

## Comparison of Various Safety Management Systems and Perceptions of Safety Management and Safety Culture in Pakistani Aviation Industry

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### Abstract

This research used industry based survey data for assessing employees perceptions regarding safety culture and safety management specific to aviation industry. Results highlighted that for ensuring safety organizations are of the view that employee's responsibilities towards safety are more essential than to implement safety management system (SMS) effectively and to inspire positive culture towards safety. Research results indicated that engineers involved in aircraft maintenance seemed to be more committed to standard operating procedures (SOPs) and effective organizational procedures/processes in ensuring maintenance system tasks and work. Amusingly, flyers viewed luck as important contributing factor towards safety. Generally, the findings propose the several aviation industry sectors need to do a lot more for ensuring improvement in existing safety culture.

**Keywords:** Aviation; Safety culture; Safety management system (SMS); Luck and safety

### Introduction

According to Ramanujam [1] in numerous ways aviation industry is like other technological advanced, high risk, and closely attached organizations which are working with the vision that 'accidents are inevitable'. Moreover 1980s and 1990s accident investigation reports have provided the road of research for connection between accidents and organizational safety management processes [2-4]. For example, National Transportation Safety Board [5] accident inquiry report of Continental Express Embraer 120 has highlighted that careless approach in hanger clearly indicates that administration did not create an effective and efficient safety orientation for their workers [5]. Therefore emphasizing the requirement to explore other logical, systemic causes that add on to occurrences, mishaps and accidents which corresponds to human error. Practices adopted by organizations which affect the safety systems reliability and performance are the techniques in which safety is ensured in aviation industry: which may lead to either 'safe' or 'careless' safety culture [6]. Safety culture features normally exists in collective organizational behavior of precaution, care, responsibility and concern [7]. Moreover, same safety culture features should be prominent in senior management commitment towards safety [8]. It is also found in the environment which is cordial for sharing important and vital information is also known as 'informed culture', whereas, in 'reporting culture' employees are willing to inform their mistakes, faults, failures and near misses. Moreover, in 'just culture' employees have the faith and trust on their organization and management that they will be dealt impartially and justly [6].

### Safety Management Systems and Safety Culture

Safety management systems in aviation organizations are designed with the understanding that there will always some unsafe acts or safety violations: one of the essential components to ensure safety is to recognize, identify, isolate and manage risks before they results in an accidents. Safety management system effectiveness depends upon how well it is merged in the organizational structure 'the ways in which tasks are accomplished'. Process of safety culture is an ongoing process. Same is created, adopted and ensured as permanent organizational feature. In safety literature of regarding high technological and high risk organizations including aviation industry safety management systems association with safety culture has been argued at length.

Controlling and monitoring authorities are also keen to observe the safety management systems, and safety culture role and their results in ensuring safety. For example, Civil Aviation Authority, United Kingdom [9], has recognized the importance of safety management system and adopted as a methodical, logical risk management linked with flight safety, ground safety and aircraft maintenance to attain higher safety standards. Likewise, Pakistan Civil Aviation Authority is taking measures to enhance flight, ground and maintenance safety standards in aviation industry, as a consequence of concerns raised from 2014 and 2016 'Towards 2017' safety forums. This research highlights the findings of aviation industry in a broader spectrum on how safety is ensured and accomplished in the aviation industry [10]. This research does not offer a comprehensive description of activities related to technicalities of aviation safety. However, this research offers an outline of processes adopted by organizations which affect safety. Specific intents of this research are to evaluate organization's approach towards safety management, to assess safety management systems and safety culture in organizations and also to draw comparison between various safety systems adopted by various countries.

### Safety model by professor James Reason

NASA has adopted the safety model of Professor Reason [6]. He identified the four critical sub-components which interact to create an "Informed Culture", namely a positive Safety Culture that effectively shares information throughout the organization and actively seeks maximum safety. The four key elements (or 'sub-cultures') are defined by Reason as under:-

1. An org climate where people readily report problems, errors and near misses.

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2. An atmosphere of trust where people are encouraged, and even rewarded, for providing safety-related info; and it is clear to everyone what is acceptable and an unacceptable behavior.
3. A culture that can adapt to changing circumstances and demands while maintaining its focus on safety.
4. The willingness and competence to draw the right concl from its safety info and the will to implement maj safety reforms.

