

# Silence in Aviation: Development and Validation of a Tool to Measure Reasons for Aircraft Maintenance Staff not Reporting

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**Background and purpose:** Organizational silence, seen as the greatest obstacle to the success of organizations and expressed as a refraining from expressing feelings, and ideas about problems encountered in their organizations, is identified as the avoidance of voluntary reporting in aviation organizations. The main purpose of this research is to identify and develop a tool to measure the various reasons for aviation employees' remaining silent about the unsafe acts and events they witness, and the factors causing them to refrain from adopting safety enhancement proposals.

**Methodology:** Within the scope of the study, a data collection tool was developed. Explanatory and confirmatory factor analysis of the data obtained from 483 employees was conducted to test the reasons for not reporting voluntarily in aviation.

**Results:** As a result, it was found that employees did not participate in voluntary reporting due to factors of silence based on relational and prosocial factors, disengagement, quiescence and acquiescence, along with fear and defensiveness.

**Conclusion:** Accordingly, organizations need to acknowledge and act with the awareness that organizational silence is a common phenomenon. The importance of voluntary reporting should be explained to employees at every opportunity and the number of quality voluntary reports should be increased. However, this should go beyond the simple slogans of 'Safety comes first in this workplace' or 'Safety first' hanging on the wall of every organization.

**Keywords:** *Organizational silence, Reporting, Safety management system, Aircraft maintenance*

## 1 Introduction

Many aviation regulations are in place for the safe operation of air transport activity located at the center of the civil aviation system because air transportation offers many benefits, especially in the economic and socio-cultural areas (IHLG, 2019). However, the expected benefits of air transportation depend on the safe operation of air

transportation procedures (Doganis, 2002).

How can aviation safety be improved? There are certainly many different answers to this question, but all of these answers require information that can be used to increase safety. The new generation safety management approaches assert that employees' experience, knowledge, opinions, suggestions, and predictions have to be drawn upon to obtain information towards enhancing safety

(Jausan et al., 2017). To make such an approach work, the voices of employees are necessary (Chen, 2017). It is underlined that if such voices are scarce or absent (Morrisson and Milliken, 2000) it would be very difficult to improve safety because safety data and information cannot be obtained (Biefeld and Grote, 2012). In this case, it is important to identify factors that reduce the voices of employees and even remove them altogether. Managers and civil aviation authorities who are striving to increase aviation safety spend great effort to identify and remove the reasons for organizational silence. For aviation safety, the most important voice for employees is voluntary reporting and, without it, any new generation of safety management approaches is destined to fail (Gerde, 2015a; Jausan et al., 2017)

Despite the fact that organizational or employee silence has recently been among the topics frequently discussed in management literature, the number of studies in which this subject is discussed, within the context of aviation, has unfortunately, been limited. This studies have focused on reasons for flight personnel to remain silent (Biefeld and Grote, 2012), cockpit interpersonal dynamics (Milanovich et al. 1998) and the source of motivation for cabin staff voicing their safety concern (Chen, 2017). While it is thought that employees do remain silent and avoid voluntary reporting by not expressing safety hazards, not providing information about unsafe incidents, and not making risk mitigation proposals that are all essential for an increase of safety, yet there is no a reliable and valid tool in the literature to measure the reasons aviation employees not reporting. Despite the criticality of voluntary reporting on safety performance, little is known about why aviation employees remain silent.

In response to such research gaps, this research is aimed find the reasons behind reporting failure behaviour, which is viewed as organizational silence, of the maintenance personnel of airline companies and the Maintenance, Repair and Overhaul Organizations (MROs) in Turkey and develop a tool to measure that. Voluntary reporting covers factors that may create unsafe conditions, such as hazards and incidents that cause such incidents, their possible consequences, the probability and severity of these consequences, and risk mitigation measures. In this study, organizational silence is defined as remaining silent even though these issues are known, seen or observed.

## 2 Literature Review

### 2.1 The Relationship between Safety Management and Voluntary Reporting

The performance-based approach sees and evaluates the world as it is, which is contrary to the traditional safety

management approach that views the world as it should be (Reason, 2008). It places people in the center of the system by acknowledging that people and organizations can make errors and violate rules, and that risks cannot be totally eliminated (Karanikas & Chionis, 2019). As stressed by Reason (2008), human errors are inevitable and it is necessary to have systems to counter and capture them by 'voluntary reporting' in a 'just culture' environment. The key to this approach is that the organization proactively enhances its safety performance through real-life conditions by way of organizational learning, and finding and solving implicit organizational problems that arise in its own context (Gerde, 2015b). For this, the organization certainly needs safety data and knowledge from its own context. On the other hand we think that the shift from a culture of compliance based approach to a performance based approach may have some difficulties for some inspectors.

The management tools that apply to the performance-based approach are the State Safety Program (SSP) and the Safety Management System. The ICAO, which published its last comprehensive regulation (Annex-18) in 1984, published Annex-19 concerning 'Safety Management' on November 14, 2013, 29 years later. With Annex-19, the ICAO makes it compulsory for states to implement the SSP, and the aviation organizations to implement the SMS (ICAO, 2013a). It is necessary to have a timely, accurate and rich safety data set so that the SMS can be successfully implemented and safety performance improved (Gerde, 2015a).

