Organizational and Individual Factors on Safety Culture in Airside Operations Department at International Airport AAA in Southeast Asia

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Abstract

This case study reports on the use of an organization development approach to develop and improve safety culture in the airside operations department at an international airport. The study used an action research approach to investigate two objectives; 1) assessing the current safety culture and opportunities for improvement; and 2) implementing appropriate OD interventions (ODI) to improve safety culture. The action research process involved managers (n = 5) and staff members (n = 100) from the department, who engaged in a series of large-group and small-group interventions planned by the researcher and department managers. A pre-test/post-test quantitative survey, coupled with formal and informal interviews and observations, were used to collect data to analyze outcomes and plan future steps. The predictors of safety culture included organizational factors (management commitment, safety communication, safety training, employee involvement, and procedural compliance) and individual factors (safety beliefs and hazard perception). The findings indicated that perceptions of safety culture significantly improved following the series of interventions, as did the components of safety culture that were identified. Qualitative interviews also indicated improvement in safety culture and greater awareness of safety issues. Furthermore, findings indicated that both organizational factors and individual factors had a significant impact on safety culture. The implication of the study is that safety culture can be influenced by organization development practices, although there were limitations to the change's scope and there is a need to consider how to sustain changes in the long term. Recommendations are provided for the focal organization, industry, and academic study based on the findings.

Introduction

With global movements of about four billion passengers forecast in 2023 (IATA, 2022), safety in airline operations is a critical concern for airports. Compared to historic figures, commercial passenger aviation is relatively safe, with just four fatal accidents (48 accidents in total) occurring on scheduled commercial flights as of 2021 (ICAO, 2022). However, ground handling remains an area of safety vulnerability, with an estimated annual total of 27,000 incidents globally (Flight Safety Foundation, 2022). This global situation is reflected in Thailand, where there were no major air accidents reported in 2021, but there were 2,729 airside safety incidents across all airlines (CAAT, 2022). While this is lower than previous years, the increasing amount of air traffic as Thailand recovers from the COVID-19 pandemic (AOT, 2022) is only likely to exacerbate the safety situation. This situation makes airside operations safety a priority for Thai airports, and one which is likely to grow in significance over time.

The purpose of the research reported here was to use organization development (OD) to help improve the safety culture in the Operations Department at a Thai international airport. The airport primarily operates domestic and regional passenger flights. Its Operations Department is directly responsible for activities including coordination of airside operations, safety management, flight services, and airside services. However, it does not provide ground handling, which is instead provided by external companies who are contracted by airlines directly.

Organizational diagnosis was conducted via interviews with three senior managers, using the STAR model (Galbraith, 2016), SWOT analysis (Leigh, 2010), and SOAR analysis (Watkins et al., 2011). During the STAR analysis, it was revealed that the Operations Department does have strategic goals to eliminate safety incidents and accidents, which are paired with on-time service delivery objectives. However, a stringent hierarchical organizational structure, top-down decision-making, unclear performance management and reward systems, and lack of commitment to safety training and safety standards were all noted as problems for the Operations Department. With a year-to-date record of 90 safety incidents and accidents, including one fatal accident, there was significant concern that airside safety was now poorer than it was pre-pandemic, despite lower aircraft movements. Thus, the SWOT analysis illustrated that even though the department was highly responsive to the need for safety and had positive teamwork skills, it had not deployed safety practices due to organizational limitations and there was a lack of safety training and failure to align key personal performance objectives (KPIs) to rewards. In the SOAR analysis, it was revealed that Operations Department's managers were heavily concerned with not just improving their safety record, but also creating a culture of safety that would lead to long-term improvement of safety within the department. Thus, the problem addressed within the research was how the Operations Department could not just address immediate safety concerns, but build a long-term safety culture.

The objectives of the study included 1) assessing the current safety culture and opportunities for improvement; and 2) implementing appropriate OD interventions (ODI) to improve safety culture. The significance of the research was primarily practical, as improving safety culture could have long-term positive consequences for the safety of passengers, crew,

and Operations Department staff according to its theoretical definition (Cooper et al., 2019). At the same time, the research also has wider significance, as it suggests a path for other airports – and other safety-critical organizations – to develop their own organizational safety culture.

