

## Article

# The Safety Management and Organizational Resilience System Maturity of Aviation Organizations during the COVID-19 Pandemic: Comparison of Two Approaches to Achieving Safety

Tomasz Ewertowski \*  and Patryk Kuźmiński

Faculty of Engineering Management, Poznan University of Technology, 2 Prof. Rychlewskiego Str.,  
60-965 Poznan, Poland

\* Correspondence: tomasz.ewertowski@put.poznan.pl

**Abstract:** The coronavirus pandemic crisis highlighted the critical importance of comprehensive safety management for all organizations. Safety management literature delineates two approaches to achieving safety, characterized as safety management through centralized control, known as the safety management system (SMS), and safety management through guided adaptability, known as organizational resilience (OR). Each of these approaches plays a pivotal role in establishing and maintaining the safety and sustainability of an organization. This paper aimed to compare the maturity of SMS with the maturity of OR, identifying the relationship between aspects of SMS and OR in the context of the crisis of the pandemic. Based on a literature review, the author presents adopted concepts of SMS and OR, as well as a customized maturity model for both. The survey methodology involved two questionnaires on SMS and OR, consisting of 26 and 18 questions, respectively. The survey was conducted in three approved training organizations (ATOs) in the Greater Poland voivodeship. When comparing key aspects of both approaches to safety management (SMS vs. OR), significant differences in ratings were observed. Additionally, a moderate correlation was found between aspects of SMS and OR. This discrepancy was reflected in the maturity models. According to the survey results, SMS achieved the fourth level of maturity, labeled proactive safety management, while OR attained the third level of maturity, termed a fairly agile organization. Furthermore, the results showed that while the guided adaptability approach is more difficult to achieve in an organization, the centralized control approach is insufficient. Therefore, both components are necessary to ensure the comprehensive safety of the organization.

**Keywords:** safety management system; organizational resilience; risk management; Safety I; Safety II; sustainability



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## 1. Introduction

The COVID-19 crisis, an extraordinary event likened to the Black Swan phenomenon, has exposed the vulnerability of many organizations [1]. This situation has created an atmosphere of uncertainty in organizations and generated threats to their efficiency and sustainable development. The crisis has tested organizations' resilience (OR), but also their ability to adapt to disruptions. Resilience research, pioneered by Weick, defines resilience as an organization's ability to cope with adversity [2]. Modern organizational safety extends beyond mere threat avoidance; it denotes an organization's proficiency in managing these threats—reducing vulnerability and mitigating impacts. The competencies to navigate uncertainty and ensure sustainable growth hinge on these abilities. Sustainable enterprises prioritize fostering knowledge, creativity, analytical prowess, and continuous learning [3]. In a highly competitive market, only the strongest will endure.

One of the severely impacted sectors during COVID-19 has been aviation. Fortunately, aviation companies have been mandated to implement safety management system (SMS) since 2013 through international and state regulations [4,5]. Aviation authorities in many

countries have mandated the institution of SMS for all their entities, although the degree and method of implementing The International Civil Aviation Organization (ICAO) annexes vary in each State [6]. Approved training organizations (ATOs) were among the first types of aviation organizations to introduce SMS. An ATO is an organization providing approved flying training for specific flight training programs (airplane or helicopter).

The safety management literature delineates two approaches to achieving safety—safety management through centralized control (SMS) or safety management through guided adaptability (OR) [7]. COVID-19 has presented significant challenges to both safety management approaches, particularly in recovery and risk management [8].

Maturity encompasses phenomena that may undergo change or development. The process of attaining maturity is linked to the enhancement of skills and the acquisition of specific characteristics, signifying readiness for particular tasks [9]. The way towards maturity is gradual, allowing for a spectrum of maturity levels. These levels denote the extent of the development of an entity towards its excellence [10]. Attaining higher levels of maturity can translate into effectiveness for an organization operating in a dynamic environment [11].

Existing research highlights the importance of both a mature SMS and OR for ensuring safety. However, there is a gap in understanding the interplay between the maturity levels of an SMS and OR. Thus, one can formulate a research problem as follows: What is the relationship between the maturity of safety management system (SMS) and the organizational resilience (OR) of aviation entities during the pandemic crisis? The theoretical and practical relevance of the problem refers to exploring how the maturity of an SMS influences organizational resilience and investigating how organizations with higher maturity in their SMS demonstrate better organizational resilience, potentially leading to improved safety outcomes. The object of this study was to investigate the relationship between the maturity of safety management system (SMS) and OR of aviation entities during the pandemic. This prompted an investigation into how three selected ATOs handled the pandemic and how their SMS maturity compared to OR maturity during this disruption.

Therefore, the paper aimed to compare two approaches to achieving safety, identifying the relationship between SMS and OR aspects in ATO organizations. Resolving the research problem involved specific research objectives:

- Identifying concepts and aspects of SMS and OR through a literature review;
- Customizing maturity models of SMS and OR from a literature review;
- Developing tools for SMS and OR research, including survey questionnaires;
- Assessing SMS and OR aspects in ATO organizations based on the survey with prepared questionnaires;
- Evaluating SMS and OR maturity levels based on customized models;
- Analyzing the relationship between the maturity of an SMS and OR aspects crucial for safety.

Achieving all the specific objectives aimed to provide a comprehensive framework for assessing the maturity of SMS and OR, and analyzing the aspects and factors that influence the relationship.

The paper's format includes an abstract summarizing the objectives, methods, findings, and conclusions; an introduction providing a brief contextualization of the study within the broader context of SMS, OR, and sustainability, and outlining the research goals; and a literature review delving into the theoretical underpinnings of SMS and OR related to the topic; materials and methods explaining the research methods step by step; results offering a precise description of survey results; discussion exploring the results, limitations, and their interpretation in the context of research goals, and conclusions providing a clear confirmation of goal achievement.

## 2. Literature Review

Regardless of the organizational type, the main concerns are survival and growth, which remain the fundamental objectives for every organization. The primary aim is to

sustain and prosper, ensuring profitability. This also applies to aviation organizations. Aviation has suffered significantly during the pandemic. The substantial reduction in trained personnel and, consequently, the decline in flight operations have had adverse consequences for all aviation companies, including ATOs. Ensuring an appropriate level of safety requires legal regulations that will force operators to implement systems and apply procedures that ensure the identification of situations threatening safety, analysis of these situations, and implementation of actions to prevent their recurrence. The need for ATOs to introduce an SMS arises from specific legal requirements [4,5]. The literature provides various definitions of an SMS. One definition is as follows: A safety management system is an approach to harmonize, rationalize, and integrate management processes, safety culture, and operational risk assessment [12]. It also encompasses legal compliance, accident reduction, and cost savings. It is a strategic investment in creating a safe and sustainable workplace. The implementation of an SMS also enhances competitiveness in the market [13]. Key processes of an SMS are as follows [4]:

- (a) Hazard identification (a method for identifying hazards related to the whole organization);
- (b) Safety reporting (a process for the acquisition of safety data);
- (c) Risk management (a standard approach for assessing risks and for applying risk controls);
- (d) Performance measurement (management tools for analyzing how effectively the organization's safety goals are being achieved);
- (e) Safety assurance (processes based on quality management principles that support continual improvement of the organization's safety performance).