The most important source of rich and qualified data that the SMS needs is employees (Liao, 2015). Voluntary reporting is the process by which employees voluntarily report safety hazards, human error and violations, incidents and their causes, and risk mitigating proposals to relevant units of the organization in order to increase safety (ICAO, 2013b). Voluntary reporting is feedback that members of the organization voluntarily provide, without any legal obligation or management pressure (FAA, 2020; SkyBrary, 2020). Mandatory reporting includes unsafe events that are required by the civil aviation authority to be notified compulsorily by service providers. The specific procedure regarding how to report about the who, what, and how questions in mandatory reporting is explained in detail by the ICAO (2013b). Civil aviation authorities, for example, are required to report accidents, near air misses, and fires during flight (Wood, 2003). New generation performance-based safety management tools cannot succeed without safety data and information; in other words, without voluntary reporting. For this reason, the ICAO requires relevant civil aviation authorities to use the voluntary reporting system (ICAO, 2013b). Such data and information provide proactivity in safety management, making it possible to identify specific contextual issues of aviation organization and to make successful predictions about future safety performance (Jausan, et al., 2017). As a result,

voluntary reporting has the potential to produce valuable information to increase safety.

In addition, being informed about incidents that do not produce serious consequences, but which are caused by the presence of safety hazards, can also produce useful information, since factors that are present in the organization regarding such incidents threaten safety, but fail to produce significant results (Liao, 2015). In other words, accidents that produce serious negative consequences and factors that cause unsafe incidents of low importance are, in fact, the same. The only difference being the degree of negativity in the outcome of the event. For this reason, having information about incidents with low-priority consequences is also crucial to the improvement of safety (FAA, 2018).

However, incidents that are thought to have had no serious consequences are not reported (Reason, 1997). Aviation organizations' awareness of accidents, of incidents that threaten safety, and of the factors that cause such incidents, is vital for the prevention of future unsafe events by taking lessons from the past. Such data and information in aviation activities can be obtained through voluntary reporting by employees (ICAO, 2013b).

## 2.2 Silence and the Concept of Organizational Silence

Silence is defined as the conscious concealment of knowledge, suggestions, thoughts, and anxiety by an individual about his/her job or organization (Morrison and Milliken, 2000; Tangirala and Ramanujam, 2008).

Employees have to make decisions regarding the explaining of their thoughts and concerns about their organization or remaining silent (Kıcır, 2018). However, it is generally observed that employees often keep information that may be valuable to an organization to themselves because they think it is safer for them not to speak, and thus they prefer to remain silent (Morrison and Milliken, 2000). This deprives decision-makers of the organization of this information when making decisions (Morrison, 2011). The phenomenon of silence can occur, not only at an individual level, but also at a group or organizational level. Silence has a contagious nature that starts at the level of individuals and then spreads to the group or organization, ending up with organizational silence (Brinsfield et al., 2009).

However, research has shown that organizational silence can degrade performance, create a potential barrier to development and innovation, and can have negative consequences at the individual/organizational level (Milliken, et al., 2003; Pope, 2019).

Organizations use a number of mechanisms to encourage employees not to remain silent and to have them point out problems or suggest solutions to these problems. This mechanism for safety in aviation organizations is the voluntary reporting system. In other words, voluntary reporting is a written feedback tool that employees use to

communicate. Employees in aviation organizations can voluntarily report incidents, unsafe acts, circumstances, conditions and the factors that cause them, and risk mitigation measures to be used to increase safety. However, employees prefer to remain silent by not participating in voluntary reporting, which is an important data source in assuring safety for various reasons and for taking necessary preventive measures (Kongsvik, et al., 2012). In this study, silent behavior is considered as not reporting voluntarily.

### 2.2.1 Types of employee silent behavior

There are variations in employee silence classifications based on employee behavior (Morrison and Milliken, 2000; Pinder and Harlos, 2001; Dyne et al., 2003). First examined by Pinder and Harlos (2001), employee silence is characterized by four different types of silence behavior (Dyne et al., 2003; Morrison and Milliken, 2000; Brinsfield, 2013), which will be further elaborated on below. On the other hand, Brinsfield (2013) has added a new dimension to previously revealed dimensions of employee silence; relational silence.

Morrison and Milliken (2000) argue that a climate of silence emerges when employees in organizations think that it is not worth the effort to talk about problems. In organizations where a climate of silence is dominant, employees think that their opinions will not be taken into consideration when they express a problem or idea, that their reports will not lead to change, and that the effort they are putting into express their thoughts is wasted; thus, they choose to remain silent (Dyne, et al., 2003). Employees who internalize the assumption that their ideas will not be considered ignore the desire to make a declaration by accepting that they will not be able to change this situation by their own efforts, remain disengaged to making any reports and prefer to accept without objection (Pinder and Harlos, 2001). Therefore, employees remain unconcerned about their organization's problems, which is reflected on the negative outcomes of the organization (Morrison and Milliken, 2000).

Underpinning another type of silent behavior is fear (Brinsfield, 2013). Propounded by Pinder and Harlos (2001) for the first time, this type of silent behavior is defined as employees remaining deliberately silent fearing being made being subject to consequences if they speak out. Based on silence, there is a fear of encountering negative consequences, such as punishment or even dismissal from the workplace (Morrison and Milliken, 2000; Kıcır, 2018). Dyne et al. (2003) argue that such silent behavior results from a wish on the part of employees to protect themselves from any possible harm.

The prosocial silence associated with organizational citizenship behavior is consciously concealed by employees thinking that they will harm their colleagues or

their organizations if they share thoughts, knowledge, and opinions about any issue within the organization (Dyne et al., 2003). In this kind of silence behavior, rather than being afraid of suffering personal harm, the employee is concerned that his/her colleagues may face negative outcomes if s/he speaks. Underlying such concealment by the employee is his/her wish to participate in some sort of co-operation with co-workers and thus, acts altruistically, without expecting anything in return (Dyne et al., 2003). Employees exhibiting this kind of behavior remain silent to protect the interests of their organizations or colleagues.

