology" are less repeated. Participants also expressed their opinions on the topics of "Reducing environmental pollution", "Environmentally friendly lifestyle", "Reducing use of substances hazardous", "Recycling technology" and "Human health".

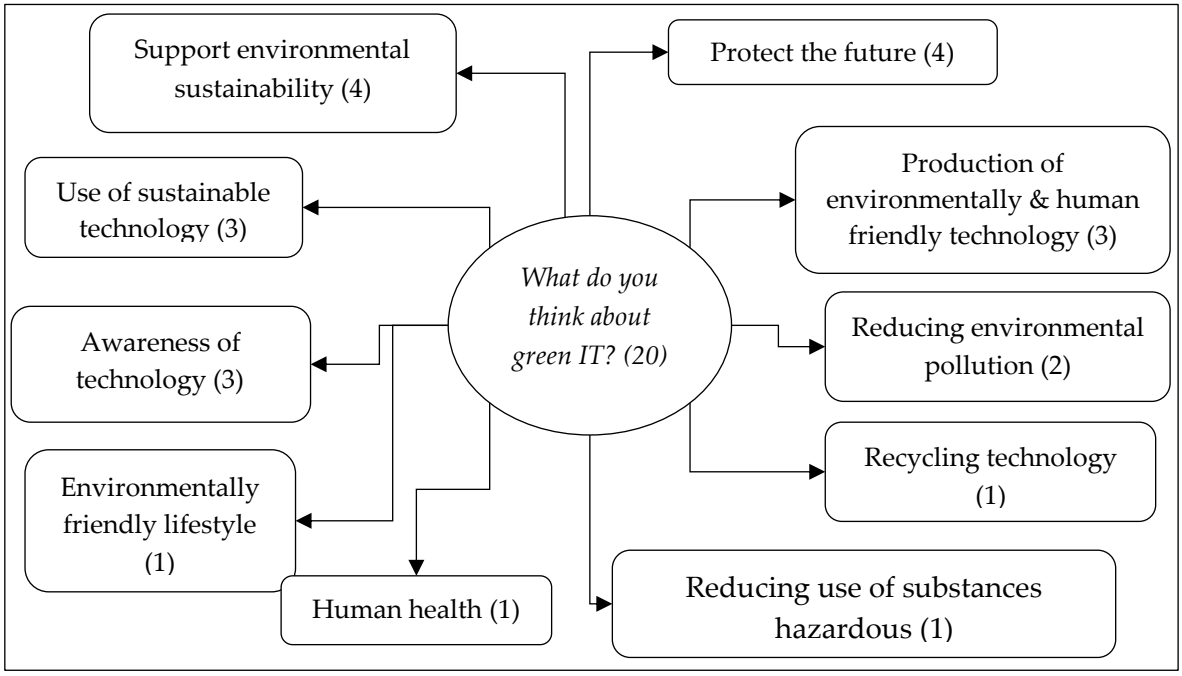

Figure 1. Thoughts about Green IT (Source: created by the authors)

20 participants who participated in the study were asked "Is There a Practice of Green IT in Your Private Life?" What are these practices, if any?" The answers to this question revealed sub-coding as in Figure 2. Examining the sub-codes reveals that "Avoid keeping devices plugged in& charged" is the most popular green IT behaviour among the participants in their daily activities. "Caring for the environment" was the other most frequently repeated code, with six repetitions. It can be noted that the sub-codes "Consider buying sustainable technology" and "Recyclable devices" attract attention with five points. The subcodes "Utilizing rechargeable batteries" and "Pay attention to using technological devices less" also received four points. Additionally, the subcodes "Use of electric vehicles" and "Use of energy-efficient light bulbs" scored three points. These codes are followed by the sub-codes "Turning off electronics that non-use", "Reducing the power mode of devices", "Use of electronic bills" and "Using a cloud storage system".

A few participants reported that they frequently lacked awareness of the routines they followed regularly (e.g. Nowadays, there are many environmental practices in everything we do. In fact, we do these practices in our daily work and life without even realizing it. For example, I think I support these practices with my electric car). However, one of the participants calls their practices for green computing as savings (e.g. Frankly, I don't think it's very much a part of my daily life right now, or even if it is, I'm not very aware of it. We consider turning off the television and reducing the power as savings.)