The International Civil Aviation Organization (ICAO) provides a framework in representing the minimum requirements for implementing and maintaining an SMS by an organization, which consists of 4 aspects and 12 factors [4,14]. The four aspects that must be designed into proactive safety are: safety policy and objectives (SP&O), safety risk management (SRM), safety assurance (SA), and safety promotion (SP) [15]. The aspects are divided into factors as follows:

- (1) SP&O:
  - (a) Management commitment and responsibility;
  - (b) Safety accountabilities;
  - (c) Appointment of key safety personnel;
  - (d) Coordination of emergency response planning;
  - (e) SMS documentation.
- (2) SRM:
  - (a) Hazard identification;
  - (b) Risk assessment and mitigation.
- (3) SA:
  - (a) Safety performance monitoring and measurement;
  - (b) The management of change;
  - (c) Continuous improvement of the SMS.
- (4) SP:
  - (a) Training and education;
  - (b) Safety communication.

The safety policy and objectives should reflect the organization's commitment to safety and include a clear statement of the human and financial resources necessary for its implementation. This commitment should be communicated throughout the organization with visible support [16].

Safety risk management entails the development and operation of a process by the aviation entity to identify threats related to the products or services offered. Identifying threats involves employing both reactive and proactive methods. This process acts as a

decision support tool in situations of uncertainty, furnishing insights into specific risks within the overall risk management process [17].

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Safety assurance in the organization involves developing and maintaining means to review its safety performance and confirm the effectiveness of its control of safety risks. The organization's safety performance is verified by comparing safety indicators and safety performance targets in the SMS [18].

Safety promotion in the organization includes developing and implementing a safety training program to ensure that the staff is trained and competent to perform SMS responsibilities. The scope of safety training should be appropriate to individuals' involvement in SMS [19].

All these aspects should consider sustainable development goals (SDGs), such as safe, affordable, accessible, and sustainable transport systems [20].

The term "resilience" originates from the Latin term "resilire," denoting the action of bouncing back or leaping [21]. Resilience is applied to many areas and has various definitions. Fiksel describes resilience as an enterprise's ability to survive, adapt, and develop against turbulent changes [22]. The definition of OR can be found in international standards [23]. ISO defines it as the ability of an organization to absorb and adapt in a changing environment [24]. Organizational resilience is related to responding to threats, primarily external to the organization, especially hostility, complexity, and variability, as well as broadly understood risk [25]. A resilient organization consequently possesses long-term progress capacity and good economic condition, maintained despite changes in external conditions [26].

The literature abounds in various conceptualizations of organizational resilience, but there is a constant argument about the need to better understand the phenomenon itself [27]. An instance is the OrgRes Diagnostic Tool, developed in cooperation with the Resilience Expert Advisory Group (REAG) in Australia and Resilient Organizations in New Zealand. REAG provides advice and specialized expertise to the Australian government on the resilience of critical infrastructure. Resilient Organizations is a social enterprise committed to strengthening the resilience of organizations worldwide. Organizational resilience, in its application, is described through 3 interdependent aspects and 13 factors of resilience [28]. The three aspects that must be designed into resilient organization are leadership and culture (L&C), change readiness (CR), and networks and relationships (N&R). The aspects are divided into factors as follows:

- (1) L&C:
  - (a) Decision making;
  - (b) Staff engagement;
  - (c) Leadership;
  - (d) Situation awareness;
  - (e) Innovation & creativity.
- (2) CR:
  - (a) Proactive posture;
  - (b) Stress testing plans;
  - (c) Planning strategies;
  - (d) Unity of purpose.
- (3) N&R:
  - (a) Effective partnership;
  - (b) Leveraging knowledge;
  - (c) Internal resources;
  - (d) Breaking silos.

Leadership and culture signify the organization's adaptive capacity shaped by its leadership. Change readiness involves the formulation of plans and strategic direction to guarantee that the organization is prepared for upcoming changes. Networks and relationships refer to the internal and external relationships cultivated and nurtured by the organization to leverage when necessary.

Two approaches to achieving safety represented by an SMS through centralized control, termed Safety I by Hollnagel, seek to align and control the organization and its personnel by centrally determining what is considered safe [29]. Safety I is characterized by the minimization of adverse events implemented mainly through safety risk management. Ignorance of the probability of the occurrence, as well as the consequences (direction and strength) of its impact, creates a situation of extreme uncertainty [30], usually associated with complexity [31]. In that case, safety management through guided adaptability, or Safety II, aims to empower the organization and its members to safely adapt to emerging situations and conditions [7]. Safety II has been proposed as a paradigm shift in safety theory [32]. In our survey, Safety II means OR, and it has posed practical challenges for safety managers in their practice. OR is characterized by the maximization of desirable events, implemented mainly through the change-ready aspect (CR).

As the system matures, the organization should strive to ensure that it functions as intended and is effective. The maturation process takes time, and its main goal should be to constantly improve the level of safety. Hammer defines maturity as the systematic improvement of the organization's skills and processes to achieve the highest possible efficiency in a given period of time [33]. Maturity models were created to monitor the progress achieved by organizations as part of continuous improvement processes. A natural feature of the organization, along with the development of the management concept, has become the pursuit of perfection by improving all processes implemented in the enterprise. Currently functioning maturity models make it possible to assess the current situation in which the organization finds itself and set goals in relation to achieving subsequent levels of maturity. Formally, the concept of a maturity model can be defined as a set of various tools and practices that enable the assessment of an organization's management competences and the improvement of key factors that lead to the achievement of previously established goals [34,35]. Concerning maturity levels, they allow organizations to improve their practices, leading to a continuous process of implementing optimization and innovation [35]. There are several models used in the indicated area, which are most often created on a 4/5/6 scale of organizational maturity. They differ from each other in terms of structure, the way of conducting the assessment, the way of collecting information, and the way of measuring results, but they are largely identical in terms of the specified levels of maturity [36]. There are many types of organizational maturity models in the literature. Regarding SMS maturity, one can find safety maturity for air navigation safety [37], an integrated management system maturity [38], and, among others, occupational health and safety maturity [39]. A model for the managerial approach to risk and hazards can also be used as the model of SMS maturity [40]. It is delineated through five maturity levels. At the less mature end is the avoidant level, where managers opt to evade direct confrontation with a crisis, only taking action if exposed to a hazard, necessitating urgent measures. Otherwise, no proactive measures are taken. The next is the reactive level, where managerial responses are typically triggered by the occurrence of a hazard, accompanied by a significant escalation in its adverse impact on safety. Consequently, the potential destructive effects of the hazard's occurrence are notably high. The third level is the solving stage, characterized by a management team reacting to a hazard without attempting to predict or prevent it in advance. Despite this, the actions taken are appropriate and effectively address the encountered hazard, minimizing its potential negative impact on safety. The proactive level is the fourth, where managers recognize the enduring negative consequences of a crisis. In response, they gather relevant information, assess risks, and establish early warning systems. Specialized groups dedicated to risk and hazard management are formed. The most mature level is the interactive one, representing the most comprehensive approach.



