A Brief Overview of Implemented Management System Standards in Aviation

Monika BLIŠŤANOVÁ¹, Michaela TIRPÁKOVÁ^{2*}

¹Associate professor, Technical University of Kosice – Faculty of Aeronautics, Kosice,
Email: Slovakia, monika.blistanova@tuke.sk

²PhD. student, Technical University of Kosice – Faculty of Aeronautics, Kosice, Slovakia,
Email: michaela.tirpakova@tuke.sk

* Corresponding Author

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Abstract

The article aims to provide an overview of implemented management system standards in aviation through the selected traditional airlines and their subsidiaries. As one of the best possibilities of achieving stable management is to use different management system standards (ISO standards, Safety Management System (SMS), etc.), which have the potential to help the company in various business issues (quality, environment, safety and security at work, information security, etc.), it is essential to address the issue of their implementation. Qualitative research focuses on data collection, which relates to selected problems and deals with the case of the implementation and use of different management systems in aviation practice. This article mainly points out the differences in implementation among selected European airlines and their subsidiaries (in training and maintenance) and using ISO standards individually or as part of an Integrated Management System (IMS). The research results show that the implemented ISO management systems vary depending on which standard is applied: ISO 9001 in 40% of selected airlines, ISO 14001 is implemented by 40% of airlines too, ISO 45001 is certified in two companies (20%), and ISO 27001 is certified only by one airline.

Key words: quality, management system standards, ISO standards, aviation, airline

Introduction

Quality can be defined in different aspects and perspectives as it is a related concept by other people. E. Deming emphasized that quality is all about people and not products. The customers' satisfaction determines quality, and since the customers' requirements and expectations are constantly changing, the organization has to adjust and react to those changes (Alauddin and Yamada, 2019). The search for a general definition of Quality has yielded variable results. Such a global definition does not exist; instead, various quality descriptions are relevant under different circumstances (Reeves and Bednar, 1994). There are many interpretations of Quality. Some are more relevant to objective facts while others to more personal feelings, but they are interdependent. In a dictionary, it can be found many definitions according to the field of interest. Plus, each quality expert explains it differently depending on their environment and criteria (Diaz, 2021). Quality in business is classified as one of manufacturing's top competitive priorities and has become a requirement for success in the global marketplace. Quality maintains a firm increase competitive advantage by delivering goods to the market that meet customer needs, engage in their planned manner, and enhance quality dimensions to "amaze and joy" the customer (Forker, Vickery and Droge, 1996). Aviation has been concentrating on a constant need and importance for improving the quality of services to provide the highest satisfaction to the passengers. Being dynamic and customer-

centric, the airline business always has scope for innovation in the service operation (Walia, Sharma and Mathur, 2021). The quality of air transport and its provision is very vulnerable to various circumstances that directly or indirectly affect it. However, what is worse is the fact that the "loss" of quality is often not due to the airport or airline operator alone, despite great efforts. The market position, prestige or reputation of an airline company may change due to rapid expansion and changing market conditions (Wen, Chen and Fu, 2014). Therefore, it should be in the best interest of the air carrier to ensure a quality system. A quality system includes the set of policies, processes, and procedures needed to plan and execute safe and efficient air operations in the aviation industry. The system combines the different internal techniques and processes and allows the organization to recognize, measure, check and improve the effectiveness and safety of its activities. One of the well-known management systems in air transport is, for example, the Safety Management System (SMS), which represent a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures. So, for the air carrier, the implementation and usage of the management system is nothing new (ICAO, 2018). According to (Commission Regulation, 2008) in EU-OPS 1.035, an operator shall set one Quality System and select one responsible Quality Manager to manage compliance with, and the competence of, procedures needed to assure safe operational practices and airworthy aircraft. Compliance monitoring must incorporate a feedback

system to the Accountable Manager to ensure corrective activity as necessary. Of course, the quality system must be defined in the appropriate documentation (SkyBrary, 2020). It is a general condition or recommendation for ensuring a quality system in aviation. Nowadays, there are many possibilities and techniques that this system can be provided. One of the best is the use of different management system standards. A management system is a way an organization operates the interrelated components of its business to achieve its objectives. These objectives can relate to various topics (or problems), including product or service quality, operational performance and efficiency, environmental performance, health and safety in the workplace, etc.