Employees prefer to remain silent if they think that their relationships will be harmed if they talk (Brinsfield, 2013). The first of such relationships is the one with managers. Employees do not want their relationship with their managers to be harmed, worrying that they will lose managerial support, or that their managers will impose various sanctions on them (Perlow and Williams, 2003). The second type of relationship is the one established with co-workers. When employees do not remain silent and speak out, they are afraid that they will be stigmatized by their co-workers as a whistleblower, troublemaker, spoilsport, killjoy, or complainer. Thinking that such perceptions would harm their relationships with their co-workers, they prefer to remain silent. Employees do not want to destroy good relationships with their colleagues (Milliken et al., 2003). In fact, employees do not talk about issues that have the potential to harm their managers or colleagues or about issues that they would not be pleased to hear themselves (Perlow and Williams, 2003)

## 3 Method

### 3.1 Population and Sample

The population of this study is composed of all the technicians, engineers, managers and maintenance planners working in aircraft maintenance organizations and aircraft maintenance units of airlines operating throughout Turkey. The main reason for choosing this study population is that maintenance personnel play a key role in ensuring safety, since the success of aircraft maintenance activities directly affects aviation safety. Another reason is that aircraft maintenance activities are extremely comprehensive, sophisticated and complex. For this reason, there are many data types and much information to be reported. If data and information subject to reporting are not reported due to silence, maintenance activities create a rich source of data for this study.

Convenience and snowball samplings are methods used in the study. In order to ensure the anonymity of the aircraft maintenance staff in the research population, and to encourage them to participate in the survey, no data was collected about the companies they were working for.

### 3.2 Data Collection

The researchers themselves developed the data collection tool. In order to create the item pool, the related scales were first reviewed. In addition, the views of academicians, recognized experts in organizational behavior and aviation safety, were consulted. As a result, an item pool of 53 items was obtained. After this, expert opinion was sought for content validity. At this stage, assistance was provided by academic staff specialising in organizational behavior, aviation safety and scale development. Between 5 January and 11 March, 2016, a total of seven experts, including three organizational behavior specialists, three aviation safety experts and one measurement and evaluation expert, was consulted through the Expert Opinion Form. For each item on this form, the experts were asked to highlight one of the following options; appropriate (keep in the data collection tool), inappropriate (remove from the data collection tool), and revision necessary (keep in the data collection tool following revision). In the case of choosing the 'inappropriate' option, the experts were asked to state their reason for so doing. The items on which the experts agreed were retained in the data collection tool, those identified for removal were dropped, and those requiring revision were revised accordingly. Finally, a 43-item data collection tool was created. A 5-point Likert-type scale was used for data collection.

To ensure the face validity of the data collection tool, the survey was piloted face-to-face with five aircraft maintenance technicians. Between 17 March and 18 April, 2016, this survey was distributed in person and via email to 1000 people using convenience sampling, with 571 of these responding. As a result, a total of 483 surveys are included in the analysis. To digitize and record the survey data, an EXCEL program was utilised. The data was then transferred into SPSS for Windows 15.0 (Statistical Package for Social Sciences) and LISREL 9.1 (Linear Structural Relations) programs.

## 4 Results

### 4.1 Sample Characteristics

Table 1 shows the demographic information of the participants. A total of 483 participants in this study. When the ages of those participating in the study are examined, it can be seen that the ratio of participants in the age group of 35 and above constitutes 31% of the total participants. When the various lengths of the participants' occupational experience are considered, it can be seen that 50% have worked for longer than five years. When the participants' age and professional experience are considered together, participants working in aircraft maintenance can be considered as experienced. It is noteworthy that, considering

their level of education, 72,3% of the participants are educated to at least an undergraduate level.

On the other hand, 174 of the participants are Certifying Staff (CS) maintenance technicians, followed by 109 non-CS maintenance technicians. Regarding their work units, 244 employees are employed in line maintenance and 164 work in base maintenance.

## 4.2 Reliability Analysis

Reliability analysis is defined as the degree to which a data collection tool produces consistent results or achieves

the same results under the same conditions (Field, 2009). For this purpose, a reliability analysis was performed according to the answers provided for the 43 Likert type questions in the study. The reliability coefficient (Cronbach's Alpha coefficient of the whole scale = .96, relational and prosocial silence .91, disengaged silence .81, quiescence and acquiescence silence .84 and fear and defensive silence .80), which was calculated for the sub-dimensions of the survey and for the whole, shows that the results have a high level of reliability. Measurements with high reliability produce observable results that are close to real results (Punch, 2005).

Table 1: Demographic and Occupational Characteristics

Variables	n	%	Variables	n	%
<b>Age</b>			<b>Gender</b>		
34 and younger	312	69.6	Female	19	3.9
35-44	83	18.6	Male	459	95
45+	53	10.8	No response	5	1.1
No response	35	7.2	Total	483	100.0
Total	483	100.0			
<b>Level of Education</b>			<b>Status of Occupation</b>		
High School	72	14.9	Unemployed	6	1.2
Associate	54	11.2	Employed in Civil Aviation	470	97.4
Bachelor's	295	61.1	No response	7	1.4
Postgraduate	54	11.2	Total	483	100.0
No response	8	1.7			
Total	483	100.0			
<b>Maintenance position</b>			<b>Maintenance unit</b>		
CS Maintenance Technician	174	36.0	Line Maintenance	244	50.5
Non-CS Maintenance Technician	109	22.6	Hangar Maintenance	164	33.9
Assistant Technician	101	20.9	Engineering Department	20	4.1
Engineer	28	5.8	Production/ Maintenance Planning	12	2.5
Other*	51	10.6	Other**	28	5.9
No response	20	4.1	No response	15	3.1
Total	483	100.0	Total	483	100.0
<b>Professional experience</b>			<b>Experience in the current organization</b>		
5 years or less	231	51.6	5 years or less	318	65.6
5-10 years	99	22.1	5-10 years	71	14.7
10-20 years	66	14.7	10-20 years	38	8.1
20+ years	52	11.6	20+ years	6	1.2
No response	35	0.6	No response	50	10.4
Total	483	100.0	Total	433	100.0

\*Component technicians, managers and warehouse staff.