It is proactive and advanced, evaluating hazards before, during, and after a crisis. This approach incorporates continual organizational learning and self-control mechanisms, all rooted in a sustainability framework.

As far as OR's maturity is concerned, one can present, among others, the maturity model to assess and foster the resilience of organizations [41] or the model of OR's maturity in the context of dealing with changes [42]. The latter is characterized by five organizational maturity levels. At the less mature end is the fragile level, where the organization struggles to cope with changes in any aspect. The second is the almost agile level, where the organization navigates changes but only in one aspect at a medium level or higher. The third is the fairly agile level, indicating that the organization handles changes but only in two aspects at a medium level or higher. The subsequent level is the agile level of maturity, wherein the organization adeptly manages changes in three aspects at a medium or higher level, with certain aspects taking precedence. The pinnacle of maturity is the resilient level, where the organization adeptly navigates changes in all aspects at a medium or higher level and consistently strives for improvement. In the context of this model, aspects refer to sharpness, intelligence, flexibility, and smartness.

### 3. Materials and Methods

This research employed a methodological approach consisting of four stages: (I) selection of the existing concepts of SMS and OR; (II) customization of the existing maturity models of SMS and OR; (III) preparation of assessment tools for SMS and OR (survey questionnaires); (IV) conduction of a survey of SMS and OR.

The first stage (I), the selection of the existing concepts of SMS and OR, was associated with the choice of the most convenient concept of SMS and OR for the study. It was decided to adopt ICAO's SMS concept, which provides a framework of SMS for an organization, consisting of 4 aspects and 12 factors [4,14]. The choice of this concept was its real presence in organizations, treating the ICAO concept as a good practice when implemented by the authorities of member states. For OR, we decided on the concept presented in the OrgRes Diagnostic Tool. The application delineates organizational resilience through 3 interrelated aspects and 13 resilience factors [28]. The reason for the selection was connected with the authors' familiarization with the concept in a previous study [43].

The second stage (II), customization of the existing maturity models of SMS and OR, encompasses a maturity assessment with a customized maturity model. We reviewed the existing maturity models and decided to customize the SMS model for a managerial approach to risk and hazards [40], and the OR maturity model in the context of dealing with changes [42]. The choice of these models was based on the possibility of the assessment of aspects that describe individual concepts adopted in stage I.

The SMS maturity model is depicted with the adjusted criteria in Table 1. The mean column denotes the adopted ranges of mean survey results on a 7-point Likert scale.

**Table 1.** Customized maturity model of SMS adapted based on [40].

Maturity Level	Mean	Description	Explanation
1	1.00–2.75	Avoidant safety management	The organization cannot deal with safety management in any aspect.
2	2.76–3.99	Reactive safety management	The organization deals with safety management but only with a single aspect.
3	4.00–4.99	Solving safety management	The organization deals with safety management but only some aspects.
4	5.00–5.99	Proactive safety management	The organization deals with safety management in all aspects, some aspects dominate.
5	6.00–7.00	Interactive safety management	The organization deals with safety management in all the aspects; moreover, it continuously strives for improvement and sustainability.

The OR maturity model is depicted with the adjusted criteria in Table 2. The mean column denotes the adopted ranges of mean survey results on a 7-point Likert scale.

**Table 2.** Customized maturity model of OR adapted based on [42].

Maturity Level	Mean	Description	Explanation
1	1.00–2.75	Fragile organization	The organization cannot deal with changes in any aspect.
2	2.76–3.99	Almost agile organization	The organization deals with changes but only a single aspect.
3	4.00–4.99	Fairly agile organization	The organization deals with changes but only some aspects.
4	5.00–5.99	Agile organization	The organization deals with changes in all aspects, some aspects dominate.
5	6.00–7.00	Resilient organization	The organization deals with changes in all the aspects; moreover, it continuously strives for improvement.

The third stage (III), preparation of assessment tools for SMS and OR, consisted of two survey questionnaires.

The SMS questionnaire was an author’s synthesis of the most important information regarding SMS [14,44]. It encompassed 4 aspects (safety policy and objectives, safety risk management, safety assurance, and safety promotion) and 12 factors, including management commitment and responsibility, safety accountabilities, appointment of key safety personnel, coordination of emergency response planning, SMS documentation, hazard identification, risk assessment and mitigation, safety performance monitoring and measurement, the management of change, continuous improvement of the SMS, training and education, and safety communication. In total, there were 18 questions. These questions were then selectively allocated to individual scales.

The initial step involved establishing the validity of the questionnaire. The process included assessing content, facade, construct, and nomological validity [45]. During the content validity assessment, two university employees assessed the questions to ensure their effectiveness in capturing the subject under investigation. The validity of the facade involved the expert, who identified any common errors, such as double-barreled and leading questions, in the survey [46]. The construct and nomological validity assessment utilized the statistical scale reliability analysis. The normal distribution of the variables was assessed using a Shapiro–Wilk test. The Shapiro–Wilk test showed that only 2 out of 9 analyzed variables statistically significantly deviated from the normal distribution. Additionally, in the case of one variable, the deviation was close to statistical insignificance. The predominance of variables consistent with a normal distribution ( $p < \alpha$ , with a significance level of 0.05) supported the use of parametric tests in further analysis.

All obtained results were subjected to statistical analysis using the Statistica 13 program. Statistical tests and coefficients were used, namely the Shapiro–Wilk test, Pearson’s  $r$  correlation coefficient, Student’s  $T$ , ANOVA, and Tukey’s post hoc test. Additionally, in order to check the research tool, a reliability analysis was performed using the Cronbach’s alpha index ( $\alpha$  CR).

To determine in the analysis whether there were statistically significant linear correlations between the variables (SP&O, SRM, SA, SP, SMS, L&C, N&R, CR, OR) measured at the interval scale, the Pearson  $r$  coefficient was used. The level  $* p < 0.05$  of statistical significance was adopted. If the correlation was statistically significant at least at the  $p < 0.05$  level, the correlation coefficient  $r$  had to be interpreted. In terms of strength, the

interpretation of the correlation coefficient was as follows: weak (0.20–0.30), moderate (0.3–0.6), strong (0.6–0.8), and very strong (0.8–0.99) [47].

Then, to determine whether two independent groups (SMS and OR) differed significantly from each other, the Student's *t*-test was employed. The test result was described using the parameters *t*—student's *t*-test statistics, and *p*—significance of the Student's *t*-test, with level of significance assigned as \*  $p < 0.05$ , indicating statistically significant differences.