### Safety Management Strats<sup>1</sup>

Following safety management strats are being envisioned and practiced in the world:-

1. **Reactive (present):** Respond to the events, which have already occurred i.e. accidents and incidents.
2. **Proactive (present):** Actively seeks the identified of hazardous conditions through analysis of the organizational processes.
3. **Predictive (future):** Analyze sys processes and convert to identify potential future problems.

### Relationship between Safety Interferences and Trends

Before analyzing the safety management concepts, it is important to understand the relationship between safety interference and its effects on ground. Whether and till what extend the safety interference can help towards reduction of accidents. ~~Based~~ Based on the data availability since late 1950s, it can be reasonably conclusion that the worldwide accidents rate (included commercial, general and even Armed Forces of the world) among diverse types of flying conditions have dropped impressively. The fact indicates that all aspects of Aviation have benefited from efforts aimed at making the skies safer. However, given the rather dramatic changes evident in accident record, experts believe that it is doubtful that any single intervention was responsible for decline in accident rate. Rather, it is likely the result of variety of factors like advancements in tech, equipment operating procedures and training practices to understand how various interventions have improved Aviation Safety. However, it is an established fact that worldwide accident rates have reduced significantly across all type of diverse flying conditions in relation with the safety interferences undertaken from time to time.

### US Navy Experience<sup>3</sup>

Accident trends in the US Naval Aviation/Marine Corps provide a better insight towards the safety interferences and their effects towards arresting the negative trends in safety and accidents. Several of the safety initiatives within the context of Naval Aviation have been superimposed on the annual accident rate as below. Shappell and Wegmann<sup>3</sup> believe that despite other factors, there is literal question among naval experts that these intervention played a significant role in the level of safety currently enjoyed by the US Navy/Marine Corps. US Naval Aviation proudly incorporates the graph below in all pub reviews of accidents/mishaps to reflect the safety interferences undertaken and their effects as under:-

- a. Early to mid-50s - development of angled carrier deck aboard naval ac carriers.
- b. Year 1951 - established of Naval Aviation Safety Centre. For first time, major Command in US Navy was assigned the sole responsibility/authority for monitoring and regulating safety issues in the fleet. Aviation Safety thus elevated to the highest level, as the Safety Centre reported direction to the Chief of Naval Ops.
- c. Mid 50s - established of squadron safety program, which included the development of aircrew coordination training and implementation of a periodic human factors review of fleet aviators, which contributed significantly to Naval Aviation Safety by identifying problems and hazards before they result in accidents.
- d. Year 1959 - formulation and implementation of Naval Aviation Maintenance Program.
- e. Early 1960 - the Replacement Air Group concept was created, requiring pilots to receive specialized training on advanced aircraft before flying in the fleet.
- f. Most recently, the established of improved squadron safety program, crew recourse management (CRM), op risk management (ORM) and implementation of periodic human factors review have all contributed significantly to Naval Aviation safety by identifying problems and hazards before they resulted in accidents.
- g. As the interferences placed are getting matured, a much lower rate of accidents are observed after 80s, where initially the plateau is achieved and accidents are in process of continuous reduction with every coming year.
- h. If the rate of major accidents today is still at level observed in year 1950, over 800 aircraft of US Navy would have been lost in year 2000 alone.

### Hel Accidents US/World Experience

Although civil helicopter sector does not have much parallel with the nature of military employment, however, is useful to strengthen and believe that planned interferences through safety measures lead towards improvements in safety standards and consequently towards reduction in the accidents. After establishment of Intl Hel Safety Team (IHST)<sup>4</sup> in year 2005 and 10 years coop efforts by the helicopter industry and government safety experts to reverse a negative trend and improve Aviation safety, accident rates have reduced significantly. Prior to establishment of IHST, worldwide civ helicopter accident was rising at rate of 2.5 percent per year. Since 2006, worldwide helicopter fleet has grown by 30% but the no of accidents have decreased from 24% up to 50% in the world. Accident rate in key nations has decreased with a range of 40 to 60% during the last 10 years ending 2015 against the baseline 2001-2005. The helicopters accident rates have been slashed by 54% in US and Europe till the end years' 2015:-

<sup>1</sup>An indep Review into the broader issues surrounding the loss of the RAF Nimrod MR2 aircraft XV230 in Afghanistan in 2006 by Charles Haddon- Cave QC, Chapter 17.