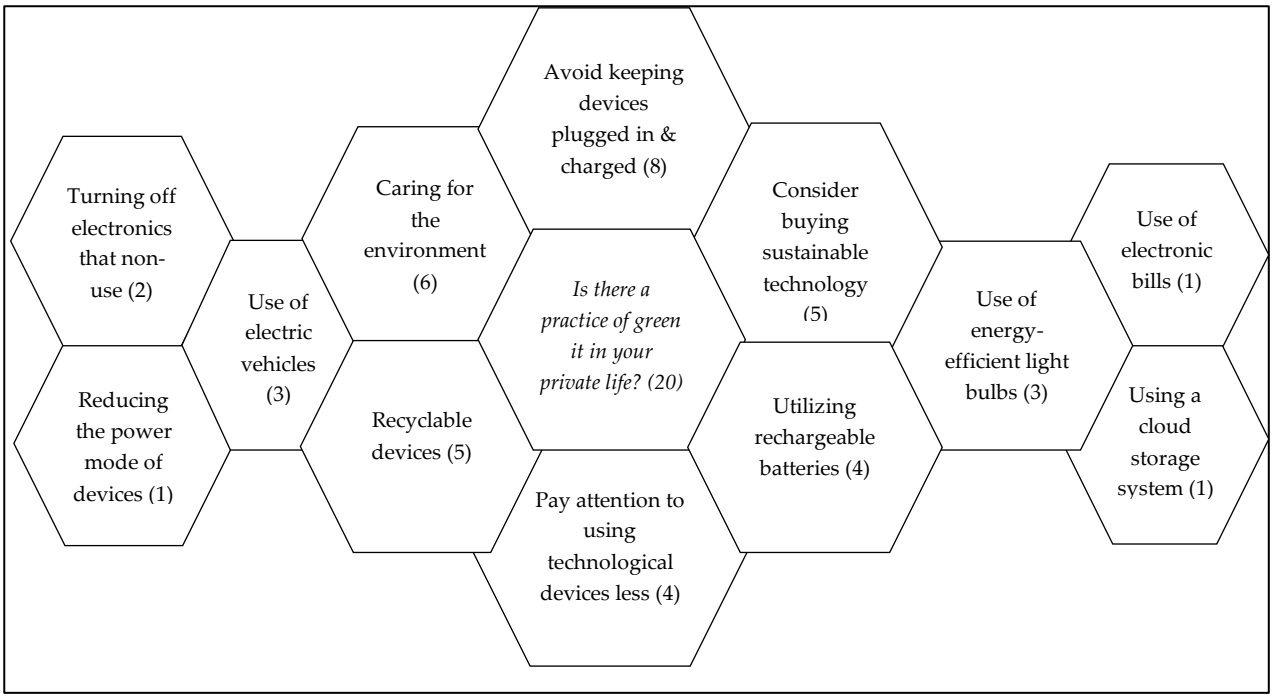

Figure 2. Private Life Practices Related to Green IT (Source: created by the authors)

4.4. Airline Company Green IT Practices

4.4.1. Green IT Awareness

20 participants were asked "What Level of Green IT Awareness Do You Think Is Among the Employees in the Institution You Work For?" Participants answered this question by evaluating it in two subcategories: "Institutional Awareness" and "Employee Awareness". These two subcategories are coded as high, medium and low.

Table 3. Green IT Awareness (source: created by the authors)

Questions Asked to the Participant	Institutional Awareness			Employee Awareness		
What Level of Green IT Awareness Do You Think Is Among the Employees in the Institution You Work For?	High	Medium	Low	High	Medium	Low
	11	5	0	1	2	5