Literature Review

OD and Safety Culture

Studies have shown that safety culture at airports require the translation of international standards and practices into local policies and norms (Musa & Isha, 2021), as well as active employee participation in the planning practice (Murphy & Efthymiou, 2017), conditions can often be difficult to achieve in airport organizations, which tend to be highly structured and change-resistant, resulting in weak safety cultures (Leib & Lu, 2013). The practice of OD is oriented toward organizational change and may be effective at overcoming problems such as change resistance and misalignment between the organization's culture, structure, and processes (Singh & Ramdeo, 2020). There are a variety of ODIs which have been used to influence safety culture in other contexts, for example safety training interventions (Marquardt et al., 2021) and interventions designed to improve teamwork and management practices (Zuschlag et al., 2016). Organizational design processes can be used to improve alignment between organizational structures and processes (Forteza et al., 2022). Thus, there are many different opportunities to address organizational safety culture through the lens of ODI. As always, specific interventions need to be tailored to the organization's needs, resources, and goals (Singh & Ramdeo, 2020). The research methodology was therefore designed with these issues in mind.

Factors in Safety Culture

There are many factors that could contribute to safety culture, which is part of why it is a complex issue to measure (Cooper et al., 2019). This study focused on seven key factors, which were evident from the pre-intervention interviews with managers as being issues in the organization. These factors included organizational factors of management commitment, safety communication, and safety training, and individual factors of employee involvement, procedural compliance, hazard perception, and safety beliefs. These factors are defined in Table 1.

Table 1

Definitions of key factors in safety culture

Definitions of key factors in safety culture	
Management commitment	The extent to which the organization's management prioritises safety behaviours and attitudes, establishes policies and procedures, allocates resources, and communicates to reinforce safety as an organizational priority (Bosak et al., 2013).
Safety communication	Exchange of information regarding safety between organizational members (Bisbey et al., 2021).
Safety training	Organizational training on safety which helps individuals identify, mitigate, or avoid safety hazards (Ricci et al., 2016).

Definitions of key factors in safety culture	
Employee involvement	The extent to which employees are empowered to participate in organizational decision-making (Wilkinson et al., 2013).
Procedural compliance	The extent to which employees are aware of and follow established safety procedures (Leach et al., 2013).
Hazard perception	The extent to which individuals can identify potential hazards in the environment (Ma et al., 2021).
Safety beliefs	The individual's beliefs about safety, safety procedures, and assessment of safety risks (Cui et al., 2013).

Organizational factors in safety culture. The importance of management commitment to organizational safety is identified as an enabling factor in the development of an organizational safety culture by Bisbey *et al.* (2021). This importance is borne out in empirical research. Drury Barnes and Drury (2019) found that lack of management commitment influenced failure to follow safety procedures in aviation maintenance. On the other hand, another study showed that management commitment increased procedural compliance in steel plants (Tsao et al., 2017).

Communication about safety within the organization, particularly by management, is noted as an enacting behavior for organizational safety culture (Bisbey *et al.*, 2021). Several empirical studies have identified communication as a practice that can influence safety beliefs and safety awareness (Basil et al., 2013; Zuschlag et al., 2016), as well as procedural compliance and participation in safety initiatives (Boughaba et al., 2014; Zuschlag et al., 2016). On the other hand, weak safety communication could impede procedural compliance and reduce the perceived importance of safety (Passenier et al., 2015).

The position of safety training is slightly more contested than the other organizational factors. Safety training does have effects on hazard perception, safety beliefs, and other aspects of safety culture (Boughaba et al., 2014; Hedlund et al., 2016), while failing to provide safety training contributes to lower levels of procedural compliance and more accidents (Drury Barnes & Drury, 2019; Kelly & Efthymiou, 2019). Thus, training remains important even if it does not directly affect safety culture (Marquardt et al., 2021). In summary, these organizational factors are strongly associated with the development of safety culture within the organization, as well on safety outcomes.

Individual factors in safety culture. Employee involvement is related to the sense of individual control and commitment to safety which are also identified as enabling factors for safety culture (Bisbey et al., 2021). Studies have shown empirically that employee involvement in safety, including organizational activities oriented to policy setting, is a factor in safety culture (Boughaba et al., 2014; Hedlund et al., 2016; Tsao et al., 2017). Furthermore, employee involvement may have an interaction effect with management commitment in creating safety culture (Passenier et al., 2015). Observation of safety procedures has been associated with employee participation in safety and the development of safety culture, as well as reducing safety incident rates (Behari, 2019; Boughaba et al., 2014; Zuschlag et al., 2016). However, procedural compliance on its own is not enough, as procedures can be complex, ambiguous, and poorly defined, leading to confusion or inappropriate action (Kannan et al., 2016; Martínez-Córcoles et al., 2014). Individual levels of hazard perception have also been

identified as a factor in safety behavior (Fabiano et al., 2022; Irwin et al., 2022), although it is not clear that hazard perception contributes directly to safety culture perceptions, which is one of the areas this research investigates. Individual safety beliefs are associated with procedural compliance (Irwin et al., 2022), although this may be a very weak association (Casey et al., 2018). In summary, there is evidence for individual factors in safety culture influencing safety practices like procedural compliance, as well as safety outcomes, but there is less evidence for their effects on the safety culture of the organization.