<sup>2</sup>Shappell SA, Wegmann DA (2000) The Human Factor Analysis and Classification System. *Avn Safety Trends* pp: 4.

<sup>3</sup>Shappell SA, Wegmann DA (2000) The Human Factor Analysis and Classification System. *Avn Safety Trends* pp: 5.

<sup>4</sup>With endorsements from participants of the 2005 Intl Hel Safety Symposium (IHSS), leadership from AHS, HAI, mfrs and other interested orgs, and the U.S. Federal Aviation Administration (FAA) joined together to form the Intl Hel Safety Team (IHST). The IHST agreed to dev and implement a data-driven, benefit-focused safety program designed to continuously reduce the risk of hel accidents. It set an aggressive goal of reducing the worldwide helicopter accident rate by 80% in 10 years (by 2016).

Years 2015 is as under:-

1. Canada: 33% decrease in accidents since year 2007.
2. Brazil: 62% decrease in accidents rate (civ Hel fleet grew by 49% during the Pd).
3. New Zealand: 43% decrease in accidents rate since year 2000.

## Why Avn Safety Foremost

Cost factor<sup>5</sup> of modern aircraft is enormous, even though these accidents occur less frequently as compared to other type of accidents in the US Navy/Marines. During year 1996 - 2000, loss incurred from Aviation accident alone cost the US Navy/Marines a loss of 3.3 Billion dollars; more than five times as that seen with all other accidents combined. Although correct data in case of Pakistan is not available for comparison, however, it can be arguably concluded that the comparative ratio of cost factor would likely to be close if not the same.

## Methodology

Keeping in view the intricacies in measuring safety management in the aviation sector, a pilot study was carried out in flight training institutions of Pakistan for developing and testing a safety assessment questionnaire. Multiple methodologies used in the pilot study ranging from personal interviews, focus group and detailed analysis of safety instructions, manuals and safety survey reports of related organizations. Moreover, literature study was conducted using journals, periodicals and magazines of Pakistan Civil Aviation Authority, meetings, seminars and speeches of professionals from aviation industry, aviation safety and flight, ground and maintenance safety related academic publications. All collected material and information was used to prepare and develop a questionnaire related to safety assessment which encompassed organizational approach towards safety management, safety culture and safety management systems. The developed questionnaire was pilot tested in aviation and flying training schools. Out of 74 items in the questionnaire, 22 were disregarded due to non-applicability in the aviation context, low response rate, shared similarity in meaning within items, and lack of relevance to safety assessment. The remaining 52 items were categorized as safety management in relation to aviation industry. The full survey questionnaire included 52 items, selected from the pilot study; same were then divided into two groups. First group consisted of organizational approach towards safety management which had (26 items) and second group consisted of organizational safety management systems and safety culture which also consist of (26 items). Items regarding organizational approach towards safety management mainly focused to gather perception and insight of respondents regarding the role performed by the industry/organization/corporation in which they are performing their duties, as an individual, to ensure safety. Likewise, items of second group organizational safety management systems and safety culture focused to collect perceptions of respondents on existing safety connected beliefs and attitudes and the techniques in which safety is accomplished in their working organizations. The survey was managed through personal liaison with Pakistan civil aviation authorities, aviation school, flying institutions, pilots, flight operation managers, ground staff and maintenance officers and individuals related to aviation industry in Pakistan. Five hundred twenty filled questionnaires were received, out of which 38 were unusable. Findings of this research are based on 414 questionnaires that were considered valid and properly filled. Though the response rate remained low but still the sample was representative of nearly the complete population of Pakistani aviation

industry. Respondents of this research represented almost all fields of the aviation industry (Table 1).