Examining the level of awareness inside the institution, 11 participants believe that theirs is a high level of green IT awareness, while five believe it to be at a medium level. In terms of employee awareness, it is seen that only one of the participants evaluated it as high, two participants evaluated it as medium and five participants evaluated it as low. Some of the participants think that trainings and sustainability goals increase awareness in the institution (*e.g. As a result of the training we provide and our operational practices in our flights, I think there is sufficient awareness of our environmental and sustainability goals*.). However, one of the participants stated that green computing is examined under the name of sustainability (e.g. Green IT is currently being examined in terms of sustainability. Our company is a company that has initiated firsts in this regard in Turkey.). It was also emphasized that the characteristics of the sector are not very suitable for green IT applications (*e.g. Actually, I don't think my institution is in a bad situation in terms of education and green. But since the aim of the personnel in our sector is to do more time performance, safety and more appropriate procedures, I think the awareness of the personnel towards green is a little lacking. Obviously, because they have other priorities.).* Finally, one of the participants said, "I don't think the staff are very conscious. But I am aware that the managers are trying to ensure this." This sentence reveals the difference in green IT awareness between the institution and the employee.

4.4.2. Budget, Training and Reward

Only 13 of those who participated in the study were asked, "Does the institution you work for have a budget

allocated for green IT?" One of them is a Senior Analysis and Reporting Specialist who works in the finance department and answers questions in the manager category. The other 12 participants are employees. While 10 of the participants answered "Yes" to this question, one participant answered "No". Two participants stated that they did not want to answer the question. One of the participants emphasized that it was not right to share information about the budget and stated that they made investments with the following words. "We have recently been making investments to reduce our emissions to combat climate change. For instance, we invested in A320-NEO aircraft for this purpose. It would not be right to share anything about the budget, but the investments made". Other answers from the participants support this statement (*e.g. The institution I work for has a plan to achieve zero carbon emissions by 2050. They plan to reduce it by twenty percent by 2030 compared to 2019. They allocate a budget and work towards operational targets such as purchasing low-emission aircraft models, weight reduction efforts in aircraft, and optimizing routes*.)

Table 4. Budget, Training and Reward (source: created by the authors)

Questions Asked to the Participant (13)		Yes	No	Not Responding
Does the institution you work for have a budget allocated for green IT?		10	1	2
Does the organization you work for provide information or training on green IT?		9	4	-
Are there any rewards and penal sanctions for green IT in the institution you work for?"	*Reward*	3	10	-
	Penal Sanction	1	12	-

"Does the organization you work for provide information or training on green IT?" of the participants, 4 gave a "No" response, while 9 gave a "Yes" response. Analysis of the responses reveals that although the company does provide technology and environmental training, it does not provide any training under the banner of "Green IT." (*e.g. "….The emphasis of these trainings is on recycling and environmental conservation rather than green IT.", "……Training is given within the company on how to use technology in the most economical way.", "……..Among these trainings, training on green informatics is also given. But we did not receive any training on this as our main training."*).

Thirteen participants were questioned, "Are there any rewards and penal sanctions for green IT in the institution you work for?" in an attempt to gather information about incentives and sanctions related to green technology in the airline industry. This question was evaluated in two sub-codes: "Reward" and "Penal Sanction". While three of the participants answered "Yes" to the reward subcode, 10 participants answered "No". As for the penal sanction sub-code, 12 participants answered "No", while one participant answered "Yes". The interesting response is as follows; "…If you come up with an idea that can contribute to the environment, the company rewards it. I haven't heard anything penal sanction. Because environmental awareness is mostly based on volunteering."

4.4.3. Green IT Practices

" What are the Green IT Operational Practices at the Organization You Work For?" The replies to the question resulted in the development of the theme in Figure 3. While some participants explain their contribution to operational processes (e.g. "…We have been integrating a lot of our applications and running a lot of activities on online platforms for a long time in order to conduct environmentally friendly operations."), some participants emphasize that these processes provide cost savings for the company (e.*g. "…But this is probably something the company does to cut down on its expenses and consider costs. We turn off the screens of counters we do not use. This is actually the company's saving, but I think this can also be counted.").*