\*\*Workshops and warehouses.



### 4.3 Factor Analysis

The first analytical goal in the study is to determine the factor structure by performing an exploratory factor analysis (EFA).

#### 4.3.1 Exploratory factor analysis

Before starting an EFA, certain basic concepts need to be questioned in order to be able to minimize problems that may arise and to test the suitability of the data set for the EFA (Field, 2009). As such, a number of key elements that require correct attention are sample size, Kaiser-Meyer-Olkin (KMO) and the Bartlett Test, and correlation matrix.

There are various views about an ideal sample size (Hair et al., 2010, Field, 2009). There are 43 items in this study. Considering the most conservative researchers in determining the size of the sample, 430 participants need to be accessed. The fact that we reached 483 participants in our study indicates that our sample size is sufficient.

To determine the adequacy of the data set for an EFA, KMO and Bartlett test analyses were conducted. The KMO test result was found to be 0,923, and  $KMO > 0,90$  can be interpreted as the perfect result. The Bartlett test was also significant ( $Sig. = 0,001 < \alpha = 0,05$ ). The high correlation between the variables and the obtained values indicate that the data set is adequate for a factor analysis.

Different methods are used to determine the number

of factors. The most commonly used method is Kaiser criterion. The Eigenvalue is based on continuing with factors greater than 1 (Kaiser, 1970). Another method is the scree plot graph. This graph determines the number of factors more successfully than the Kaiser criterion (Field, 2009; Thompson, 2004).

In order to obtain the best possible factor structure, more than one analysis was performed considering various criteria. Finally, it was decided that the number of factors should be four. This also coincides with the number of factors expected from the theoretical explanation of the data collection tool reported in the relevant literature.

According to the factor analysis, it appears that the items are grouped under four different dimensions. When items are evaluated in terms of not meeting the level of acceptance and factor loadings, certain items are clearly in line with other items and some items cannot meet the acceptance level for the factor load value. According to this, it can be said that these items do not sufficiently contribute to explain the variance of the latent variable (Netemeyer, et al., 2003). Therefore, the mentioned items are excluded from the analysis.

The appropriateness of the data set to the factor analysis needs to be tested after each procedure. For this purpose, KMO and Bartlett tests were performed again. A new factor analysis was performed following the removal of overlapping and low factor loadings. Starting with 43 items, the final version of the data collection tool included a total of 25 items after dropping 18 items based on the factor analyses. Table 2 shows the values of the rotated factor analysis obtained after item removal.

Table 2: KMO and Bartlett Test Results

KMO and Bartlett Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		,922
Bartlett's Test of Sphericity	Chi-square	5607,065
	Degree of freedom (df)	300
	Significance	,000

Table 3: Total Variance Explained

Factors	Initial Eigenvalues			Rotated Squared Weights Total			Rotation Squared Weights Total		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1	10.104	40.416	40.416	10.104	40.416	40.416	4.973	19.892	19.892
2	1.955	7.818	48.235	1.955	7.818	48.235	3.892	15.567	35.459
3	1.762	7.049	55.283	1.762	7.049	55.283	3.441	13.764	49.223
4	1.248	4.993	60.276	1.248	4.993	60.276	2.763	11.054	60.276
...	...	...	...						
25	0.172	.689	100.00						

After reducing the number of items, the result of the KMO test was found to be 0,922. Since KMO is >0.90, an excellent result is obtained and each variable in the measure can be predicted perfectly by other variables (Tabachnick and Fidell, 2007).

According to the factor analysis after subtracting the items that do not meet the overlapping and factor load value, the four factors obtained account for 60,276% of

the total variance. In the factor analysis conducted in social sciences, the variance explained may be between 40 and 60% (Hair, et al., 2010). Therefore, a contribution of 60,276% is sufficient in explaining the total variance of these four factors in the study. The high total variance explained suggests that the structure developed on the causes of voluntary reporting is well measured (Tabachnick and Fidell, 2007).

Table 4: Rotated Factor Matrix

Items		Rotated Factor Loads			
		Relational and Prosocial Silence	Disengaged Silence	Quiescence and Acquiescence Silence	Fear and Defensive Silence
S12	I do not want to stir up trouble with my co-worker(s) by reporting them	.776			
S27	I do not want to damage my relationships with my co-worker(s) by reporting them	.697			
S11	I am concerned about being cast out by my co-workers	.694			
S43	I do not want to stir up trouble with my manager(s) by reporting them	.681			
S23	I do not want to be stigmatized as the 'complainer' in my company/among my co-workers	.664			
S42	I do not want to reveal my company's faults and cause it to be penalized by the DGCA <sup>1</sup>	.655			
S34	I do not want to damage my relationships with my manager(s) by reporting them	.641			
S24	I do not want to reveal my company's faults and cause it to be penalized by the EASA <sup>2</sup>	.640			
S36	I do not want to reveal my co-workers' faults and cause them to be punished	.634			
S20	I do not want to waste my free time reporting		.716		
S29	I do not want to bother with learning how to report		.682		
S18	I do not think reporting is my job		.679		
S37	I do not want to waste time reporting when I do not have time for my own duties		.651		
S17	I do not think reporting will do me any good		.638		
S21	I do not know how to report		.590		
S35	I think that the issue to be reported has already been reported by someone else		.568		

<sup>1</sup>Directorate General of Civil Aviation.