Methodology

The qualitative research was aimed to collect data about management systems standards and their usage in aviation practice. For the data collection, a standardized search approach was used. All online academic databases (Web of Science, Scopus, Google Scholar) were searched by using the search terms "management system standards", "ISO standards", "safety management system", and "aviation". Classical methods of analysis and synthesis, together with a description, standard search methods and their frameworks, were used to elaborate the article. Emphasis was placed on terms such as quality, standard, ISO standards and airlines. The airlines located in Europe and are among the best known and have a strong market position in terms of the number of passengers carried have been selected. These airlines also have subsidiaries, so the overall analysis was more comprehensive and the results more suitable for use. The first part of the research described the theoretical basis, i.e. ISO

standards related to quality, environment, health and safety and information security. At the same time, the Safety Management System (SMS) was briefly described, a standard which is a mandatory management system used in air transport, especially for air carriers. In the next part, the research dealt with specific airlines and their application of ISO standards in practice. In the last phase, the research results were expressed as a percentage and graphically. For the article, many online resources were used, mainly available documents published by the International Organization for Standardization and publicly available resources published by selected airlines on their official websites.

ISO standards in general

ISO management system standards (ISO MSS) are various technical, industrial or commercial standards published by International Organization for Standardization. It is the world's largest developer of voluntary international standards, and it helps world trade by presenting traditional standards among nations. Application of the standards helps design products and services that are safe and protected, reliable, and of sufficient quality. The standards support businesses and manufacturers improve productivity while reducing errors or failures and waste. Plus, the standards help safeguard consumers and the end-users of products and services, guaranteeing that certified products correspond to the minimum standards set internationally. Companies can think about standards as people's experience in their subject matter and know the requirements and needs of the organizations they represent – people such as producers, sellers, buyers, customers, trade organizations, users or regulators (ISO, 2021a).

For this article, four ISO standards () commonly used in aviation and that reflect the conditions of aviation business have been selected and further defined.

ISO Standard	Indication	Main Aim
Quality Management Standards	ISO 9000 Family	help to operate more efficiently and decrease product failures
Environmental Management Standards	ISO 14000 Family	help to decrease environmental impacts, reduce waste and be more sustainable
Health and Safety Standards	ISO 45000 Family	help to reduce accidents in the workplace
IT Security Standards	ISO/IEC 27001	help to keep sensitive information secure

Table 1: ISO standards, including primary purpose and international indication

ISO 9000 Family – Quality Management

Standard is designed to enhance the quality of products and services and consistently satisfy company customers' expectations. ISO 9001 places out the guidelines for a quality management system and is the exclusive standard in the group that can be certified (although this is not a requirement). The quality standard is based on several quality management principles and helps guarantee that customers get constant, good-quality products and services, bringing many business benefits (ISO, 2021b).

ISO 14000 Family – Environmental Management

Standard is created for companies and organizations of every kind that need practical tools and mechanisms to achieve environmental responsibilities and stability. At present, the issue of the environment and sustainability is very topical and often mentioned. Many companies strive to be environmentally

responsible, so the adoption and certification of this standard can benefit companies. The standard provides many tools and means to be an ecologically accountable, independent, and successful organization (ISO, 2021c).

ISO 45000 Family – Occupational Health and Safety

Standard is created for responsible companies to increase worker safety and protection, reduce workplace risks, and make more reliable, safer working conditions. ISO committee of Occupational Health & Safety specialists introduced an International Standard with the potential to ensure a better and safer working environment, which contributes to higher employee motivation and better working well-being. ISO 45001 forms on the success of earlier international standards in this area, such as OHSAS 18001 and so on (ISO, 2021d).

ISO/IEC 27000 – Information Security Management

Standard is designed to ensure information and information systems' protection (or stability) and keep all information assets secure. ISO/IEC 27001 is generally known, providing requirements for an information security management system (ISMS), though there are more than a dozen standards. Applying them allows organizations of each kind to maintain the security of assets such as financial information, intellectual property, employee details or information entrusted by third parties (ISO, 2021e).

Each of the defined standards has its benefits and

advantages in the company structure. But the present quality method of Integrated Management Systems (IMS) is used to ensure even more standards effectivity. An IMS (Figure 1) refers to integrating several different standards into a simple system that meets the requirements of each of the standards. This enables the organisation to work as a single system with unified objectives. IMS allows a business to streamline its management, save time, and improve efficiency by directing all management system elements as a whole. A successful and strong IMS cuts the needless hassle (errors) and work of multiple management systems. A significant advantage is that this system can have different variations according to the needs of the company.

Figure 1: Integrated Management System (IMS) and its components, including relation to Total Quality Management (TQM) and Safety Management System (SMS)

Before starting the analysis of management systems, it is necessary to define other concepts and management systems.

ISO 9000 - Quality Management System (QMS) refers to the number of business processes, policies, and procedures to ensure that the organization meets all the customer and compliance demands. Implementing a quality management system influences every aspect of an organization's performance.