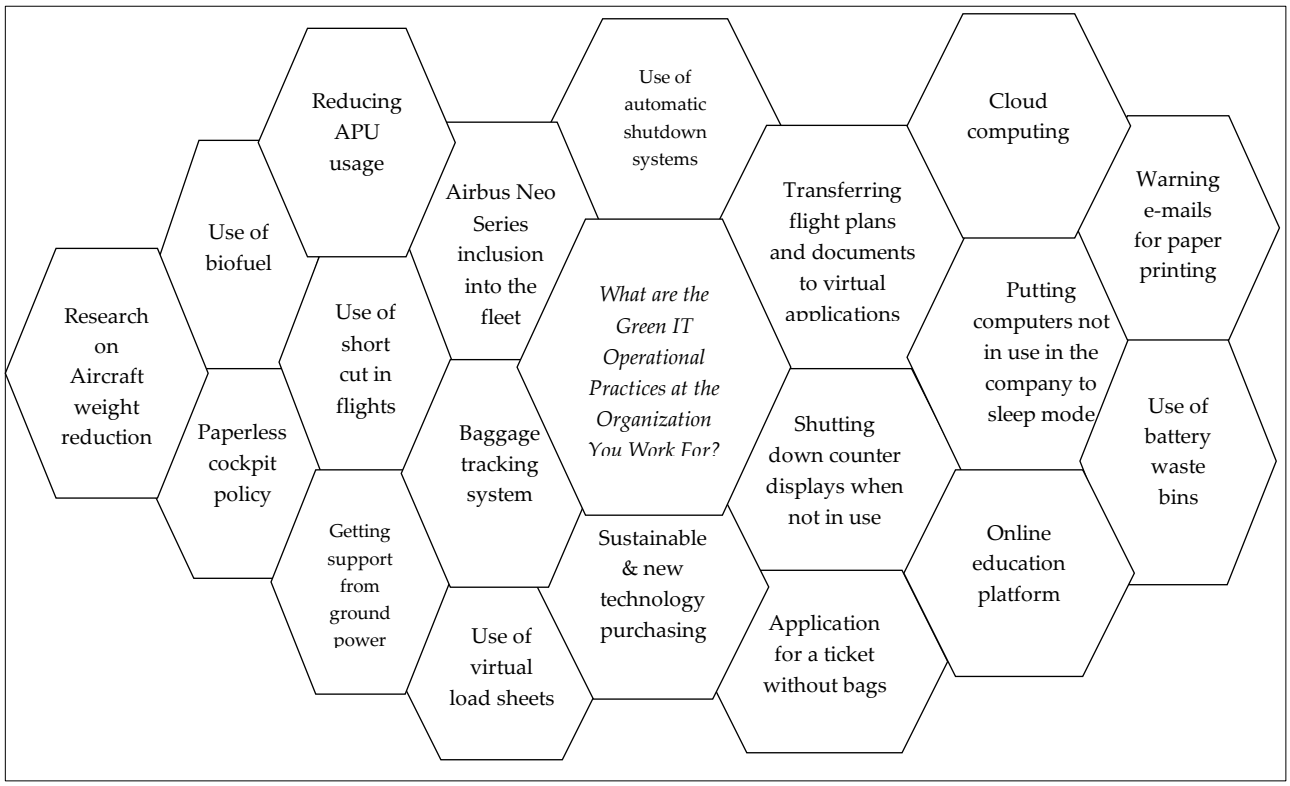

Figure 3. Green IT operational practices in the airlines companies (source: created by the authors)

In order to find out whether green IT affects workflow and scheduling performance within the business, 14 participants were asked, "*Are there green IT practices that affect workflow and scheduling performance positively or negatively in the unit you work in?"* Only the "Positive Outcomes" subcode could be created;

- Saving time in operations
- Easy access to information using tablets
- Reducing fuel consumption
- Ensuring energy savings through technology
- Monthly flight schedule and planning
- Access to flight information
- Increasing awareness by projecting information on the screen
- Ease of boarding operation
- Reduction of human error
- Correct luggage matching
- Facilitation of business processes
- Improving the service process
- Technical improvements in the lost and found
- Reduction of unnecessary communication between departments

In addition to the positive outcomes listed above, one participant mentioned a striking fact about aviation;

"….I believe there is a lack of integration between green IT applications and aviation because time is a critical component in operational applications. Because closing and reopening the applications we use means that we are delaying that flight. At this point, I can say that green IT practices are inversely proportional to workflow. That's why I think green IT applications are not very useful, especially in the aviation community…"

4.4.4. Senior Managers

Detailed questions were asked to senior managers about the green IT policy of the institution they work for, investments made or planned for green IT, additional costs of green IT applications, operational practices, human resources practices and promotional practices.