<sup>2</sup>European Aviation Safety Agency

Table 4: Rotated Factor Matrix (continues)

S31	I think that previous reports have been covered up			.803	
S30	There has been no feedback on previous reports			.756	
S28	I think our managers do not encourage reporting			.744	
S22	I think our managers urging us to report is only lipservice			.726	
S19	I do not think that our managers like to hear anything negative			.573	
S2	I think the DGCA will punish me				.803
S1	I think my company will punish me				.756
S4	I think that I will face the same problems experienced by my co-workers who have previously reported				.700
S3	I do not think there is any legislation in place to protect me in case of an accident investigation				.651
<b>Mean</b>		2.479	2.162	2.612	2.484
<b>SD</b>		.852	.677	.913	.917

According to the analysis results, it is obvious that all the items meet the acceptance level of the factor load values. Analysis of basic components such as the factorization method was used to reveal factor design, and maximum variability (Varimax) was chosen as an orthogonal rotation method. The most important reason for choosing the orthogonal rotation method is that this method offers the opportunity to easily interpret, describe and report results (Field, 2009, Tabachnick and Fidell, 2007; Hair, et al., 2010).

The first factor corresponds to the dimension of relational and prosocial silence in the organizational silence literature. For this reason, this factor is called 'relational and prosocial silence'. In the study, aircraft maintenance employees not reporting voluntarily, based on relational and prosocial inclination, accounts for 19.8% of total variance. This is the strongest factor among the four factors explaining voluntary reporting. With the highest item load among all items, the item, 'I do not want to stir up trouble with my coworker(s) by reporting them' indicates that employees remain silent because they do not want to harm their relationships within their organization. The employees think that if they talk about a coworker whose behavior is the subject of the report, then the relationship with him/her will be damaged and they may be stigmatized as a snitch that constantly complains and causes harm to colleagues. Employees do not want to end up in such a problematic situation.

With high item loads, the statements, 'I do not want to reveal my company's faults and cause it to be penalized

by the DGCA' and, 'I do not want to reveal my co-workers' faults and cause them to be harmed' demonstrate that employees display prosocial behavior and thus feel forced to remain silent. In the light of this finding, it can be concluded that employees do not want to report voluntarily on matters involving their colleagues.

The second factor is labeled 'disengaged silence'. The item, 'I do not want to waste my free time reporting', had the highest load here. Employees do not see reporting as a worthwhile endeavor. In addition, the item, 'I do not think reporting will do me any good', indicates that employees display silent behavior in voluntary reporting. By performing benefit-cost analysis, Premeaux and Bedeian (2001) states that an employee will be silent if s/he thinks s/he cannot benefit by speaking up. When these two items are considered together, it is clear that the employee remains silent because he/she does not care to waste time reporting, thinking that it will not be of any use to him/her.

Since the third factor is similar to the acquiescent silence reported in the relevant organizational silence literature, it is labeled 'quiescence and acquiescence silence.' The items 'I think that previous reports have been covered up' and 'There has been no feedback on previous reports' had the highest loads among the other items. These statements and their values indicate that employees will not report when they think that that reporting matters that they care about and want to be valued will be of no use. When organizations do not act on voluntary reports or do not inform their employees about their responses to the reports, employees are led to believe that reporting will be useless.



Moreover, the employee feels worthless when failing to receive feedback from the company. Consequently, in line with findings reported by Wood (2003), employees who think that their ideas are not valued become less motivated to contribute to the safety performance of their organization by reporting voluntarily.

Finally, the fourth factor in our study corresponds to silence based on fear and defensiveness as reported in the organizational silence literature. The silence factor based on fear and defensiveness, which accounts for 11.0% of total variance, draws attention as the highest item load among all the items included in the measurement tool. Arguably, the most important factor causing silence based on fear and defensiveness is the existence of a weak positive just culture in organizations. Dekker and Breakey (2016) state that such a weak culture negatively affects reporting. This can be explained by the fact that filing a report can result in penalties for the employee, and the employee does not want to suffer such harm (Morrison and Milliken, 2000). If disciplinary system practices in an organization causes such an unfair perception of unfairness, employees' fear and worries concerning reporting will increase and the weak positive just culture will force them into silence. Employees are sometimes afraid that the information contained in a report may be used against them and that they will be penalized. Such penalties include humiliation in front of co-workers, being fined, being dismissed from work, or even losing a professional license. The fact that these survey items received high item loads can be interpreted as an indicator of such employee fears.

Another important finding of this study is that a number of the factors (relational and prosocial silence) proposed in the literature are combined, while some (disengaged silence, quiescence and acquiescence silence, and fear and defensive silence) emerge as separate factors, in harmony with the relevant literature.

### 4.3.2 Confirmatory factor analysis

Confirmatory factor analysis (CFA) is employed to test the accuracy of a previously established relationship by the researcher (Netemeyer, et al., 2003). For this purpose, in this study, firstly, a four-factor structure is obtained by EFA. In the second phase, the research aims to test four latent variables; prosocial silence, fear and defensive silence, disengaged silence, and quiescence and acquiescence silence.