## Results

First group consisted of organizational approach towards safety management included 26 items. Second group consisted of organizational safety management systems and safety culture which also consisted of 26 items. Both groups were tested on a 5-point scale where 1=strongly disagree and 5=strongly agree. Cronbach's Alpha was 0.933 and 0.922, Kaiser-Meyer-Olkin measure of sampling adequacy was 0.948 and 0.947 and Bartlett's test of Sphericity was significant in both sets of data, highlighting that it was appropriate to use factor analytical method to both data sets. Initial factor solution identified four factors from each data group, basing upon scree plot pattern and decision rule that Eigen values should be higher than or equivalent to one. For determination of factors practical value, two conditions were exercised: First condition was that each item had to surpass 0.4 factor loading, and if loading of any variable is considerably depends upon more than one factor then that variable was incorporated along with that factor which had highest loading factor. First group questionnaire discovered respondent's opinion about organizational approach towards safety management exists in their organizations. Numerous variables were attained from pertinent literature for determination of best safety practices adopted by organizations for management of safety aspects. Pilot test of these best safety practices were carried out for assessment scale optimization of 26 variables. Through factor analysis four factors were removed from the variables Table 2. On first 11 variables, first factor loaded heavily. This factor was named as "positive safety practices". Approximately four-fifth of total difference was enlightened by positive safety practices factor only. Next 6 variables highly correlated with second factor. This factor was named as "safety education". This factor highlights that to ensure safety it is essential to impart safety education. Third factor was named as "implementation of safety (SOPs), policies, instructions and procedures" because next 7 variables were loaded high on this factor. Including last two variables, fourth factor was termed as "personal/individual's safety obligations and responsibilities" because it revealed individual's responsibilities and role towards safety. As reflected in Table 2 these above mentioned four factors accounted for 60.29% of the difference. As indicated

Core Business of Respondents	Frequency	Percent
Maintenance engineering	73	
Air transport/Airline	137	
Airport/aerodrome	18	
Helicopter operations	25	
Quality assurance/Safety education/exams	11	
Flight training	42	
Other-air traffic control <sup>a</sup> and general aviation	152	
<b>Total</b>	<b>458</b>	<b>100</b>
Respondents' Position in Organization	Frequency	Percent
Pilot	168	
Maintenance engineer	78	
Flight training instructor	45	
Manager	83	
Personnel, quality assurance/safety education/exams	25	
Other-air traffic controller and general aviation personnel	59	
<b>Total</b>	<b>458</b>	<b>100</b>

<sup>a</sup>Category air traffic control was combined with general aviation to preserve confidentiality.

**Table 1:** Distribution of surveyor respondents by their business and position in organization/industry.

<sup>5</sup>Shappell SA, Wegmann DA (2000) The Human Factor Analysis and Classification System. Avn Safety Trends pp: 8.