The literature review concluded with the conceptual framework (Figure 1) and statement of hypotheses (Table 2).
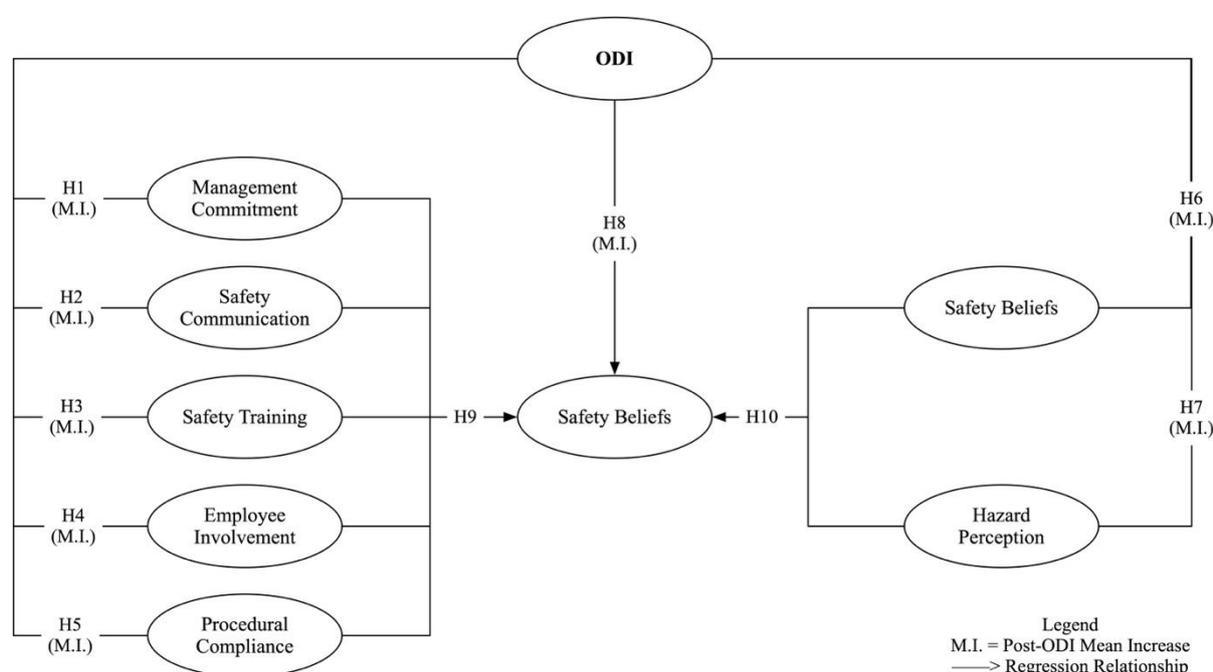
Figure 1
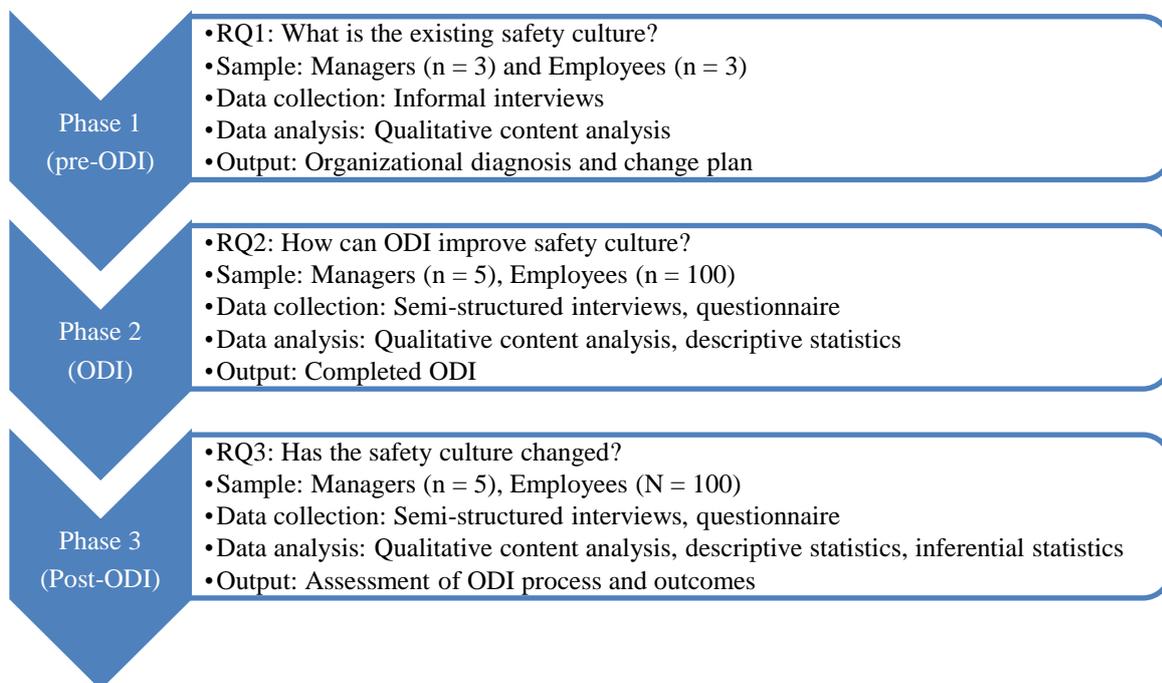
Conceptual Framework