A single factor ANOVA was used to determine whether more than two groups (ATO 1, ATO 2, and ATO 3) differed from each other in a statistically significant way in terms of variables measured at the interval scale. Additionally, using this test, it was necessary to determine which groups differed significantly from each other, and for this purpose, the Tukey's post hoc test was conducted. The level \*  $p < 0.05$  of statistical significance was adopted.

Consequently, in the SMS questionnaire the Pearson *r* correlation coefficients were employed. The Cronbach's alpha coefficient ( $\alpha$  CR) for the SMS questionnaire, with an overall value of 0.94, confirmed the questionnaire's reliability for data evaluation [44]. However, the item-total correlation varied from 0.47 to 0.91. The whole ICAO SMS framework aspects and factors were based on [4,14]. The characteristics of the research subjects and respondents are depicted in Table 3, and the whole questionnaire with all questions is presented in Table 4. In the context of the reliability of questions belonging to the individual scales of SMS,  $\alpha$  CR is presented in Table 5.

**Table 3.** Features of the research subjects.

Features	ATO 1	ATO 2	ATO 3	TOTAL
Number of respondents	9	16	11	36
Response rate	64%	57%	61%	60%
Age range of respondents	24–65	25–64	21–59	-
Average experience of responders at the company	6	5	4	-
Size of the company	Small	Small	Small	-
The SMS implementation time	2014	2009	2011	-

**Table 4.** Results of SMS questionnaire.

No.	Rated Item	Mean	SD
1.	The safety policy indicates what types of behavior are unacceptable and includes conditions for which there will be no disciplinary action used.	5.97	1.25
2.	The safety policy actively encourages reporting safety issues.	5.78	1.59
3.	All staff members (including the responsible manager) know and understand their rights and obligations in relation to accountability and safety performance of the organization.	5.69	1.06
4.	The organization has appointed a safety manager and a safety analysis board.	6.47	0.65
5.	The organization has an emergency response plan (ERP) that defines the roles, responsibilities, and actions of staff.	5.69	1.67
6.	SMS documentation is regularly analyzed and updated.	5.72	1.67
7.	A confidential safety reporting system exists in the organization that also promotes the reporting of mistakes or threats.	6.19	1.01
8.	Identification and risk assessment for serious threats was carried out in the organization corresponding with a sustainability approach.	6.06	1.19
9.	There are criteria that allow the organization to establish acceptable risk levels for identified threats.	5.69	1.39
10.	The organization appropriately documents the corrective/preventive actions taken.	6.06	0.92



**Table 4.** *Cont.*

No.	Rated Item	Mean	SD
11.	The SMS system is periodically audited to assess its effectiveness and check whether applicable standards and regulations are complied with.	6.33	0.99
12.	Conclusions drawn from safety reviews within the organization directly impact safety policies and procedures.	6.14	1.18
13.	There is a formal process for managing organizational change.	5.75	1.38
14.	A method has been introduced to monitor overall SMS results to enable continuous improvement of the organization.	5.44	1.70
15.	All staff members have received training in the organization's SMS and their roles and responsibilities regarding the SMS.	6.25	0.87
16.	The effectiveness of SMS training is measured.	5.14	1.31
17.	Safety information reaches the staff at every level in the organization.	4.89	2.04
18.	The organization's safety culture is developed, among others, by explaining specific safety activities to personnel.	5.89	1.12

**Table 5.** Scales of SP&O, SRM, SA, SP, and SMS and their results.

Scale	Item List	ATO 1	ATO 2	ATO 3	Total	$\alpha$ CR
SP&O	1–6	6.12	6.34	5.02	5.89	0.94
SRM	7–10	6.50	6.47	4.91	6.00	0.94
SA	11–14	6.28	6.57	4.64	5.92	0.94
SP	15–18	4.97	6.16	5.01	5.54	0.97
SMS	1–18	5.97	6.39	4.89	5.84	0.93

The OR questionnaire is an author's modification of the OrgRes Diagnostic Tool. It had previously been utilized by the authors in another study [43]. It consisted of 3 characteristics/aspects (leadership and culture, change readiness, and networks and relationships), and 13 factors: leadership, staff engagement, situation awareness, decision-making, innovation and creativity, networks and relationships, effective partnerships, leveraging knowledge, breaking silos, internal resources, unity of purpose, proactive posture, and planning strategies. In total, there were 26 questions. These questions were then selectively allocated to individual scales.

The OR questionnaire, similarly to the SMS questionnaire, was subject to content, facade, construct, and nomological validity. The overall Cronbach's alpha coefficient of the OR questionnaire was 0.92, confirming the reliability of the questionnaire for data evaluation [48]. However, the item-total correlation varied from 0.31 to 0.88. The whole OrgRes Diagnostic framework aspects and factors were based on [28], and the questionnaire with all questions is presented in Table 6. In the context of the reliability of questions belonging to the individual scales of OR,  $\alpha$  CR is presented in Table 7.

**Table 6.** Results of OR questionnaire adapted based on [43].

No.	Rated Item	Mean	SD
1.	The management of the company demonstrates forward-thinking, flexibility, and an entrepreneurial mindset when making decisions. This is particularly evident in times of crisis.	5.22	0.90
2.	The management team analyzes the many different options and available data before making a final decision.	4.39	1.48
3.	Employees exhibit proper motivation, directing their efforts towards attaining well-defined objectives in the workplace.	4.00	0.96

Table 6. Cont.

No.	Rated Item	Mean	SD
4.	People in our organization work on the problem until it is resolved.	5.62	1.32
5.	As an organization, we constantly monitor the internal and market situation in search of conditions for crisis situations.	5.17	1.33
6.	Employees express their opinions on the activities of the organization in order to improve its operation.	5.97	0.97
7.	Our organization can effectively make challenging decisions under time constraints, utilizing standard operating procedures (SOPs) and dynamic management approaches.	5.44	1.73
8.	We have a clearly defined contingency response cell that— if necessary—will be able to take control over the activities of the organization.	5.11	1.74
9.	The organization supports people who can think creatively and solve problems effectively.	5.53	1.16
10.	There are activities organized to promote innovation and creativity within the company.	3.53	1.48
11.	We build strong business relationships with various other organizations, both during and outside the crisis.	4.97	1.18
12.	Critical points that may hinder cooperation with other organizations are constantly monitored.	4.83	1.03
13.	If decision-makers are unavailable at the moment, we have alternative individuals who can serve as substitutes.	5.58	1.57
14.	Training programs are offered to employees to mitigate the impact of the pandemic on the organization's operations.	3.39	1.42
15.	Employees from various departments effectively cooperate with each other, exchanging ideas and information.	5.94	1.01
16.	A sense of community with other employees is a very important part of cooperation. Disputes are resolved efficiently and quickly and the atmosphere is generally friendly.	5.70	1.09
17.	The organization maintains a consistently satisfactory level of employees and resources, enabling it to effectively navigate through crises.	4.72	1.65
18.	Employees' qualifications are systematically raised and their potential developed.	4.81	1.31
19.	Coworkers have clearly defined goals and priorities during the crisis.	4.72	1.39
20.	Management actions support a sense of unity among employees.	4.08	1.68
21.	As an organization, we have selected specific areas for risk monitoring and identified corresponding indicators.	4.83	1.23
22.	The procedures within the company can be modified in order to increase the quality of management and better adapt them to the situation.	4.67	1.62
23.	Our company has contingency plans in place that will be activated in the event of different types of market disruptions.	4.36	1.55
24.	The company pursues an ideal vision of its operations, striving consistently to achieve it through its actions.	5.22	1.24
25.	As a company, we regularly review our capabilities to identify potential weaknesses.	5.03	1.40
26.	The identification of operational gaps in the system during the audit serves as the foundation for analyzing their root causes and implementing new, innovative solutions to prevent their recurrence in the future.	4.94	1.45