Variables	Factors	1	2	3	4
	<b>Your organization</b>				
V6	Takes everyone's safety seriously for whom it is responsible as a document holder	0.578	0.328	0.443	-0.095
V7	Considers safety-related paperwork essential to ensure everyone's safety	0.502	0.221	0.433	0.069
V8	Enforces its safety policies and procedures effectively	0.628	0.432	0.357	-0.088
V10	Praises those who raise safety concerns	0.624	0.335	0.261	-0.202
V11	Has a safety officer at hand if and when needed	0.452	0.395	0.360	-0.132
V12	Takes disciplinary action for non-compliance	0.538	0.350	-0.055	0.162
V13	Provides adequate resources to ensure safety policy and procedures are followed	0.563	0.369	0.421	-0.126
V14	Promotes safety through managers/supervisors leading by example	0.655	0.410	0.270	-0.112
V16	Takes action on the reported safety concerns	0.683	0.193	0.376	-0.149
V17	Supports staff when they report a situation that can lead to danger	0.647	0.234	0.398	-0.237
V18	Considers it to be responsible for the safety of its employees and clients.	0.634	0.077	0.282	-0.082
V20	Ensures that staff attends safety courses and seminars.	0.161	0.759	0.321	-0.072
V21	Has in-house safety education Programmed.	0.092	0.744	0.402	-0.010
V22	Ensures all staff are current with regard to safety rules and procedures	0.369	0.705	0.278	-0.027
V23	Educates staff about the benefits and costs of safety and accidents.	0.316	0.728	0.196	0.001
V24	Allows you to practice what you have learned in safety courses and seminars	0.394	0.681	0.194	-0.107
V25	Considers safety education to be an important part of ensuring safety.	0.517	0.639	0.195	-0.169
V1	Has incident/accident investigation methods in place	0.133	0.164	0.782	0.043
V2	Have safety instructions that are easy to follow.	0.270	0.313	0.624	-0.080
V3	Has a system in place whereby staff can report incidents anonymously.	0.172	0.248	0.460	-0.072
V4	Has a safety policy that is non-punitive	0.293	0.111	0.618	-0.251
V5	Has a practicable safety policy understood by all.	0.367	0.362	0.588	-0.06
V9	Carries out internal safety audit periodically.	0.199	0.236	0.583	0.013
V15	Has a position on 'safety at a reasonable cost' when making crucial decisions	0.341	0.102	0.441	0.081
V19	Takes the view that it is up to the individual to ensure own safety	-0.146	0.077	-0.006	0.832
V26	Considers safety education to be individual staff's responsibility	-0.46	-0.198	-0.041	0.845
	Variation explained by each factor				
	Mean of Factor items	44.87%	6.28%	5.25%	3.92%
	Total variation explained by these factors	60.29%			
	Cronbach's alpha	0.9328			
	Kaiser-Meyer-Olkin measure of sampling adequacy	0.944			
	Bartlett's tests of sphericity				
	Approx. chi-square	5629.132			
	Df	323			
	Significance	0.000			

**Table 2:** Results of factor analysis of data related to organizations' approach to safety management.

in Table 3, first group data analysis (factors mean) highlighted that respondents are of the opinion that their organization give importance to "individual's safety obligations/responsibilities" (2.95) more significantly in safety management than any other elements. Even though by carrying out pilot study, scale to measure organizational approach towards safety management was established, developed and enhanced. Attribution of factors relative importance is solely because of question's nature and questionnaire wording as highlighted in Table 2. Keeping this in view, it appears that organizations of the respondents give more emphasis towards individual's responsibility towards safety than inculcating positive safety practices and executing safety instruction, policies and SOPs. Whereas, conflicting to this view, aircraft/ground accident investigations highlight that organizational and individual involvement towards safety cannot be detached. Accidents occur as result of joint effect of extended period standing environments, culture of organizations, prevailing working practices, behaviors, customs, attitudes and individual's isolated unsafe actions (Tables 2 and 3) [11,12].

Number two categorized variable 'Safety education' (2.43), highlights that this is regarded important factor towards safety enhancement. Keeping in view first two factors it seems that organizations are alleged to give importance to role of safety education towards safety and

therefore ensure its availability using multiple ways. Nevertheless, they had an opinion that it is employer obligation to obtain it and use the same for ensuring own safety in during operations. Respondents had a view that organizations in which they are employed give less emphasis towards safety SOPs, policies instructions procedures and positive safety practices implementation. This employer view may be because organizations assume that employees working in aviation industry should exercise safety as routine affair. If organizations this hypothesis is considered correct then there are chances of employees becoming unworried and complacent towards safety. The variables integrated in above mentioned two factors highlight safety practices such as risk management, resource allocation and monitoring and revising safety SOPs, procedures and policies during operations. Keeping respondents view these factors (18 variables) should be given low priority by their worker, it indicates that not sufficient efforts have been put on at strategic level to ensure safety [7], which exposes organizations for both latent and active failures [6].