Table 2

Hypotheses of the study

Hypothesis	Statement
1	There is a significant difference between pre-ODI and post-ODI levels of management commitment.
2	There is a significant difference between pre-ODI and post-ODI levels of safety communication.
3	There is a significant difference between pre-ODI and post-ODI levels of safety training.
4	There is a significant difference between pre-ODI and post-ODI levels of employee involvement.
5	There is a significant difference between pre-ODI and post-ODI levels of procedural compliance.
6	There is a significant difference between pre-ODI and post-ODI levels of safety beliefs.
7	There is a significant difference between pre-ODI and post-ODI levels of hazard perception.
8	There is a significant difference between pre-ODI and post-ODI levels of safety culture.
9	There is a significant impact of organizational factors (management commitment, safety communication and safety training) on safety culture.
10	There is a significant impact of individual factors (safety beliefs, employee involvement, procedure compliance and hazard perception) on safety culture.

Research Methodology

The study was designed as a three-phase action research process, using the action research cycle of Warner Burke and Noumair (2015). The study used a balanced mixed methods research design, with qualitative and quantitative data collected throughout the study and then triangulated to address the research questions (Creswell & Plano Clark, 2018). Qualitative research was used in all three stages of the research, as it enabled detailed and rich data collection. Additionally, a questionnaire was used to collect pre-ODI/post-ODI data in order to investigate changes in the factors in safety culture and contributions to safety culture after the intervention. The research phases, questions, and methodologies are summarized in Figure 2.

Figure 2

The research design

Phase 1 (pre-ODI)
- RQ1: What is the existing safety culture?
- Sample: Managers (n = 3) and Employees (n = 3)
- Data collection: Informal interviews
- Data analysis: Qualitative content analysis
- Output: Organizational diagnosis and change plan

Phase 2 (ODI)
- RQ2: How can ODI improve safety culture?
- Sample: Managers (n = 5), Employees (n = 100)
- Data collection: Semi-structured interviews, questionnaire
- Data analysis: Qualitative content analysis, descriptive statistics
- Output: Completed ODI

Phase 3 (Post-ODI)
- RQ3: Has the safety culture changed?
- Sample: Managers (n = 5), Employees (N = 100)
- Data collection: Semi-structured interviews, questionnaire
- Data analysis: Qualitative content analysis, descriptive statistics, inferential statistics
- Output: Assessment of ODI process and outcomes

Sampling

The Operations Department has a very large staff, estimated at around 8,000 people working in airside operations in total, with an estimated 5,000 people employed directly by the airport. However, the Operations Department was unwilling to commit to a large sample for the intervention process due to the resource commitment required. Instead, a small work unit of approximately 120 people (including front-line employees, managers, and support staff) was selected to trial the intervention, after which the Operations Department's management would assess whether it should be extended. Thus, the sample was based on the organization's requirements and resource commitment.

There were two groups involved in the ODI process. Managers included Operations Department top managers (n = 3) and middle managers (n = 2). Top managers participated in all phases, while middle manages participated in Phase 2 and Phase 3. Employees (n = 100) were included in all three phases as well. The employee sample was a slight reduction from the full unit, as three employees left during the intervention.