According to the data obtained, the airline company also has a sustainability office and Corporate Sustainability Policy. It can also be said that the airline has made a 2050 Net Zero Carbon Emission commitment to IATA. The airline, which wants to reduce carbon emissions by 20% by 2030 in order to fulfill its commitment, is increasing the number of Airbus NEO model aircraft with its fleet transformation strategy. However, one of the managers stated that investments have been made regarding the use of SAF, drawing attention to the rejuvenation of the fleet, weight reduction in aircraft and the best use of routes. One of the managers explained the projects they carried out for green IT as follows;

"We aim to be the greenest airline in our region by carrying out processes such as ISO 14001:2015 Environmental Management System, Carbon Transparency Project, ICAO Carbon Conversion and Reduction Program for International Aviation Activities, European Union Emission Trading System, and implementing all our operations and activities with the understanding of "sustainable environment"

In addition, managers generally emphasize that they do not perceive investments in green IT as an additional cost and that it is a necessity. Managers stated that they shared the environmental studies on green informatics with the public in their action plans and reports, and also stated their success in the "Carbon Disclosure Project" in the field of climate change.

4.4.5. Public Relations Department

The participant who supported the study to represent the public relations department stated that they shared the emission indicators resulting from flights on their websites monthly. The participant also stated that they actively share special news about sustainability and inform the public and then the environmental practices carried out by the airline company played an important role in the choice of passengers by raising awareness. According to the participant, the company supports various voluntary initiatives and acts in support of IATA's decisions. Finally, the participant did not provide information about the public relations department's obligations regarding green IT.

4.4.6. IT Department

The participant explained their processes with the following sentences: "We have been carrying out many of our applications integrated with automation for a very long time to carry out environmentally friendly operations, and thus we have eliminated the paper and similar documents that were used extensively before." However, according to the participant, projects are developed in the IT department of the airline company to control and improve the applications and the instructions from the sustainability office are implemented.

4.4.7. Finance Department

According to the participant, the airline company is making investments to reduce emissions to combat climate change. The participant gave the aircraft type change as an example to this issue. According to the information obtained from the participant, the airline company is considering investments in the use of alternative fuel and sustainable energy resources.

4.4.8. Human Resources Management Department

The participant stated that training and development programs were created in line with the work of the sustainability office within the enterprise and that they reached employees through a platform. In addition, when asked whether there are investments in green IT, the participant stated that they collect the sustainability ideas of the staff throughout the year, choose the best of these ideas and reward them. Finally, when the participant was asked about the human resources department's obligation regarding green IT, the answer was to contribute to personal and professional development and raise environmental awareness through training.

5. CONCLUSIONS

According to the data obtained from the study, it can be said that most airline employees focus more on the benefits of technology. Generally speaking, this condition is intimately correlated with the habits of heavy technology users (Olson, 2008; Jongsaguan & Ghoneim, 2017; Loeser et al., 2017; Anthony Jnr, 2020b). Furthermore, it is evident from an evaluation of the concept's awareness that green IT is associated with sustainable technology in a manner consistent with the literature (Pattinson et al., 2015, Molla, 2008; Woldu et al., 2019; Lei & Ngai, 2014; Iravani et al. 2017; Arulrajah et al., 2020; Ryoo & Koo, 2013; Molla et al., 2014). It

has been determined that "green IT" as a concept has not become widespread in airline companies, but processes are carried out with many sustainable practices that support green IT. Obviously, the participants were not given comprehensive training in the name of green IT, but they received many trainings including sustainability and green IT. As a result, before the interview, the participants read brief studies to gain an understanding of the idea of green IT. These trainings are one of the critical initiatives for process adaptation (Woldu et al., 2019; Warith, 2019).