#### **Factors related to organizational approach towards safety management and core business and respondent's position**

Keeping in view relative significance given to four factors and core business of respondents, businesses related to aircraft maintenance are



Factors	Means	Standard Deviations
Positive safety practices	2.23	0.82
Safety education	2.41	0.90
Implementation of safety policies and procedures	2.20	0.71
Individual's safety responsibilities	2.98	1.03

**Table 3:** Means and standard deviations of factors related to organizations approach to safety management.

considered to take “safety education” and “positive safety practices” as the two vital factors in implementation of safety SOPs, practices and procedures. Likewise, keeping in view the respondent’s position and four factors it indicates that aircraft maintenance industry assume that their workers think that safety education, positive safety practices and ensuring implementation of safety SOPs, policies, instructions and procedures are vital features ensure safety in aircraft maintenance industry. Keeping this, view aeronautical engineers, aircraft maintenance staffs stand out between their coworkers in aviation industry. Moreover, aviation industry and organizations are supposed to give more importance towards implementation of safety SOPs, positive safety practices, policies, instructions, procedures and safety education to their employers for ensuring safety comparing to any other industry. Among aircraft maintenance engineers staffs especially engineers a culture seems to have developed which indicate that they are devoted to ensure safety in their routine maintenance work by intensely following SOPs, policies, instructions and regulatory procedures. 12% of major aviation occurrences and accidents occurred due to maintenance and inspection shortfalls which is major finding [13]. It is important to know that aircraft accident related to maintenance is on rise [5]. Employees working as air traffic controller and working in aviation industry as general are of the view that their organizations pay more value towards individual’s safety responsibility/ obligation than any other aspect. Pilots and air traffic controllers decision-making is based upon the information and statistics received in writing, audio, graphic or visual form demanding a greater judgment level which normally expose them to mistakes although having fully trained and experienced [14,15]. Questionnaire second group gathered respondent’s opinions regarding organizational safety culture and safety management systems. Pilot test to optimize scale of 26 variables, attained from organizational positive safety culture and safety management systems literature was conducted. Table 4 indicates 4 vital factors from list of 26 variables and also factor solution. According to views of respondents regarding the ways by which safety is ensured in their industries/organizations on first 16 variables factor 1 loading high. “Organizational positive safety practices and dynamics” can be named as first factor. Only first factor solution has described 3/4 of total variation. On next 3 variables, second factor loading high and was named as “regulator’s role”. On next 3 variables, factor 3 loaded high was termed as “luck and safety”. “Safety management, decision-making and training” was considered as factor 4, which included last 4 variables. Second group of data factor analysis catered for 61.60% of explained variation as indicated in Table 4. Second group of data analysis factors means indicate that respondents seemed ‘luck and safety’ (3.82) as vital factor highlighting behaviors and beliefs perform an important part in aviation industry safety features Table 5. According to respondents views regulator’s role’ was rated as number 2 (2.89) highlighting the significance of role of Civil Aviation Authority in implementation of safety. Nevertheless pilot study was carried out for development, assessment and optimization of organizational safety culture and management systems in aviation industry. Relative significance of factors can be credited to the type of questions and questionnaire