The samples were different for each phase of the research. In Phase 1 (Pre-ODI), data was collected from top managers (n = 3) for the entry, contracting, diagnosis, planning, and feedback stages of the action research cycle. After formal transition to the ODI stage, but before the intervention began, quantitative data was collected from the full sample of employees (n = 100), top managers (n = 3), and middle managers (n = 2). Additionally, employee interviews were conducted with a small sample of employees (n = 3). Following the ODI, but prior to beginning the evaluation process, quantitative data was collected a second time from employees (n = 100), top managers (n = 3), and middle managers (n = 2). Qualitative data was also collected from top managers (n = 3) and employees (n = 3).

Instruments

In Phase 1, informal interviews were used to collect data from Operations Department top managers. Therefore, there was no formal instrument used in this phase. In Phase 2 and 3, semi-structured interviews were used to direct shorter interviews about the ODI activities. Additionally, a pre-test/post-test questionnaire was used for quantitative data collection. This questionnaire is summarized in Table 2. The pre-test questionnaire and interviews were conducted prior to commencing the intervention, and thus are reflective of the pre-ODI state of the organization, although they were scheduled as part of the ODI phase.

In order to assess the questionnaire's content validity, the item-objective congruence (IOC) approach (Rovinelli & Hambleton, 1977) was used to evaluate the item scales. A panel of five experts was asked to review the scale items and specify whether these items reflected the construct; items with an IOC index of under 0.8 (indicating that one expert felt it did not reflect the construct or more than one expert was uncertain) were removed or rephrased. All items included within the scale passed the IOC scale. Therefore, they were included in the final questionnaire.

A brief pilot test was conducted during the Pre-ODI data collection at the beginning of Phase 2 (prior to the intervention). In the pilot test, 29 questionnaires were distributed to a randomly selected sub-sample of the participants. Once these questionnaires were collected, Cronbach's alpha (Cronbach, 1951) was used to assess internal consistency, using a minimum value of alpha = 0.800 (Bonett & Wright, 2015). As Table 2 shows, all scales passed this minimum value, indicating the items were reflecting a similar construct. Therefore, the questionnaire passed preliminary checks for content validity and reliability.

Table 2

Research questionnaire

Scale	Items	Alpha	Sources
Management Commitment	3	0.826	Huang et al. (2012), Tsao et al. (2017)
Safety Communication	3	0.800	Boughaba et al. (2014), Tsao et al. (2017)
Safety Training	3	0.889	Boughaba et al. (2014), Huang, et al. (2012)
Employee Involvement	3	0.878	Boughaba et al. (2014), Tsao et al. (2017)
Safety Beliefs	3	0.876	Hunter (2002)
Procedural Compliance	3	0.894	Boughaba et al. (2014)
Hazard Perception	3	0.921	Han et al. (2019)
Safety Culture	4	0.910	Cooper (2000), Guldenmund (2000)

Data Collection

For qualitative data in all phases, data was collected using interviews, including unstructured interviews (Phase 1) and semi-structured interviews (Phases 2 and 3). These different approaches were selected because unstructured interviews enable free-form exploration and detailed and thick description, while semi-structured interviews help to guide discussion and enable efficient data collection and analysis (Edwards & Holland, 2013). Quantitative data was collected at the beginning and end of Phase 2, before and after the interventions. Data was collected using a Google Forms questionnaire, which was distributed to participants via email.

The Intervention

The ODI process, which was conducted in November to December 2023, lasted a total of two weeks. The intervention activities, which began with a kick-off meeting and closed with a final meeting, is summarized in Table 3. This summary also includes the researcher's observations and recommendations about the intervention process and outcomes.

Table 3

Intervention activities and observations

Intervention	Objectives	Participants	Key Activities	Observations and Recommendations
1. Pre-implementation management meeting	Identify needs Set intentions Provide information on safety culture	Management	Introduction Supplementary information Review of activities and schedule Question session	Managers were very positive about the project, although some activities needed to be rescheduled to prevent interference with operations.
2. Kick-off meeting	Present intervention Explain expected outcomes	Management Employees	Introductions Small-group icebreaker activities	Participant groups developed personal definitions of safety culture and brainstormed on which safety issues should be addressed. There was some