**Table 7.** Scales of L&C, N&R, CR, and OR and their results.

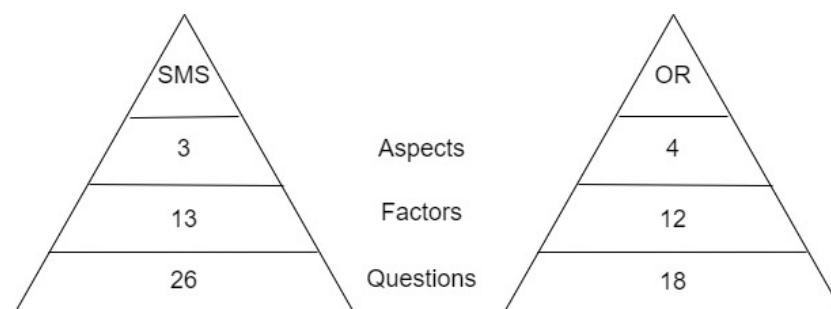
Scale	Item List	ATO 1	ATO 2	ATO 3	Total	$\alpha$ CR
L&C	1–10	5.38	5.28	4.29	5.00	0.95
N&R	11–18	4.80	5.61	4.18	5.00	0.94
CR	19–26	5.23	5.25	3.57	4.73	0.95
OR	1–26	5.14	5.38	4.01	4.91	0.91

The proposed scoring for individual response outcomes in both questionnaires utilized a seven-point Likert-type scale, outlined as follows:

I strongly disagree—1 point;  
 I disagree—2 points;  
 I rather disagree—3 points;  
 I have no opinion—4 points;  
 I rather agree—5 points;  
 I agree—6 points;  
 I strongly agree—7 points.

While the Likert scale can be considered an ordinal variable, it is possible to treat it as an interval variable under the assumption that there are equal distances between the answers [49]. Variables on an interval scale with a minimum of five degrees can be regarded as continuous variables [50]. This assumption was applied in the subsequent analyses, where quantitative methods were employed.

The structure of both SMS and OR questionnaires is presented in Figure 1.

**Figure 1.** The structure of both SMS and OR questionnaires.

The fourth stage (IV), conduction of the SMS and OR survey, took place between 1 December 2021 and 20 January 2022. The research sample consisted of 3 out of twelve local ATOs in the Greater Poland voivodeship. The division of enterprise size (micro, small, medium, or large) was made based on [51]. The ATO organizations were usually micro (1–9 employees) or small (10–49 employees). Taking into account both in-flight and ground staff familiar with SMS, the median value of potential respondents in a company was assumed to be 18. Thanks to these assumptions, it was possible to assess the population of respondents at 216. Due to the assumption of conducting an initial study, a 90% confidence level and a 90% confidence interval were established. As a result, a sufficient sample of 36 respondents was calculated [52]. Therefore, the authors considered the results sufficient in terms of quality. However, the survey has limitations described in the Section 5. The sample type used in the survey was non-probability convenience sampling due to time and cost limitations.

The survey included an accompanying cover letter outlining the survey's purpose. Participation was voluntary and anonymous, and respondents were instructed not to provide comments on the survey methodology and tools. Given the research characteristics and the regulations of the Commission on Ethics of Scientific Research at Poznan University of Technology, the study was exempt from review. Moreover, the research commenced before

the commission's appointment by the Rector's Order RO/IV/15/2022. The questionnaire targeted aviation flying and ground personnel familiar with the SMS. Due to the specific nature of aviation training organizations (ATOs), the prevailing epidemic conditions hindering direct contact, and the research scope, the authors opted for the computer-assisted web interview (CAWI) method.

#### 4. Results

The following statements describe companies' SMS and OR during the threat of a pandemic. The results of the SMS questionnaire are presented in Table 4.

The findings were analyzed in more detail to identify scales for computing SP&O, SRM, SA, SP, and SMS. These scales are presented in Table 5.

The results of the OR questionnaire are presented in Table 6.

The obtained results were further elaborated in order to find scales for calculating the L&C, N&R, CR, and OR. They are depicted in Table 7.

The overall-scale correlation ranged from 0.23 to 0.96. In terms of strength, the correlation varied from weak (0.20–0.30) to very strong (0.9–0.99), with most values falling within the moderate (0.3–0.6) or strong (0.7–0.8) interval of strength [47].

Table 8 presents the calculated Pearson  $r$  correlation results between SP&O, SRM, SA, SP, SMS, L&C, N&R, CR, and OR scales.

**Table 8.** The results of the Pearson  $r$  correlation between SP&O, SRM, SA, SP, SMS, L&C, N&R, CR, and OR scales.

Variable	SP&O	SRM	SA	SP	SMS	L&C	N&R	CR	OR
SP&O	1.00	0.92	0.89	0.67	0.96	0.33	0.39	0.44	0.42
SRM	-	1.00	0.91	0.58	0.94	0.38	0.38	0.52	0.47
SA	-	-	1.00	0.65	0.95	0.50	0.53	0.64	0.61
SP	-	-	-	1.00	0.78	0.23	0.58	0.37	0.42
SMS	-	-	-	-	1.00	0.40	0.51	0.55	0.53
L&C	-	-	-	-	-	1.00	0.77	0.80	0.91
N&R	-	-	-	-	-	-	1.00	0.80	0.92
CR	-	-	-	-	-	-	-	1.00	0.94
OR	-	-	-	-	-	-	-	-	1.00

#### 5. Discussion

The goals of the survey were achieved. The literature review outlined existing SMS and OR concepts, emphasizing key features. These insights informed the development of survey questionnaires. Based on a literature review, a maturity model of SMS and OR was devised with a customization process based on the chosen maturity models of SMS and OR. On this basis, surveys of SMS and OR maturity in ATO organizations were conducted.

Overall, the research indicated a relationship between SMS and OR aspects in ATO organizations during COVID-19.