wording statement as reflected in Table 4. Interestingly respondents think that luck and safety have more importance as compared with training, positive safety practices and dynamics of industry. An individual may or may not have control but respondent’s importance given to luck and safety reflects individuals’ behaviors, beliefs and attitudes towards safety. According to Guldenmund [16] such as ‘fatalism’ this factor configuration is similar to findings of other researchers and ‘personal skepticism’ [17]. Remarkably, keeping in view safety culture and safety management systems (SMS) factors Table 5 and organizational position of respondents ‘flyers/pilots’ consider luck and safety as vital factor for safety in aviation. It is prominent to highlight that pilots consider in no circumstances accidents can be prevented whatever anyone does. It is consider by flyers that sooner or later everyone is expected to meet an accident and in aviation industry especially as pilot luck has a major role. This research finding is similar to Australian aviation industry and thus creates similar safety fears that ‘when safety culture moves from an individual who believed that it can avert accidents to an individual who agrees accidents to be unavoidable, therefore risk of occurring accidents will rise’ [18]. More research work is required to explore whether this particular research finding which highlighted flyer’s lack of confidence in existing safety structure or illustrates professional realism of working in an atmosphere which is closely attached communicating systems [1] and is exposed to accidents [6]. ‘Regulator’s role’ was considered as second vital factor suggested that Pakistani aviation industry organizations are assumed to be relying upon Pakistan CAA (Civil Aviation Authority) in connection with implementation of safety. Pakistani Civil Aviation Authority is responsible for establishment of civil aviation flight and ground safety standards, monitoring and compliance to already established standards and provision of search and rescue services throughout Pakistan [19]. Pakistan Civil Aviation Authority is also responsible to conduct incident, occurrence and accident investigations which enhances and modify safety education [20]. Respondents have a view that involvement and participation of Pakistan Civil Aviation Authority has to be authoritative, especially in ensuring the implementation of rules, regulations, procedures and policies regarding aviation. Moreover, Civil Aviation Authority plays a pivotal role as guide in checking, and regulation of aviation safety. “Training, safety management and decision-making” were considered as third strongest element. It is important to highlight that respondents did not identify that in their industries this third factor was considered much important. It can be assumed that aviation industry does not pay ample importance on frequent training and on using latest technology for managing their safety systems. One of the reasons for this may be that safety in aviation industry has a price and cost and the other reason may be that resources needed for training and improvement, and handling safety material might be limited. Variable used to inquire organizational position regarding ‘safety measures at realistic cost’ might have been observed as puzzling and vague. Weakest factor observed was ‘Dynamics of any organization and positive safety drills’. Seemingly, 16 variables were incorporated by this factor. This recommends that in aviation industry, workers do not ponder much on safety linked communications, events, and rehearses. Moreover they do not consider these measures to be of much significance in safety. This factor comprised of variables somewhat related to items described by Diaz and Cabrera [7] in his safety beliefs investigation, functions required by an organization to ensure operational safety management by Pollitt and Bouckaert [21]. And lastly scale regarding safety climate established by Guldenmund [16]. Keeping contents of this aspect in view, it seems that organizations might be observing safety by not particular safety management systems (SMS) and safety traditional

Variables	Factors				
	In your Organizations	1	2	3	4
V1	There is an open communication between management and staff about safety issues.	0.826	-0.030	-0.061	0.041
V2	Management usually informs staff of incidents and their outcomes	0.698	-0.062	-0.085	0.257
V3	Safety information is brought to staff's attention by their managers/supervisors	0.770	-0.024	-0.021	0.244
V4	Management takes a personal interest in safety compliance	0.841	-0.025	0.009	0.148
V5	Even due to financial pressures, safety takes priority	0.851	0.054	-0.057	-0.026
V6	If employee safety is at risk, managers halt operations.	0.818	0.088	-0.012	-0.074
V7	If employee safety is at risk, managers halt operations.	0.843	0.015	-0.041	0.063
V8	Management encourages fearless reporting of incidents, errors, and safety concerns	0.806	0.161	0.065	0.102
V10	Managers have open discussion with employees about safety issues.	0.801	-0.052	0.041	0.166
V11	Staff does not risk their jobs when they report safety concerns to management	0.796	0.166	-0.017	-0.036
V15	The knowledge gained from incident reviews is usually put into practice	0.621	0.252	0.003	0.198
V17	Management allocates resources to meet safety needs	0.758	0.101	-0.113	0.168
V18	Management knows what goes on in operations	0.732	0.146	-0.022	0.123
V19	Management does something about hazards before accidents can occur	0.787	0.139	-0.082	0.099
V21	Most staff receives adequate initial training to confidently do the job	0.663	0.153	0.108	0.317
V23	Staff does not face reprisal for raising safety issues.	0.816	0.162	-0.007	-0.076
V12	The regulator's (CAA) rules and policies are clear and simple to follow	0.055	0.822	0.034	0.017
V13	CAA's audits are useful in ensuring safety	0.104	0.758	0.051	0.098
V14	You are clear about the difference in CAA's safety and enforcement roles.	0.091	0.724	-0.199	0.042
V22	You believe accidents will happen no matter what anyone does	0.097	0.027	0.781	-0.041
V24	Staff believes that luck plays a major role in aviation safety	-0.25	-0.132	0.637	0.197
V25	You believe everyone is likely to have an accident sooner or later	0.005	-0.025	0.831	-0.156
V9	Management takes disciplinary action against staff for regulatory noncompliance	0.386	0.071	0.176	0.426
V16	You have up-to-date software/technology to manage safety systems	0.363	0.227	-0.016	0.576
V20	Pilots/engineers receive recurrent training	0.519	0.084	-0.044	0.564
V26	Judgment of 'safety at a reasonable cost' does not put people at risk	0.366	0.061	0.197	-0.490
Variation explained by each factor mean of factor items		42.54%	7.81%	6.75%	4.83%
Total variation explained by these factors		62.60%			
Cronbach's alpha		0.9230			
Kaiser-Meyer-Olkin measure of sampling adequacy		0.948			
Bartlett's tests of sphericity					
Approx. chi-square		5446.487			
Df		328			
Significance		0.000			