The concept of Total Quality Management (TQM) is one of the options for the air carrier or another company in aviation. A primary definition of TQM describes a management approach to long-term success (and prosperity) within customer satisfaction. In a TQM effort, all members of an organization participate in developing processes, products, services, and the culture in which they work. Total Quality Management (TQM) and ISO 9000 - Quality Management Systems (QMS) both express successful ways to enshrine quality into organizations' efforts beyond the world (ASQ, 2021).

As already mentioned, the introduction of Safety

Management System (SMS) is mandatory for airlines under the ICAO requirement. Whether ISO QMS or SMS, management systems are similar in various aspects, for instance, in the system's structure. Although both management systems incorporate several related types of components (Figure 2) and elements (e.g., policy and objectives, management commitment, training, education, communication throughout the organisation) and similar tools can be used, an essential difference can be seen in the safety risk management component, it is a key component in an SMS though is not a QMS requirement (Roelen and Klompstra, 2012). In the following figure it is possible to observe the main components of both management systems and their common signs in each component. SMS emphasizes the efficiency and safety of the system while QMS the quality of the system. Thus, both systems dealt with the system's properties, which should be high quality, safe and efficient. The components deal with the goals and support of those goals and effectiveness and way of achieving them (Tirpáková et al., 2021).

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Figure 2: The main components of the Safety Management System (SMS) and Quality Management System (QMS), including definitions

QMS requirements can be applied to any organisation and are focused on processes for product realisation in an organisation. ISO standard does not require the identification of hazards.

ICAO SMS requirements apply to aviation operators and are focused on identifying hazards in a reactive, proactive and predictive manner, and are focused on safety performance and continuous improvement of the overall performance of the SMS, which has to be monitored using safety performance indicators.

Results

European airlines have been selected (), which are among

the best known for their long tradition in the market or other strengths (for example, they were the founding airlines of the alliances). Plus, these airlines also have subsidiaries in maintenance and education that have an excellent market position. Airlines have been reviewed, and their annual reports, certifications and organizational structures have provided a summary of the information, summarized in the following section. As each air carrier must implement safety management system SMS, this system will also be listed in the following table () together with the management system in a general and Integrated Management System (IMS).

Base	Airline	Subsidiaries	SMS	MS	IMS
Czech Republic	Czech Airlines	Czech Airlines Handling	yes	yes	-
Germany	The Lufthansa Group	Lufthansa Technik/ Training	yes	yes	in Lufthansa Technik
United Kingdom	British Airways	-	yes	TQM	-
France	Air France	Air France Industries	yes	yes	yes
Poland	LOT Polish Airlines	LOT Cargo	yes	in LOT Cargo	-
Ireland	Ryanair	-	yes	TQM	-

Table 2: Selected European airlines (with some subsidiaries in maintenance and education) and safety management system (SMS), management system (MS), including an Integrated Management System (IMS)

Czech Airlines (abbr. ČSA) is the national carrier of the Czech Republic. It was founded in 1923, and the airline's hub is at Václav Havel Airport Prague. It is one of the five oldest airlines in the world. The company operates mainly scheduled flights, and it is a member of the International Air Transport Association (IATA) and the alliance SkyTeam. The airline has a relatively strong position in the market and operates its flights to 22 destinations, including the USA, Canada and South Korea (Planespotter, 2021). The Environmental Management System (EMS) was implemented in the company in 2008, in order with the requirements of the ISO 14001 Certificate. Since then, it has been constantly re-certified by an international company. The main goal of the airline is to reduce both the direct and indirect impact of their operation on the environment

and, to the maximum extent, apply the prevention strategy and the principles of avoiding pollution (CSA, 2021). Other ISO standards are not implemented by this airline or its subsidiary Czech Airlines Handling.

The Lufthansa Group is a worldwide aviation group with more than 530 subsidiaries and equity investments. The Lufthansa Group is formed of the segments Network Airlines, Eurowings and Aviation Services. The company includes:

- Deutsche Lufthansa (commonly shortened to Lufthansa) is the largest German airline that, when combined with its subsidiaries, is the second-largest airline in Europe. It was formed in 1953 and is one of the five founding members of Star Alliance, and of course the member of the International Air Transport

Association (IATA). It is a strong airline and partner with hubs at Frankfurt and Munich airports. The airline operates flights to up to 220 destinations worldwide and has a fleet of 275 aircraft (Airbus and Boeing) and another 157 ordered (Lufthansa, 2021).