When it comes to the overall level of SMS, it was 5.84 (see Table 5). The best results were in ATO 2 (6.39), ATO 1 (5.97), and ATO 3 (4.89), respectively. According to the ANOVA test, the overall level of the SMS in ATO 3 differed significantly from that in ATO 1 ( $p = 0.013 < 0.05$ ), and ATO 2 ( $p = 0.0002 < 0.05$ ). It seems worthwhile underscoring that there was a positive association between better implementation of SMSs and outcomes measured by the comprehensiveness of hazard prevention programs and accident rates [53]. The best results in terms of the SMS aspects were related to safety risk management (6.0), safety assurance (5.92), safety policy and objectives (5.89), and safety promotion (5.54), respectively. It can be inferred that there was indeed a subtle distinction in the aspects of SMS evaluation. Factors of safety risk management such as hazard identification, risk assessment, and mitigation are essential steps in ensuring the reliability and safety of the organizations. These procedures, in turn, lay the foundation for the design and operation of safety management systems [40,54]. In safety assurance, on the other hand, the change

management process is essential for safety performance monitoring and managing safety efficiently [55]. Safety policy and objectives include very important factors for preparing for disruption, such as coordination of emergency response planning in all organizational units. As far as SMS maturity is concerned, the overall level of the SMSs was proactive safety management (see Table 1). This means that organizations dealt with safety management in all aspects, but some aspects dominated (SRM, SA, and SP&O). However, when one takes ATOs separately, ATO 2 had an interactive safety management. This means that the organization dealt with safety management in all aspects; moreover, it continuously strived for improvement and sustainability. ATO 1 had a proactive SMS, but that of ATO 3 focused on just solving safety management. ATO 3 dealt with safety management but only some aspects (SP&O and SP).

The overall level of OR was 4.91 (see Table 7). The best results were in ATO 2 (5.38), ATO 1 (5.14), and ATO 3 (4.01) respectively. According to the ANOVA test, the overall level of OR in ATO 3 differed significantly from that of ATO 1 ( $p = 0.0006 < 0.05$ ), and ATO 2 ( $p = 0.0001 < 0.05$ ). The best results in terms of OR aspects were related to leadership and culture (5.0), networks and relationships (5.00), and change readiness (4.73), respectively. Leadership and culture have an impact on an organization's capacity for adaptation and support for decision-making, which provides insights and immediately usable solutions to manage crises [56]. Furthermore, leadership and networking denote the organization's ability to endure complex situations during shocks and revert to its pre-crisis state [57]. It can be concluded that, actually, there was a slight difference in the aspects of OR assessment. However, factors of change readiness seemed also important for building of OR in the organization [39]. As far as the OR maturity was concerned, overall companies were rated as fairly agile organizations (see Table 2). This means that organizations dealt with changes but only some aspects (L&C and N&R). However, when one takes ATOs separately, ATO 2 was an agile organization. This means that the organization dealt with changes in all aspects, but some aspects dominated (N&R and L&C). ATO 1 was also rated as an agile organization, but ATO 3 was a fairly agile organization.

Based on submitted results analysis, it can be concluded that the average SMS score was 0.93 higher than the OR score. According to the Student's *t*-test,  $p = 0.000035 < 0.05$ ; thus, average the SMS differed significantly from the average OR score. This result shows that building a safety management system that is well assessed by employees is not tantamount to building an organization that is resistant to disruptions. SMSs are characterized by minimization of adverse events implemented mainly through safety risk management aspect (SRM) consisting of hazard identification, risk assessment, and mitigation [7]; this was proved in the survey where the best results were in SRM (6.00). OR is characterized by maximization of desirable events, implemented mainly through change-ready (CR) aspects consisting of proactive posture, stress testing plans, planning strategies, and unity of purpose [42]. The worst results were visible in the survey which found relatively weak results in CR (4.73). This situation is reflected in maturity models. According to survey results, SMS had the fourth level of maturity, proactive safety management, while OR had just the third level of maturity, that of fairly agile organizations. This suggests that it is generally easier to achieve the goals of SMSs than OR. Furthermore, it should be noted that maturity scores for both SMS and OR differed from one ATO to another. This of ATO 3 was the worst, despite its earlier implementation of an SMS than ATO 1. This of ATO 2 was the best. This means that earlier introduction of systemic safety management is not a guarantee of better results. Everything depends on many factors that are hidden in the SMS and OR aspects. Thus, the organizations with higher maturity in SMS demonstrate better organizational resilience, potentially leading to improved safety outcomes. The results of maturity levels of SMS and OR for each ATO and for total ATO score are presented in Table 9.

Additionally, Pearson *r* correlation coefficients were employed. In terms of strength, the correlation varied from weak to strong, with most values falling within the moderate interval of strength [47]. Pearson rank-order correlations between SP&O, SRM, SA, SP, SMS, L&C, N&R, CR, and OR were calculated (see Table 8). The calculations revealed



mostly moderate to very strong correlations between the parameters. The results of the pairs between SMS and OR aspects were as follows: SP&O/L&C—0.33, SP&O/N&R—0.39, SP&O/CR—0.44, SRM/L&C—0.38, SRM/N&R—0.38, SRM/CR—0.52, SA/L&C—0.50, SA/N&R—0.53, SA/CR—0.64, SP/L&C—0.23, SP/N&R—0.58, SP/CR—0.37. This means that the scales were mostly moderately correlated. The overall correlation between SMS and OR was 0.53. The key features of SMS were defined by their strong similarity in goals, which is seen in the degree of complementarity observed in the OR aspects [32]. Furthermore, considering the substantial disparity in average outcomes between SMS and OR, it is advisable to view both approaches as complementary. Therefore, both components are necessary to ensure the comprehensive safety of the organization [29,32].

**Table 9.** The results of maturity levels of SMS and OR.

MaturityLevel	SMS					OR				
	1	2	3	4	5	1	2	3	4	5
ATO1				X *					X	
ATO2					X				X	
ATO3			X					X		
ATO total				X				X		

\*—assessed level of maturity.

The inherent restrictions associated with the sample size and choosing a non-probability convenience sampling method limit this study. The samples were chosen based on subjective judgment rather than through random selection. These also included population, size of company, and types of industry. Moreover, the ranges of average maturity results obtained in the adapted maturity models were conventional, so they can be treated as biased. Although this study's findings provide insights into workers' perceptions of SMS and OR aspects, they are limited to aviation. Furthermore, the tested aspects are more relevant to this sector. Thus, this study is not conclusive, and the findings can be incomplete and may not be generalized. However, the authors trust that the presented results may become the basis for initial conclusions and further research that will reduce the presented limitations. For this reason, the results of the research are particularly useful for managers and specialists dealing with safety issues in organizations.

## 6. Conclusions

Aviation was one of the industries most affected by the COVID-19 pandemic. Since safety is an important issue in aviation organizations, its management and approaches to achieving safety are crucial. Therefore, the paper aims to compare maturity of two approaches to achieving safety, characterized as safety management through centralized control (SMS), and safety management through guided adaptability (OR), identifying the relationship between SMS and OR aspects in ATO organizations. Existing research highlights the importance of both a mature SMS and OR for ensuring safety. To meet the goals, the authors (1) identified concepts and aspects of SMS and OR through a literature review, (2) customized existing maturity models of SMS and OR, (3) developed tools for SMS and OR research, including survey questionnaires, (4) assessed SMS and OR aspects in ATO organizations based on the survey with prepared questionnaires, (5) evaluated SMS and OR maturity levels based on customized models, and (6) analyzed the relationship between the maturity of SMS and OR aspects crucial for safety.