Intervention	Objectives	Participants	Key Activities	Observations and Recommendations
	Encourage employee engagement		Brainstorming workshops Summary discussion	awkward communication between managers and employees, who were not used to collaboration. It was recommended that managers should address communication.
3. Safety perception development	Develop safety perceptions collaboratively	Managers Employees	Group analysis of safety situation Small-group exercises on safety and hazard perception	Participants successfully analyzed safety situations and reflected on safety beliefs and hazard perception. However, management-employee communication continued to be a challenge. Workshop communication practices were modified to encourage employee participation. Specifically, question cards were introduced to lessen reluctance to ask questions and participate in the workshop.
4. Safety culture workshops	Promote discourse on safety culture and the meaning of safety in the organization	Management Employees	Reflection and discussion on Operations Department safety culture	Safety culture workshops were conducted in five small groups (five managers and 20 employees per group). Most workshops had useful discussion on safety culture, with the question cards contributing to a greater willingness to ask questions.
5. Safety issue workshops	Promote awareness of safety issues and develop collaborative solutions	Management Employees	Facilitated roundtable discussion on Operations Department safety issues Small-group problem-solving on key safety issues	Safety culture workshops were conducted in two small groups (five managers and 20 employees per group) and signup was optional. The first half of the informal safety culture workshop was a role-play activity, in which small groups re-enacted real life safety incidents and evaluated what happened and what should have happened. In the second half of the workshop, participants came back together to discuss what the roleplay activities suggested about safety culture, what the key issues were, and how these could be changed. Key issues were reluctance to call attention to errors out of fear of blame and a perception of management indifference.
6. Small informal workshops	Encourage collaborative problem solving	Management Employees	Roundtable discussion	Informal safety workshops were conducted in groups of 10-12, and attendance was optional.

Intervention	Objectives	Participants	Key Activities	Observations and Recommendations
	Brainstorming process changes to improve safety			The first half of each workshop was devoted to discussion to identify the five biggest safety issues. The second half of the workshop was a small-group problem-solving activity, in which groups of five participants each developed a creative solution to one problem.
7. Management communication	Reinforce management commitment to safety culture Setting safety expectations Recognising wins	Management	Formal communication Informal communication	Regular management communication on safety was implemented during the training process. This communication included formal communication (emails from top management) and informal communication (ad hoc communication from line managers and supervisors). The formal communication worked well and resulted in many more communication points during the week. However, informal communication varied between managers, raising the possibility that there is a need for more management training on effective communication.
8. Closing meeting	Conclude the ODI Cement change Present next steps	Employees Management	Recap of process and outcomes Recognition of the outcomes and work put in Introduction of planned next steps	Overall response was positive, but there is a need to follow through on the change in order to 'cement' these changes to safety culture.

Data Analysis

Qualitative content analysis (QCA) was used to analyze qualitative data for all stages. QCA was selected because it enables both data reduction and interpretation of textual sources (Mayring, 2022). Quantitative data analysis was conducted in SPSS. Analysis including descriptive statistics and regression analysis (to address Hypotheses 9 and 10) was conducted separately for the pre-ODI and post-ODI data. Paired t-tests were used to investigate significant mean differences between the pre-ODI and post-ODI data.

Results and Discussion

The pre-ODI Situation

Qualitative findings. Pre-ODI interviews revealed that while managers were committed to safety as a departmental priority, the hierarchical organizational structure and limited power outside the department meant that safety was often not the first priority. Safety communication was very limited, with a strong assumption that employees "knew what to do", and only had to follow written policies and procedures, which were the main route to communication. Safety training was also limited, with little access for most line employees outside legally mandatory training. Thus, in terms of organizational factors in safety culture, there was an awareness that safety was an issue, but this was not followed through to enabling mechanisms (Bisbey et al., 2021) for safety culture.

Individual factors were even more limited. Employee involvement was limited to procedural compliance. As one manager noted, employees could make safety suggestions to their supervisors, which might then be considered by the management team, but there was no mechanism for active or formal involvement. There was a strong belief in safety on the part of individuals, but they were less certain about what their co-workers believed. Procedural compliance was very high on a personal level, but it was recognized that procedural compliance was not enough to ensure safety. Hazard perception was also high, with the recognition that it was not enough to ensure safety. Thus, individuals felt they were engaged in appropriate enabling behaviors (Bisbey et al., 2021) but were less certain about whether there was a culture of safety.

Overall, the safety culture could be described as opaque. While safety was considered a priority, there were a lot of assumptions that "everyone knows" how to do safety. Furthermore, safety was sometimes deprioritized for other organizational safety priorities. Overall, this indicates a weak safety culture where the focus is not truly on safety. This can be explained for example through lack of alignment of the environment with the core assumptions of safety (Guldenmund, 2000) and through the lack of reciprocal interaction between the individual and the safety environment (Cooper, 2000).