**Table 4:** Factor analysis of data related to safety management systems, and safety culture in organizations.

procedures to be essential in safeguarding safety. This research finding is steady with previous observation that workers in aviation industry do pay much attention towards positive safety procedures, practices and application of procedures and policies related to safety Table 3. Seeing four factors and respondent's position, it is worth mentioning that engineers working for aircraft maintenance consider dynamics of organization, safety management training (SMT), safety management system (SMS) and decision making process to be significant factors in safeguarding safety. Likewise, seeing four factors and core business of respondents, it is obvious that engineering sector related to aircraft maintenance is professed to consider dynamics of organization and safety management training (SMT) safety, management system (SMS) and decision making process to be serious apparatuses in managing safety in the type of work they perform. In short, engineering workers involved in aircraft maintenance regard dynamics of organization and safety management system (SMS) highly important in managing safety (Tables 4 and 5).

## Conclusions

This research highlighted employee's perceptions regarding aviation safety culture and safety management in aviation industry basing upon two data sets. Firstly organizations' attitude towards safety management having (26 variables) and safety management system

Factors	Means	Standard Deviations
Organizational dynamics and positive safety practices	2.20	0.86
Regulator's role	2.85	0.85
Luck and safety	3.81	0.84
Safety management, training and decision making	2.68	0.75

**Table 5:** Means and standard deviations of factors related to safety management systems (SMS), and safety culture in aviation industries.

(SMS), and organizational safety culture (26 variables). For assessment of safety management in aviation organizations, through pilot study a calculation scale was established and optimized for every data set. Both data sets were imperiled to factor analysis and appeared results to have acceptable inner reliability. The other interesting finding of this research was that pilots consider "Luck and Safety" as the most vital factor towards aviation safety. Individual's working as quality inspectors, imparting safety education and responsible for safety examinations also have similar views. For establishment whether there is any lack of confidence on safety provision system or that workers just perform their task with the idea and knowledge that in aviation safety is dependent upon good/bad luck there is a need for further research. Major finding of this research was that workers working in aviation industry are not seemed to be paying much importance towards organizational aviation safety culture and safety management system (SMS), particularly

and air traffic control (ATC), overall aviation sector and airport sector. Seemingly, they assume this as an individual's obligation. Moreover, safety to be given more importance than safety teaching, positive safety procedures and implementation of safety procedures, SOPs, instructions and policies. Furthermore, findings highlight that aviation organization does not respect safety training, management, and decision-making process of much significance in managing and ensuring safety. This might be less wanted keeping in view shortage of resources for funding such events and to promote safety culture having positive effects. In reality, only engineers related to aircraft maintenance gives safety culture, safety management system (SMS) much significance. The other important finding is that employers do not pay much importance towards safety related procedures and processes, events and structures such as regular training, having latest technology for management of safety information. Moreover, they do not have a position towards the awareness regarding "Safety at a rational cost". However, Pakistani civil aviation authorities' participation, particularly in relation to aviation rules, regulations, procedures and policies, examining and their role as a mentor and supervisor was considered authoritative. Finally, this research has provided a comparison between various organizations and a synopsis of employees view regarding how safety is accomplished in aviation industry. Basing upon findings of this research, it can be established that organizations in numerous industry sectors could perform better in handling safety and can improve safety culture. It is suggested that several sectors work in collaboration with civil aviation authority (CAA) for improvement of safety in aviation industry. Further research work is required to explore and excavate deeper into the aspects and issues raised in this research.

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