#### 4.3.2.1 First-order confirmatory factor analysis

The purpose of the first-order CFA is to test whether the resulting structure of the EFA yields the voluntary reporting variable in aviation. The four-factorial structure

obtained as a result of the EFA was first tested by a first order CFA. In the first-level CFA analysis as shown in Table 5. Good fit index values correspond to a good fit (Thompson, 2004). The goodness of the GF values can be interpreted as being appropriate for the aggregated data on the model being tested for the reasons for failure to report voluntarily.

#### 4.3.2.2 Second-order confirmatory factor analysis

In the first-order CFA, four dimensions came together to form the voluntary reporting variable. However, the 'Failure to Report Voluntarily' variable was not included in this analysis. By adding this variable to the model, the second-order CFA was performed to see whether the four factors (latent variables) obtained after the first-order CFA explained the 'Failure to Report Voluntarily' latent variable.

In the first-order analysis, the four factors that can be seen as relatively independent, but interrelated, bases are components of the 'Failure to Report Voluntarily' latent variable, which is meant to be a higher level structure. One-way linear relationships are defined for latent variables from the variables observed in the first-order analysis. One-way linear relationships are also defined in the direction from the observed variables to the observed variables in the second order analysis. One-way linear relationships demonstrate that latent variables predict observed variables. The results of second-order CFA are shown in Figure 1.

According to the goodness of fit indices obtained after the retest, the four-factorial structure was accepted as adequate to explain the latent variable 'Failure to Report Voluntarily in Aviation'. In other words, the reasons for the lack of voluntary reporting by aircraft maintenance workers were tested by second-order CFA, and it was concluded that the four latent variables together create an absence to report voluntarily in aviation.

At this stage of the analysis, each goodness of fit value will be examined, and the relationship of the four latent variables with the silence in aviation variable will be tested. When the relevant goodness of fit values is analyzed, it clearly corresponds to a good fit (Thompson, 2004).

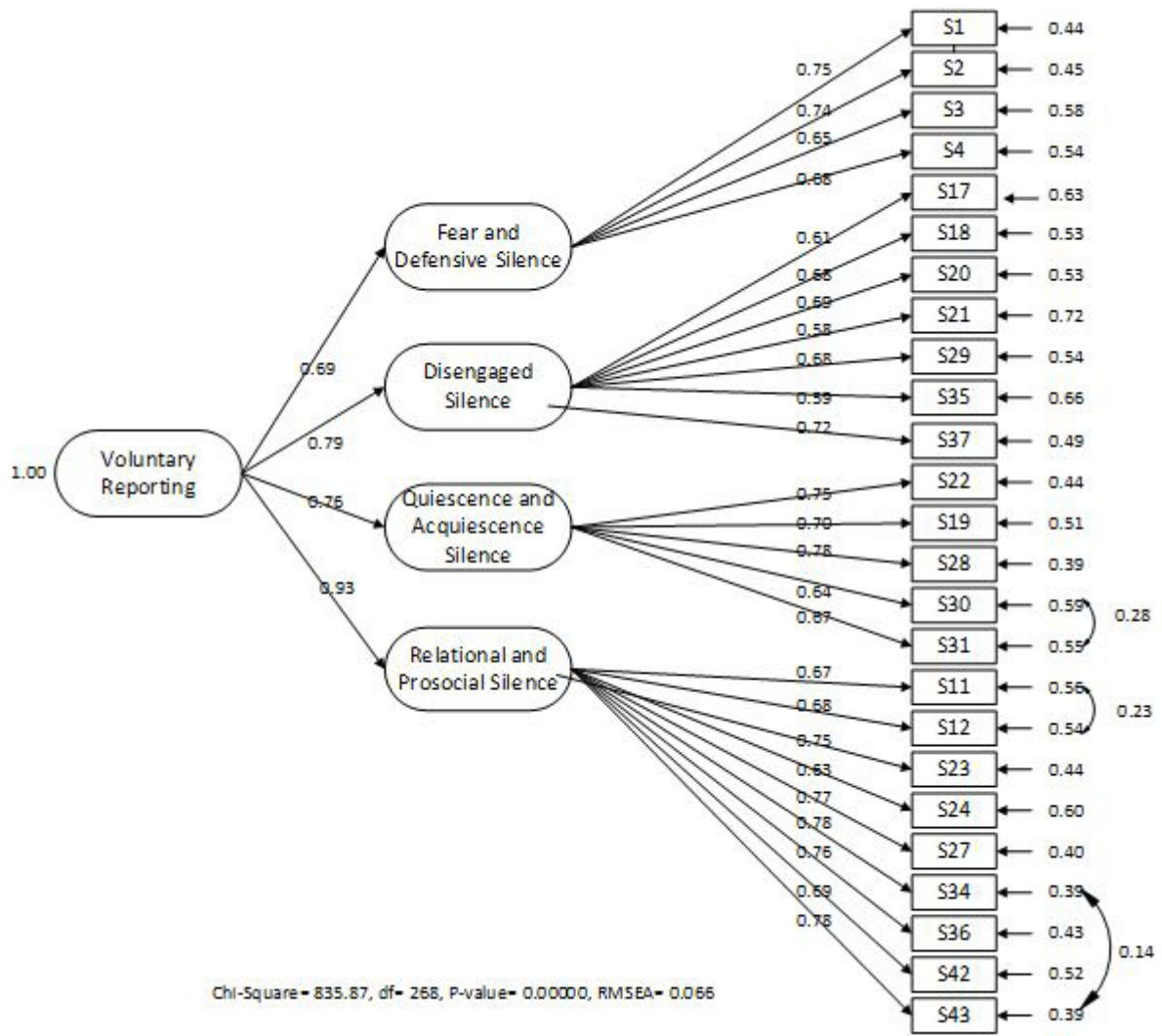


Figure 1: Second-order Confirmatory Factor Analysis (The values in the figure are standardized coefficients)