Quantitative findings. The descriptive statistics of the questionnaire (Table 3) show that the overall perception of safety culture and its determinants was low. The lowest scale mean observed was for safety culture (M = 2.19, SD = 0.845), followed by employee involvement (M = 2.42, SD = 1.22), hazard perception (M = 2.46, SD = 1.178), safety communication (M = 2.56, SD = 1.15), procedural compliance (M = 2.58, SD = 1.117), safety training (M = 2.58, SD = 1.178), safety beliefs (M = 2.80, SD = 0.870), and management commitment (M= 3.00, SD = 1.11). Most of the items did not reach the mid-point in the Likert scale, indicating that participants felt neutral or disagreed with most of the statements given. Perceptions were weakest for employee involvement hazard perception, and safety culture, where participants disagreed with every statement. This supports the interviewees' perceptions that safety culture is weak, and this is reflected in organizational and individual enabling factors.

ODI Outcomes

Qualitative findings. Overall, interviewees reported improvement in safety culture, both in terms of the organizational and the individual determinants. Respondents noted that there was increased and more visible management commitment to safety, including changes such as formal and informal communication and greater resource allocation. Much more frequent communication was cited as one of the biggest changes, and positively viewed. Safety training remained a weak spot, however. While some participants acknowledged increased awareness of training, others noted that there was still limited access for operational staff. While this indicates that not everything has changed, it suggests that the organization is moving in the right direction.

Changes in individual factors were mixed. The respondents acknowledged increased invitation from management to share views, but noted there had not been real changes such as inclusion of employees on safety committees or implementation of a formal safety suggestion system. However, respondents were more aware of the need for procedural compliance and reported looking up procedures rather than relying on memory. Safety beliefs were intensified, and hazard perception did improve.

Perceptions of the organization's safety culture also improved, with a clearer idea of the position of safety in the organization. However, respondents were cautious about whether these changes would be sustained in the long term, noting that continued management support for change was needed to fully implement the changes.

Quantitative findings. The descriptive statistics highlight the increase in most attitudes and perceptions surrounding safety culture in the post-ODI period. During the post-ODI period, the highest means observed were for the management commitment (M = 4.00, SD = 0.834) and safety training (M = 4.00, SD = 0.829) scales. This was followed by safety communication (M = 3.99, SD = 0.826), employee involvement (M = 3.97), safety culture (M = 3.96, SD = 0.826), procedural compliance (M = 3.93, SD = 0.850), hazard perception (M = 3.91, SD = 0.931), and safety beliefs M = 3.50, SD = 1.05). With most items moving from the disagree to neutral range into the neutral to agree range by the Likert scale. These responses support the qualitative findings that there were improvements in the perception of safety culture, even though the results do not indicate that any of the factors were fully improved. Table 5 summarizes the hypothesis outcomes, which are discussed in detail here.

Paired t-tests (p < .05) were used to compare means of pre-ODI and post-ODI data, testing Hypotheses 1 to 8. The results of these t-tests show that there were significant differences in organizational factors of management commitment (Pre-ODI M = 3.00; Post-ODI M = 4.00; t = 11.786, p < .001), safety communication (Pre-ODI M = 2.56; Post-ODI M = 3.99; t = 15.042, p < .001), and safety training (Pre-ODI M = 2.58; Post-ODI M = 3.95; t = 13.640, p < .001). There were also significant differences in employee involvement (Pre-ODI M = 2.42; Post-ODI M = 3.97; t = 15.439, p < .001), safety beliefs (Pre-ODI M = 2.80; Post-ODI M = 3.50; t = 14.641, p < .001), procedural compliance (Pre-ODI M = 2.58; Post-ODI M = 3.94; t = 13.640, p < .001), and hazard perception (Pre-ODI M = 2.46; Post-ODI M= 3.81; t = 11.743, p < .001). Finally, there was also a significant difference in safety culture (Pre-ODI M = 2.19; Post-ODI M = 3.96; t = 19.766, p < .001). In all of these cases, the means were

higher after the ODI than they were before the ODI. Therefore, Hypotheses 1 to 8 were supported, as there were significant differences in all factors These findings supported the usefulness of the ODI process on improving safety culture by influencing both individual attitudes and organizational practices and beliefs about safety.

Finally, hypotheses 9 and 10 were tested using multiple regression. The first regression test showed that management commitment (t = 2.081, p = 0.040), safety communication (t = 3.001, p = .003), and safety training (t = 9.278, p < .001) were all significant and have positive influences on safety culture. These factors explained 98.7% of variance in safety culture (adj. R-squared = 0.987). The first regression test also showed significant and positive effects of employee involvement (t = 2.387, p = .019) and procedural compliance (t = 2.815, p = .006) on safety culture. These findings supported Hypothesis 9. The second regression test) showed that safety beliefs (t = 2.866, p = .005) and hazard perception (t = 2.049, p = .043) also had a significant effect on safety culture. These factors explained 61.8% of variance in safety culture (adj. R^2 = 0.618). Therefore, Hypothesis 10 was also supported. The tests of these two hypotheses showed that the ODI had a significant impact on safety culture and its determinants. This finding was generally consistent with previous studies presented in the literature review. It also contributed to the literature by showing that individual factors – not just organizational factors – can play a role in safety culture.