Although the airline company supports corporate green processes, there is a general perception that employees are not very aware of green IT. Low employee awareness has the potential to sabotage the airline's critical investments and sustainability efforts. As a result, instruction in green IT awareness is crucial (Harvey et al., 2013; Köse, 2020). It is also noteworthy that employees perceive that the airline company implements green IT practices only for the purpose of reducing costs to the business. It is necessary to alter employees' prejudiced viewpoints on green IT practices. It is important to remember that employees play a crucial role in the success of green IT solutions (Anthony et al., 2018). According to Chow & Chen's (2009) research, people's intentions to adopt green IT practices are largely influenced by their level of awareness of the activity. To increase the productivity of green information systems and maximize them, it is necessary to adopt environmental sustainability principles and reinforce these principles before, during and after the use of green information technologies (Ijab et al., 2010). It is necessary to raise public awareness of environmental sustainability and green management through constant education initiatives (Aboramadan & Karatepe, 2021; Rondeau et al., 2015; Kotze, 2017).

Sustainable fleet organization, implementation of environmental systems, SAF fuel investments and digitalization of flight documents, ground power, baggage-free tickets, cloud computing and similar operational applications stand out as common ideas of employees that improve processes. The notion that managing technology-independent business processes is nearly impossible and that the airline industry makes it impossible for the green IT strategy to be completely adapted to operations both highlight the challenges faced by the aviation sector in implementing green IT (Iravani et al., 2017; Warith, 2019; Gotay, 2020).

However, despite all these difficulties, it is seen that important international authorities such as IATA, ICAO and EASA gather airline companies under one roof with policies towards green IT. (International Civil Aviation Organization [ICAO], 2012; IATA, 2021; IATA, 2022a; IATA, 2022b; EASA, 2022). The airline company's having a Corporate Sustainability Policy, improving its business processes in line with IATA, and taking the 2050 Net Zero Carbon emission decision are some of the important corporate steps taken in the name of green IT (Mithal & Rutherford, 2023; ICAO Environment, 2023; Federal Aviation Administration, 2021). Wang et al. (2020: 201) according to the findings of the study, the support of top managers in institutions, policy and regulation, institutional pressure, human resources and green IT practices are key factors in directing them. It is promising that investments made for sustainability such as fleet and fuel are not seen as additional costs, contrary to the literature (Watson et al., 2010; Bai & Sarkis, 2013; Aksoy et al., 2022; Abdi et al., 2022).

A crucial first step in increasing public knowledge is the monthly publication of the emission indicators from flights on the airline company's website, which is the purview of the accountability principle. The spread of similar airline practices will increase awareness and strengthen the environmental image (Domdouzis, 2015; Murugesan, 2009; Esty ve Winston, 2009). It is noteworthy that the airline company does not have a reward-punishment system for green IT, but verbal expressions such as thanks and appreciation are included. Rewarding new green ideas within the company also shows that there is an opportunity for green IT. Creating an environmental management system as part of an airline's operational policy will support staff in committing to efforts to improve efficiency and sustainability (Kotze, 2017). This system involves encouraging staff to adopt green IT practices and volunteering for environmentally friendly activities to improve the environmental performance of the organization (Ojo et al., 2019; Rondeau et al., 2015).

The worldwide airline industry is the focus of the investigation. However, considering the current conditions of the researcher and the data privacy policies of airline companies, it is not possible to reach the entire universe. Therefore, the most important limitation of this research is not being able to reach the entire universe. A lower limitation related to this situation is that the airline companies in Türkiye, where the research was conducted, did not follow clear policies in supporting researchers, which made sample selection difficult. Therefore, data

was collected in the research using the convenience sampling method. Another limitation of the research was that participants did not answer some questions during the interview due to concerns that they would include business information. Therefore, superficial answers were received in some of the data obtained from semi-structured interviews. In future studies, the sensitivity of airline companies regarding data sharing may be taken into consideration.

In this study, an in-depth process was carried out to reveal the current status of green IT practices in airline companies. With the data obtained, a transcript was prepared for airline companies within the scope of green IT practices. In future studies, the practices of airline companies can be reflected in theory by taking into account comprehensive quantitative models in the literature (Koo & Chung, 2014; Ojo et al., 2019; Ojo & Raman, 2019; Ojo et al, 2020; Ojo & Fauzi, 2020; Mishra et al., 2014; Akman & Mishra, 2015). Researchers who will study theoretical models on this subject can consider the practices in this study.

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