Table 5: Goodness-of-Fit Values Obtained from the First-order and Second-order Confirmatory Factor Analysis

Model No.	N	Chi-square/df	GFI	AGFI	CFI	NNFI	RMSEA	RMR
First-order CFA	483	3.04	0.87	0.86	0.97	0.96	0.06	0.07
Second-order CFA	483	3.11	0.87	0.85	0.97	0.96	0.06	0.06

To sum up, the four-factorial structure, resulting from the EFA, was first tested by first order CFA. Second-order CFA was performed after the first-order analysis and the relationship between the four-factorial latent variable and the 'silence in aviation' latent variable was tested. The second-order factor analysis shows that the four latent components explained the 'failure to report voluntarily' variable on the basis of relational and prosocial silence, disengaged silence, quiescence and acquiescence silence, and fear and defensive silence.

## 5 Discussion

With the developed data collection tool, the collected data were first subjected to EFA and a four-factorial structure was obtained. The obtained four-factorial structure was tested in a model created by first-order CFA and it was concluded that the 25 observed variables explain the latent variables of relational and prosocial silence, disengaged silence, quiescence and acquiescence silence, and fear and defensive silence. In the second order CFA, voluntary reporting was accepted to be measured with four latent variables, and was assembled into a holistic model. Based on the obtained goodness of fit values, it was concluded that the 'Failure to Report Voluntarily' latent variable was explained by the four latent variables.

According to the results of our study, the relational and prosocial silence is the primary factor among the factors that lead to aircraft maintenance employees' exhibiting silence behavior and their lack of voluntary reporting. The fear of harming relationships, the anxiety of becoming a wet blanket in the group, the fear of getting stigmatized as a whistle-blower, the risk of being perceived as a troublemaker and a complainer force employees into silence (Milliken et al., 2003). In addition, it can be argued that, the high femininity and collectivism characteristics of the Turkish culture (Göregenli, 1997) may be playing an important role in such employee silence. In societies where collectivism is dominant, people remain loyal to their communities throughout their lives, and the social relationships have to be good (Hofstede, et al., 2010). Deterioration of relationships is avoided because it causes individuals to feel stressed. Therefore, collectivist traits lead employees to prosocial behaviors by making them care about other people and try to prevent harm to the organization or group they belong, which ultimately keeps them from reporting voluntarily. Notifying authorities about coworker faults through voluntary reporting corresponds to whistleblowing and sycophancy, which are not approved by the larger society (Çakıcı, 2010). Besides, the teamwork required for aircraft maintenance and the fact that these teams are composed of small groups results in revealing which employee knows or reports what, and thus in the event that a worker reports voluntarily, s/he knows that s/he will be easily

figured out as the person doing the reporting. As another characteristic of the Turkish culture, employees view reporting, which is to cause trouble for their organization, as biting the hand that feeds them, something clearly frowned upon by the mainstream society.

In our study, another factor causing employees not to be involved in voluntary reporting is the disengaged silence. It was concluded that, employees display selfish behaviors (Premeaux and Bedeian, 2001), and after doing a benefit-cost analysis between silence and voluntary reporting, if they decide that remaining silent would be more advantageous, they may prefer staying quiet even if the safety is threatened. On the other hand, psychological contract violations and procedural injustice in organizations cause employee disappointment and cynicism. Experiencing such disappointment, employees exhibit cynical behaviors (Özgener, et al., 2008), which leads employees to remain silent based on disengaged. In addition, employees' not knowing how to report, or their lack of motivation to spend time learning how to do it indicates that they are disengaged to reporting.

Another factor negatively affecting employees' voluntary reporting is the acquiescence and quiescence silence. Based on the findings from the present study, which confirm other related research, the reason underlying this silence is the belief held by employees that their opinions do not count and that they cannot make a difference or change anything by reporting (Wood, 2003). According to the Turkish values survey conducted throughout Turkey between 2011 and 2012, Turkish employees believe that they have to follow the orders given by their superiors whether they make sense or not (40% of the participants stated that the instructions must be followed). This rate is 10% higher than the average found for Europe. In other words, the tendency of employees in Turkish society to fulfill orders without question is higher than the European average (Esmer, 2012). These findings indicate that employees in the Turkish society are obedient, that they do not feel the need to make extra effort to make reporting work, and that they accept the situation more easily.

The motivation underlying the quiescent and acquiescent and disengaged silences can be explained by Vroom's Expectation Theory. According to Vroom, if certain behavior helps a person attain desired results, or leads to undesired results but the outcome is predicted to be more positive, s/he tends to exhibit certain behavior with a positive attitude. If employees keep getting positive results when they express their opinions clearly, it seems reasonable to assume that the value they attach to reporting will increase and that they will repeat their reporting behavior. However, if employees face adverse outcomes due to reporting, their reporting behavior may become less frequent. By trying to predict the benefits and losses depending on their reporting, employees carry out a cost-benefit analysis. This analysis could indicate a future benefit or cost involved in

reporting. Therefore, it can be argued that the aforementioned dimensions of silence may be influenced by this analysis (Premeaux and Bedeian, 2001).