- Swiss International Air Lines (commonly shortened to Swiss) is the flag carrier of Switzerland, performing scheduled flights in Europe and to North America, South America, Africa and Asia. It was founded in 1953 and is a member of the Star Alliance and the member of the International Air Transport Association (IATA). Zurich Airport works as its single hub and Geneva Airport as a center city. The airline operates flights to up to 100 destinations worldwide and has a fleet of 92 aircraft (Swiss, 2021).
- Austrian Airlines (abbreviated to Austrian) is the national carrier of Austria. It was founded in 1957, and the airline's hub is at Vienna International Airport in Schwechat. It is one of the five oldest airlines in the world. The company operates mainly scheduled flights, and it is a member of the alliance Star Alliance and IATA. The airline has a dense route network, especially in central and eastern Europe. It operates its flights to 130 destinations with a fleet size of 69 aircraft (Austrian, 2021).
- Brussels Airlines is the national carrier and biggest airline of Belgium, based and headquartered at Brussels Airport. It was formed in 2006, and it is a member of the alliance Star Alliance and IATA. It works to over 100 destinations in Europe, North America, Africa and offers charter services, maintenance, and crew training. The company has a fleet of 38 aircraft (Brussels Airlines, 2021).

All these airlines belong to the Lufthansa Group, from which they have certain benefits. Environmental protection and sustainable growth and development are high-priority goals of the Lufthansa Group. To maintain the systematic control and continuous optimization of environmentally related processes, the Lufthansa Group firmly forwards the implementation of environmental management systems according to ISO 14001 or EMAS at the Group companies (Lufthansa Group, 2021a). The Lufthansa Group protects and secures all data according to the highest standards (ISO 27000) (Lufthansa Group, 2021b). Health and safety are implemented into the company's organization, but it is not certificated according to ISO standards. In summary, the airlines belonging to the Lufthansa Group are certified according to only two standards, environmental management and information security. Subsidiaries that belong to the group (e.g. educational organization Lufthansa Training – certified according to ISO 9001 or maintenance organization (Lufthansa Technik)) have been certified according to others standards.

- Lufthansa Technik - a company that deals (Lufthansa Technik, 2021) with aircraft maintenance, repair, overhaul and modification services for civil aircraft, from commercial to VIP, and particular mission aircraft is certified by an integrated management system. This system combines ISO 14001: 2015, EN 9001: 2018, EN 9110: 2018, ISO 45001: 2018. This example clearly shows that mergers have an excellent impact on their management. Lufthansa Group stands for good quality management and creates space for the implementation

of the Integrated Management System.

British Airways is the flag carrier airline of the United Kingdom (UK). It was founded as Aircraft Transport and Travel Limited in 1919, and then as British Airways in 1974. The airline is the second-largest UK carrier, based on fleet size and passengers transported, behind easyJet (low-cost airline). The central hub is at Heathrow Airport. It is a founding member of the Oneworld airline alliance and member of International Airlines Group (IAG), a Spain holding company. The airline operates flights to 183 destinations worldwide and has 254 aircraft (including Airbus and Boeing) (British Airways, 2021a). The airline environmental management system is certified through the International Air Transport Association (IATA) IEnvA system. The IEnvA system is specific for airlines and demonstrates equivalency to the new ISO 14001: 2015 EMS standard (British Airways, 2021b). IEnvA program is an evaluation system designed to independently assess and improve the environmental management of an airline. None of the ISO standard is implemented by this airline, but airline has implemented Total Quality Management, as one of the management system possibilities.

Air France is the flag carrier of France. It was formed in 1933, and it is a subsidiary of the Air France–KLM Group and one of the establishing members of the SkyTeam global airline alliance. The airline's global hub is at Charles de Gaulle Airport, and Orly Airport is the primary domestic hub. The airline operates flights to 211 destinations worldwide, and it has 213 aircraft (including Airbus and Boeing) (Air France, 2021). Air France/KLM has started a program to monitor operational processes aimed at continuous performance improvement, effective compliance, and the prevention of risks to provide high-quality products and services, and adopted several ISO standards are implemented as Integrated management system (IMS). In 2016, within the framework of the Single & Global Certification, Air France requested an audit of the ISO 14001 (Environment), ISO 22000 (Food Hygiene) and OHSAS 18001 (Occupational Health and Safety) standards over all its activities. For maintenance activities, this audit was supplemented by the following standards: ISO 9001 (Quality), EN–Aircraft maintenance 9100 (Design), 9110 (Realization), 9120 (Storage) and ISO 15489 (Documentation) (Afiklmem, 2021).