Table 5

Hypothesis results

Hypothesis	Statement	Outcome
1	There is a significant difference between pre-ODI and post-ODI levels of management commitment.	Supported
2	There is a significant difference between pre-ODI and post-ODI levels of safety communication.	Supported
3	There is a significant difference between pre-ODI and post-ODI levels of safety training.	Supported
4	There is a significant difference between pre-ODI and post-ODI levels of safety beliefs.	Supported
5	There is a significant difference pre-ODI and post-ODI levels of employee involvement.	Supported
6	There is a significant difference between pre-ODI and post-ODI levels of procedural compliance.	Supported
7	There is a significant difference between pre-ODI and post-ODI levels of hazard perception.	Supported
8	There is a significant difference between pre-ODI and post-ODI levels of safety culture.	Supported
9	There is a significant impact of organizational factors (management commitment, safety communication and safety training) on safety culture.	Supported
10	There is a significant impact of individual factors (safety beliefs, employee involvement, procedure compliance and hazard perception) on safety culture.	Supported

Organizational outcomes. The final aspect of the ODI outcome was the organizational response to the findings and how they were brought forward. The organization's managers could not commit specifically to future rounds of ODI. However, they were eager not to lose

momentum from the ODI process, and did commit to continuation of increased management commitment to safety and the safety communication program which had been set in place. Additionally, the Operations Department managers were investigating ways to extend access to safety training, particularly the optional safety training which had previously only been available to limited numbers of staff members, and to increase employee involvement in the safety process. These changes were designed to ensure that the beginning safety culture developed as part of the ODI was sustained and deepened over time. Overall, the ODI process was successful, although limited, in the perspective of what it achieved in the organization.

Conclusions and Recommendations

This research demonstrated both the usefulness and the limitations of OD as an approach to building safety culture in an international airport. Through the OD process, both managers and employees gained a sense that management was committed to safety, increased communication about safety and awareness of safety training, and began to feel an improved sense of involvement, stronger belief in the importance of safety, more concern about procedural compliance, and improved hazard perception. Overall, the safety culture at the organization was improved, with mean improvements in overall levels of both organization-level and individual-level factors in safety culture.

There is still work to be done, especially a need to improve access to and availability of safety training and developing formal mechanisms for employee involvement in safety culture. These issues could potentially benefit from some additional OD, this time focused on strategic and techno-structural changes to address the issues within the organization rather than focusing on individual processes and people. Some issues, such as uncertainty about the sustainability of the new safety culture, will simply take time to refreeze the changes made and implement them within the broader culture of the airport organization. The Operations Department's top management did recognize the need for additional training and was considering extension of the ODI at the time of writing.

Recommendations for the focal organization therefore implementation of safety training programs aimed at Operations Department non-managerial employees and continued development of formal channels for employee involvement in safety decision making. With regard to safety training programs, most employees did receive required safety training, but there was little opportunity for optional training for non-managerial employees. It is recommended that optional safety training should be opened to non-managerial employees and a system of incentives and rewards set into place to encourage its use. With regard to employee involvement, it is recommended that a safety council, which includes management and employees, could be set up to influence safety policies and procedures and promote a culture of safety. It is also recommended that before beginning these additional interventions, a management-level intervention at organizational communication would be helpful. This training should address collaboration and solicitation of employee participation, in order to improve communication skills for managers. This was noted as a challenge within the interventions, particularly the small-group interventions, and needs to be addressed before

additional ODI activities in order to improve the chances of success.

With respect to the airport sector, this research suggests that there may be a broader issue with inadequate safety culture in airside operations. This has been under-investigated in the academic literature, especially in comparison to in-flight safety culture, but it is something to be concerned about given the potential for safety incidents in airside operations. It is recommended that other airside operations departments should conduct an audit of their safety cultures and, if appropriate, should undertake their own interventions in order to improve safety culture as needed. These interventions should not be generalized from the current research, as individual organizations are likely to have their own issues, but instead should combine organizational techno-structural change and individual-level interventions such as safety training as needed.

With respect to the literature, it is recommended that more research could be conducted on the use of OD to create and sustain organizational safety cultures, particularly in organizations where safety is mission-critical and those with strong constraints in the external environment. This research would improve the understanding of both the strengths and the limitations of OD as a practice to address organizational safety culture and the development of tools that can do so effectively at the group, department, or organizational level.

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