The Safety I and Safety II approaches are considered complementary. Similarly, corresponding safety management methods such as safety management through centralized control (SMS), and safety management through guided adaptability (OR) should be seen as complementary. As the research shows, the guided adaptability approach is more difficult to achieve in an organization. However, the centralized control approach is insuf-

ficient; therefore, both components are necessary to ensure the comprehensive safety of the organization.

The COVID-19 pandemic has significant implications for future safety management. This paper imparts insights into the advantages that organizations can gain by embracing the SMS and OR approaches to thrive and prosper in uncertain environments. The experience gained over the past years can play an immediate role in ensuring safety in organizations through several key strategies. (1) Organizations can utilize insights gained from past pandemics to improve and revise their preparedness plans. (2) Encouraging collaboration across various departments and functions proved crucial during previous pandemics. Organizations can institutionalize cross-functional teamwork, fostering a culture of adaptability and quick decision-making. (3) Organizations can establish systems for continuous monitoring of emerging threats. This allows for proactive adjustments for safety measures. (4) Reflecting on both successes and challenges encountered during past pandemics provides valuable insights. Organizations can celebrate what worked well and address areas that need improvement, ensuring a more effective response in the future. By integrating these lessons into organizational practices, companies can enhance their resilience, adaptability, and overall safety measures, better preparing them to navigate and mitigate the impact of future crisis.

Due to the limitations presented in the research, additional surveys should be carried out in more companies. The next important step is the development of safety management approaches for specific industries. It is important to find ways of effective coexistence of Safety I and Safety II approaches to anticipate and respond successfully to adverse events and emerging situations and finally achieve the safety of the organization during crises.

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## References

1. Taleb, N.N. *The Black Swan: The Impact of the Highly Improbable*, 1st ed.; Random House: New York, NY, USA, 2007; 366p.
2. Weick, K.E. The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster. *Adm. Sci. Q.* **1993**, *38*, 628–652. [CrossRef]
3. Rainey, D.L. *Sustainable Business Development: Inventing the Future Through Strategy, Innovation, and Leadership*; Cambridge University Press: Cambridge, UK, 2010; 674p.
4. ICAO. *Annex 19, Safety Management*, 2nd ed.; ICAO: Montreal, QC, Canada, 2016.
5. COMMISSION REGULATION (EU) No 1178/2011 Laying down Technical Requirements and Administrative Procedures Related to Civil Aviation Aircrew Pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council. Available online: <http://data.europa.eu/eli/reg/2011/1178/oj/pol> (accessed on 13 January 2024).
6. Batuwangala, E.; Silva, J.; Wild, G. The Regulatory Framework for Safety Management Systems in Airworthiness Organisations. *Aerospace* **2018**, *5*, 117. [CrossRef]
7. Provan, D.J.; Woods, D.D.; Dekker, S.W.A.; Rae, A.J. Safety II professionals: How resilience engineering can transform safety practice. *Reliab. Eng. Syst. Saf.* **2020**, *195*, 106740. [CrossRef]
8. Ewertowski, T. A Standard-Based Concept of the Integration of the Corporate Recovery Management Systems: Coping with Adversity and Uncertainty during a Pandemic. *Sustainability* **2022**, *14*, 1254. [CrossRef]
9. Alonso, J.; De Soria, I.M.; Orue-Echevarria, L.; Vergara, M. Enterprise Collaboration Maturity Model (ECMM): Preliminary Definition and Future Challenges. In *Enterprise Interoperability IV*; Part VII; Springer: London, UK, 2010.