LOT Polish Airlines is the flag carrier of Poland, and it was formed in 1928. It is one of the world's oldest airlines in operation. The airline's hub is at Warsaw Chopin Airport (the largest hub in Central and Eastern Europe), and it is a member of Star Alliance. With a fleet of around 100 aircraft, LOT Polish Airlines operates to over 120 destinations across Europe, Asia and North America. The airline is not certified by any ISO standards, which does not apply to LOT Cargo, which has implemented Quality Management System as is certified according to ISO 9001: 2015 (LOT, 2021).

Ryanair is an ultra-low-cost carrier of Ireland established in 1984. It forms the most significant part of the Ryanair Holdings family. It is headquartered in Dublin, with its primary operational bases at Dublin airport and London Stansted airports. The airline has been defined by its fast expansion and the success of its low-cost business model. Ryanair's route network works in 40 countries in Europe, North Africa, and the Middle East (Israel, Lebanon and Jordan) (Ryanair, 2021). This major low-cost company is involved in various fields but is not currently certified by any ISO standard, but it has applied TQM.

Figure 3: Graphic summary of ISO MSS implemented by selected European airlines and their subsidiaries

The (Figure 3) shows that European airlines are primarily concerned with the environmental aspect, so ISO 14000 is also the most represented. It is also based on logical reasoning, as airlines make a significant contribution to environmental pollution. Airlines' goal is, therefore, to reduce the high percentage of emissions and noise thanks to the implemented standard. Conversely, where airlines or their particular subsidiaries deal with the maintenance, repair or modification of aircraft and aeronautics, the ISO 45001 standard (or its variation OHSAS 18000) also appears. As these standards deal with the creation of good working conditions and at the same time help to achieve high workplace safety, such a decision by these technically oriented airlines is justified. The ISO 9000 - QMS of certifications covers quality management standards, and it is certified by a few airlines or technically focused subsidiaries. The reason may also be that it is an effort to create a quality product (aircraft), which must meet specific standards and necessary parameters. On the other hand, it is much more complex than in the provision of services. It remains interesting that data protection and information security by the ISO 27001 standard were found in only one selected airline. Although this standard is already quite widespread, certification is not yet very common in airlines. Other ISO standards have emerged from the research, such as ISO 22000, which has been supplemented by the Integrated Management System in the case of Air France. It should be emphasized that these ISO standards are voluntary and aim to support and assist so that even if an airline does not have this certification, it does not mean that it is of poor quality or does not have a good quality system.

Conclusion

From a managerial point of view, air carriers have to make many decisions that directly or indirectly affect their further activities. The use of management systems is nothing new in the aviation sector and air transport. On the contrary, there are requirements directly from ICAO, EASA or other international organizations to ensure management systems. As mentioned several times, one of the mandatory management systems for air carriers is implementing a Safety Management System (SMS). SMS is not significantly different from other management systems as a management system, and it is often similar. This can also bring many benefits to the air carrier because it knows how to proceed and what to prepare for implementing other systems. Based on the examined available documents (annual reports, certifications, organizational structures and websites) for selected European airlines and their subsidiaries (Figure 4), it can be assumed that introducing management systems is justified various ways. Some airlines already have Total Quality Management (TQM) or Integrated Management System (IMS) in place, but some have only one ISO standard (mostly ISO 14000) and prefer another option. Airlines use ISO standards more in subsidiaries that are in charge of a specific product (aircraft) and its maintenance. An environmental standard is also often used, which may also be the result of the fact that this topic is often discussed today and air transport has a high share in the negative impact on the environment.

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Figure 4: Graphical results of the research emphasise the application of ISO management system standards and selected airlines, including their subsidiaries

The graph (Figure 4) shows ten companies in the aviation sector, either classic airlines (including one low-cost), airlines group or subsidiaries engaged in education or maintenance of aviation technology and its modifications. The results show the implemented management systems: ISO 9001 is presented in the research four times in Lufthansa Training, Lufthansa Technik, Air France Maintenance and LOT Cargo (40%). ISO 14001 is implemented by Lufthansa Group, Lufthansa Technik, Air France and Czech Airlines (40%), ISO 45001 is certified in two companies Lufthansa Technik and Air France (20%), ISO 27001 is certified by whole Lufthansa Group (10%) and Total Quality Management is applied in two airlines: British Airways and Ryanair (20%).

Aviation organizations (airlines, airports, service providers) are regulated and controlled by legislation and various regulation concerning safety management systems and usually other management systems, e.g., quality, security, occupational safety, and environmental protection. This wants the appropriate balance of the implementation of the various management systems within an organization. Plus, regulations allow the combination of the different management systems into one management system. However, it should be considered that although management systems are similar, they are not the same. Understanding their differences and their relationship is therefore significant.

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