The last factor that led to the absence of voluntary reporting in the survey is fear and defensive silence. It has been emphasized in many studies that employees remain silent based on fear and defensiveness (Morrison and Milliken, 2000; Dyne et al., 2003; Brinsfield, 2013). Maslow's Hierarchy of Needs Theory (1943) can help to explain the motivation source of fear and defensive silence. According to this theory, the behavior of an individual is directed towards satisfying a need, within an order of hierarchy. One of these is a need for safety. Safety refers to protection from physiological and psychological harm. It is an important necessity to have work and regular income so that people can meet their needs and feel safe. Aircraft maintenance personnel may feel threatened by the risk of losing their jobs or licences. If reporting is likely to produce such consequences, employees who need to feel safe may avoid reporting (Schepers, et al., 2008).

Perhaps counter-intuitively, the factor comprising items with the highest item loads in all factors makes less of a contribution to the total variance than the relational and prosocial silence. One factor that causes this situation could be the collective characteristics of Turkish culture. Combined with its collectivist characteristics (Hofstede, et al., 2010), the individual characteristics of Turkish culture (Göregenli, 1997) may have resulted in this type of more relational and prosocial employee silence. The individual characteristics of this society may mean that, taking into account personal interests, the employee remains silent in order not to strain his/her relationships with co-workers or managers. On the other hand, a majority of previous research indicates that the most important factor leading to a failure to voluntarily report by employees is fear (Jausan et al., 2017; Bienefeld and Grote, 2012; Gerede, 2015b). Our study finds that employees remain silent, based on fear and defensiveness.

## 6 Conclusion and suggestions

In aviation organizations, employees' preference of reporting critical information about incidents or remaining silent about them can determine the fine line between life and death. Employees' silent behaviors can threaten aviation safety and cause irreparable accidents. Reporting is also the basis of proactivity and without reporting the performance based safety management approach cannot succeed.

Therefore, in order to encourage voluntary reporting that would provide very valuable data for increased aviation safety, identifying why employees remain silent is an urgent research problem. This study aimed at determining the reasons for the behaviors of not voluntarily reporting

and remaining silent displayed by the employees working in aircraft maintenance organizations, which are the key hubs of the activities directly affecting aviation safety. To achieve this, we developed a tool to measure reasons aviation employees not reporting and made validity and reliability analysis. The four-factor structure of the failure of aircraft maintenance employees to report based on relational and prosocial, fear and defensive, quiescence and acquiescence, and disengaged silence was found to be structurally valid.

Accordingly, organizations need to acknowledge and act with the awareness that organizational silence is a common phenomenon. The importance of voluntary reporting should be explained to employees at every opportunity and the number of quality voluntary reports should be increased. However, this should go beyond the simple slogans of 'Safety comes first in this workplace' or 'Safety first' hanging on the wall of every organization. Organizations absolutely need to embrace the strong just culture. In the presence of such a positive just culture, when employees want to report, they will be free from any fear of punishment or harm.

Although this study has contributed to the knowledge of organizational silence and voluntary reporting literature, it still has certain limitations. Therefore, further research is recommended to strengthen the findings. In some cases, even if legal mechanisms and voluntary reporting systems created in organizations are sufficient for employees to speak or voluntarily report, employees could prefer to remain silent. It would be interesting to investigate how organizational trust, organizational justice, national culture, organizational culture and laws system effect voluntary reporting. In addition, the tool developed in this study has only confirmed on aircraft maintenance employees and both EFA and CFA is conducted to the same sample. In future studies, confirmation of the tool could be done on other aviation employees rather than only aircraft maintenance employees to strengthen the results. Finally, this research is conducted on MROs operating in Turkey. Further research would be to test the robustness of this tool in other countries.

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**Molk v letalstvu: razvoj in validacija orodja za merjenje razlogov, da osebje za vzdrževanje letal ne poroča**

**Ozadje in namen:** Organizacijski molk, ki je često največja ovira za uspeh organizacij, se kaže kot izogibanje izražanja čustev in idej o težavah, s katerimi se srečujejo njihove organizacije. Opredelimo ga lahko kot izogibanje prostovoljnemu poročanju v letalskih organizacijah. Glavni namen te raziskave je opredeliti in razviti orodje za merjenje razlogov, zaradi katerih letalski uslužbenci molčijo o nevarnih dogodkih in dogodkih, ki so jim priča, ter dejavnikov, zaradi katerih se vzdržijo sprejemanja predlogov za izboljšanje varnosti.

**Zasnova / metodologija / pristop:** V okviru študije je bilo razvito orodje za zbiranje podatkov. Pojasnjevalna in potrditvena faktorska analiza podatkov, pridobljenih od 483 zaposlenih, je bila izvedena za preizkus razlogov za prostovoljno poročanje v letalstvu.

**Rezultati:** Posledično je bilo ugotovljeno, da zaposleni niso sodelovali pri prostovoljnem poročanju zaradi dejavnikov molka, ki temeljijo na relacijskih in prosocialnih dejavnikih, razdruževanju, mirovanju in popuščanju ter strahu in obrambnosti.

**Zaključek:** V skladu s tem morajo organizacije priznati in delovati z zavedanjem, da je organizacijski molk pogost pojav. Pomen prostovoljnega poročanja je treba zaposlenim razložiti ob vsaki priložnosti in povečati število kakovostnih prostovoljnih poročil. Vendar bi to morale presegati preprosta gesla „Varnost je na prvem mestu na delovnem mestu“ ali „Varnost najprej“, ki visi na steni vsake organizacije.

**Gljučne besede:** *Organizacijska tišina, Poročanje, Sistem varnega upravljanja, Vzdrževanje letal*