10. Gren, L.; Torkar, R.; Feldt, R. The prospects of a quantitative measurement of agility: A validation study on an agile maturity model. *J. Syst. Soft.* **2015**, *107*, 38–49. [CrossRef]
11. Skrzypek, A. Dojrzałość organizacji—Źródła, uwarunkowania i konsekwencje. *Nowe Tendencje W Zarządzaniu* **2022**, *2*, 51–74. [CrossRef]
12. Waddington, J.G.; Lafortune, J.F.; Duffey, R.B. *Institutional Failure: Are Safety Management Systems the Answer?* Canadian Nuclear Society: Toronto, ON, Canada, 2009; p. 275.
13. Yoon, S.J.; Lin, H.K.; Chen, G.; Yi, S.; Choi, J.; Rui, Z. Effect of Occupational Health and Safety Management System on Work-Related Accident Rate and Differences of Occupational Health and Safety Management System Awareness between Managers in South Korea's Construction Industry. *Saf. Health Work* **2013**, *4*, 201–209. [CrossRef]
14. ICAO. *Safety Management Manual Doc 9859*, 4th ed.; ICAO: Montreal, QC, Canada, 2018.
15. Stolzer, A.J.; Sumwalt, R.L.; Goglia, J.J. *Safety Management Systems in Aviation*, 3rd ed.; CRC Press: Boca Raton, FL, USA, 2023. [CrossRef]
16. Łuczak, K.R. Zarządzanie Bezpieczeństwem w Lotnictwie Cywilnym. Uniwersytet Śląski. 2016. Available online: <https://www.sbc.org.pl/dlibra/publication//231668/edition/218989> (accessed on 13 January 2024).
17. Ewertowski, T.; Butlewski, M. Managerial Perception of Risk in an Organization in a Post-COVID-19 Work Environment. *Int. J. Environ. Res. Public Health* **2022**, *19*, 14978. [CrossRef]
18. Yeun, R.; Bates, P.; Murray, P. Aviation safety management systems. *World Rev. Intermodal Transp. Res.* **2014**, *5*, 168–196. [CrossRef]
19. Kešel'ová, M.; Blišťanová, M.; Hanák, P.; Brůnová, L. Safety Management System in Aviation: Comparative Analysis of Safety Management System Approaches in V4 Countries. *Manag. Syst. Prod. Eng.* **2021**, *29*, 208–214. [CrossRef]
20. The 17 Goals | Sustainable Development. Available online: <https://sdgs.un.org/goals> (accessed on 7 January 2024).
21. Zhang, Y.; Wang, W.; Mi, L.; Huang, C.; Xiao, H.; Shang, K.; Qiao, L.; Wang, L. Organizational resilience in development: A systematic review based on bibliometric analysis and visualization. *Int. J. Disaster Risk Reduct.* **2022**, *83*, 103408. [CrossRef]
22. Fiksel, J. Sustainability and resilience: Toward a systems approach. *Sustain. Sci. Pract. Policy* **2006**, *2*, 14–21. [CrossRef]
23. Ewertowski, T.; Güldoğuş, B.Ç.; Kuter, S.; Akyüz, S.; Weber, G.W.; Sadłowska-Wrzesińska, J.; Racek, E. The use of machine learning techniques for assessing the potential of organizational resilience. *Cent. Eur. J. Oper. Res.* **2023**. [CrossRef]
24. ISO 22316:2017; Security and Resilience—Organizational Resilience—Principles and Attributes. ISO: Geneva, Switzerland, 2017.
25. Ingram, T. *Odporność Organizacyjna Przedsiębiorstw Rodzinnych*; Wydawnictwo Uniwersytetu Ekonomicznego w Katowicach: Katowice, Poland, 2023.
26. Brusset, X.; Teller, C. Supply chain capabilities, risks, and resilience. *Int. J. Prod. Econ.* **2017**, *184*, 59–68. [CrossRef]
27. Van der Vegt, G.; Essens, P.; Wahlström, M.; George, G. Managing Risk and Resilience. *Acad. Manag. J.* **2015**, *58*, 971–980. [CrossRef]
28. Home-Dewar, L. OrgRes Organisational Resilience Tool. Resilient Organisations. 2022. Available online: <https://www.resorgs.org.nz/orgres-tool/> (accessed on 13 January 2024).
29. Hollnagel, E. *Safety-I and Safety-II: The Past and Future of Safety Management*; CRC Press: Boca Raton, FL, USA, 2018; 198p.
30. Świerczek, A. *Rezyliencja Łańcuchów Dostaw Jako Złożone Systemy Adaptacyjne*; Polskie Wydawnictwo Ekonomiczne: Warszawa, Poland, 2020.
31. Sadłowska-Wrzesińska, J. *Work Safety Culture: On the Edge of Chaos*; Wydawnictwo Naukowe FNCE: Poznań, Poland, 2023.
32. Ungar, M. (Ed.) *Multisystemic Resilience: Adaptation and Transformation in Contexts of Change*; Oxford University Press: Oxford, UK, 2021. [CrossRef]
33. Hammer, M. *The Process Audit*; Harvard Business Review: Brighton, MA, USA, 2007.
34. Commerce, O.G. *Zarządzanie Ryzykiem: Przewodnik dla Praktyków*; The Stationery Office: London, UK, 2010; 196p.
35. Van Looy, A. *Business Process Maturity: A Comparative Study on a Sample of Business Process Maturity Models*; Springer International Publishing: Cham, Switzerland, 2014.
36. Kosieradzka, A.; Smagowicz, J. Model dojrzałości organizacji w obszarze publicznego zarządzania kryzysowego. *Zesz Nauk Organ Zarządzanie Politech Śląska* **2018**, *128*, 217–230. Available online: <https://bibliotekanauki.pl/articles/322008> (accessed on 13 January 2024).
37. Yoon, M.G.; Kim, J.K. Evaluation methodology for safety maturity in air navigation safety. *J. Air Transp. Manag.* **2022**, *98*, 102159. [CrossRef]
38. Moumen, M.; Elaoufir, H. An integrated management system: From various aspects of the literature to a maturity model based on the process approach. *Int. J. Product. Qual. Manag.* **2018**, *23*, 218–246. [CrossRef]
39. Fertat, L.; Cherkaoui, A. Occupational health maturity by combined AHP and fuzzy comprehensive evaluation methods. *Commun. IBIMA* **2018**, *2018*, 812944.
40. Dudek, E.; Pietrzak, M. Does Deterioration of Aerodromes' Economic Situation Influence the Level of Safety in Civil Aviation? What Can Be Done to Prevent It in Line with a Sustainable Transport Systems Approach? *Energies* **2022**, *15*, 97. [CrossRef]
41. Stocker, J.; Herda, N.; Wolf, M.; Ruf, S. A Maturity Model to Assess and Foster the Resilience of Organizations. *Art. Soc.* **2022**, *1*, 1–12. Available online: <https://www.paradigmpress.org/as/article/view/329> (accessed on 13 January 2024).
42. Stachowiak, A.; Pawłyszyn, I. From Fragility through Agility to Resilience: The Role of Sustainable Improvement in Increasing Organizational Maturity. *Sustainability* **2021**, *13*, 4991. [CrossRef]

43. Ewertowski, T.; Kuźmiński, P. OrgRes Diagnostic Tool for Organizational Resilience: The Case of a Polish Aviation Company during the Pandemic. *Eur. Res. Stud.* **2021**, *XXIV*, 122–139. Available online: <https://ersj.eu/journal/2707> (accessed on 13 January 2024).
44. Management System Assessment Tool. EASA. 2023. Available online: <https://www.easa.europa.eu/en/document-library/general-publications/management-system-assessment-tool> (accessed on 13 January 2024).
45. Czakon, W. Walidacja narzędzia pomiarowego w naukach o zarządzaniu. *Przegląd Organizacji* **2019**, *4*, 3–10. [CrossRef]
46. Collingridge, D. Validating a Questionnaire. Methodspace. Available online: <https://www.methodspace.com/blog/validating-a-questionnaire> (accessed on 13 January 2024).
47. Akoglu, H. User's guide to correlation coefficients. *Turk. J. Emerg. Med.* **2018**, *18*, 91–93. [CrossRef]
48. Taber, K.S. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Res. Sci. Educ.* **2018**, *48*, 1273–1296. [CrossRef]
49. Joshi, A.; Kale, S.; Chandel, S.; Pal, D.K. Likert scale: Explored and explained. *Br. J. Appl. Sci. Technol.* **2015**, *7*, 396–403. [CrossRef]
50. Weziak-Białowolska, D. Operacjonalizacja i skalowanie w ilościowych badaniach społecznych. *ISiD Work Pap.* **2011**, *16*, 49.
51. Commission Recommendation of 6 May 2003 Concerning the Definition of Micro, Small and Medium-Sized Enterprises (Text with EEA Relevance) (Notified under Document Number C(2003) 1422). 2003, Volume 124. OJ L. Available online: <http://data.europa.eu/eli/reco/2003/361/oj/eng> (accessed on 13 January 2024).
52. Sample Size Calculator. Available online: <https://www.calculator.net/sample-size-calculator.html> (accessed on 11 January 2024).
53. Hedlund, F. The relationship between the implementation of voluntary Five-Star occupational health and safety management system and the incidence of fatal and permanently disabling injury. *Saf. Sci.* **2014**, *63*, 94–103. [CrossRef]
54. Stroeve, S.; Smeltink, J.; Kirwan, B. Assessing and Advancing Safety Management in Aviation. *Safety* **2022**, *8*, 20. [CrossRef]
55. Marzec, D. The management of change as part of the safety management system of selected civil aviation organizations. *War Stud. Univ. Sci. Q.* **2019**, *115*, 60–76.
56. Bracci, E.; Tallaki, M. Resilience capacities and management control systems in public sector organizations. *J. Account. Organ. Chang.* **2021**, *17*, 332–351. [CrossRef]
57. Bartuseviciene, I.; Butkus, M.; Schiuma, G. Modelling organizational resilience structure: Insights to assess resilience integrating bounce-back and bounce-forward. *Eur. J. Innov. Manag.* **2024**, *27*, 153–169. [CrossRef]

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