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A study of challenges to the success of the safety management system in aircraft maintenance organizations in Turkey

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ABSTRACT

The ICAO is an international regulatory authority put in place, in addition to current prescriptive regulatory approaches based on regulatory compliance that use reactive tools, performance based approaches that focus on, processes, proactivity, productivity and safety performance, to reduce the number of accidents and fatalities irrespective of the volume of air traffic. The safety management system (SMS), a product of this new approach, requires transformations which are likely to create certain challenges to its performance. This study sets out to investigate the challenges to the successful implementation of SMS in aircraft maintenance organizations, the degree of priority of these challenges, the major problems affecting the performance of SMS, the factors causing the problems, and the ensuing results.

During a two-day workshop, a problem analysis was conducted with experts using the nominal group technique. At the end of the study, it was identified that 'just culture' problems would be the main challenge to the success of the SMS. It was predicted that, impairing the reporting process, these problems are likely to have an adverse impact on information acquisition within an organization, organizational learning, efficiency of predictive tools and proactivity.

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1. Introduction

Air transport has highly significant benefits in economic and socio-cultural domains (O'Connor, 1995:14; Oum and Yu, 1998:1; Button and Taylor, 2000:209; Wells, 1999:25–29). In order to yield these benefits, there is a need to carry out aviation activities safely, otherwise confidence in air transport will reduce, direct and indirect effects of unsafe aviation activities will increase, and expected benefits will not be attained. This is why both regulatory authorities and airlines constantly endeavor to improve aviation safety.

Air transport is considered to be a safe mode of transport (ICAO, 2009:3–5) and, since the mid-1980s, the fatal accident rate in air transport operations has remained fairly stable. This trend suggests that, as air traffic grows, the total number of accidents will also increase (Wiegmann and Shappel, 2003:8–9; Transportation Research Board, 2009:7). The International Civil Aviation Organization (ICAO), recognizing these facts, and that the public's perception of aviation safety is based largely on the number of aircraft accidents rather than the accident rate (ICAO, 2003:67), issued a resolution in 2003 to reduce the numbers of accidents and fatalities irrespective of the volume of air traffic (Transportation Research Board, 2009:7). However, when the ICAO and civil aviation stakeholders began preparing the Global Aviation Safety Roadmap in 2005, in order to achieve this aim, they were faced with a significant challenge; with air travel already the safest form of transportation, the challenge to industry and regulatory agencies is to make an already safe system safer (Industry Safety Strategy Group, 2006:1–3).

That is why the ICAO, as an international regulatory authority, put in place, in addition to the current prescriptive regulatory approaches based on regulatory compliance that use reactive tools, performance based approaches that focus on processes, proactivity, predictivity and safety performance. In other words the ICAO considers that the existing prescriptive approach to safety should be complemented with a performance-based approach (ICAO, 2009:3–13; ICAO, 2013:2–32; Oster et al., 2013:161) In this vein, the ICAO asks countries to implement the State Safety Program (SSP) and airlines to implement the safety management system (SMS) in the context of this program (ICAO, 2009:3–1). With a view to improving safety and complying with ICAO regulations, the Turkish Civil Aviation Authority (Directorate General of Civil Aviation Authority – Turkish DGCA) rendered it obligatory for aircraft maintenance organizations to implement the SMS by the end of 2012 (Directive on Safety Management System in Civil Aviation, 2012). The Turkish DGCA, in line with the ICAO recommendation,

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relies on a phased approach and follows a progressive transition plan in the implementation of SMS.

Aviation safety will be adversely affected if the SMS, which is used to reduce accident rates and enhance aviation safety, does not work in practice. Since the SMS is a management tool that brings a number of additional changes to conventional safety management approaches, certain challenges may be expected to emerge in the transition process. Therefore, it is of particular importance for the enhancement of the SMS performance to identify the challenges in the process of putting the SMS into practice. Appropriate solutions should be developed in order to promote the success of the SMS. Between 2002 and 2012, total passenger traffic increased by 336%, aircraft traffic by 184% and freight traffic by 167% in Turkey. The General Directorate of State Airports Authority of Turkey estimates an increase of 10% in air traffic in 2014 and 2015 (General Directorate of *State Airports*, 2014). Safety risks are likely to increase in line with any increase in production.

In this context, the purpose of this study is as follows:

1. What are the challenges that are likely to occur in the process of implementing the SMS in aircraft maintenance organizations in Turkey? Which of these challenges are likely to cause more problems compared to others? Which of these problems is the most serious?
2. What are the factors that cause the main problem?
3. What are the effects deriving from the main problem?

2. Literature review

2.1. Traditional safety management approaches in aviation

Traditional safety management approaches see the world as 'how it should be'. This is based on the assumption that the aviation system operates as it is designed. In line with this assumption, the ideal world is described in normative terms. In order to assure aviation safety, aviation companies and employees are required to comply with and preserve this world order. Accordingly, the main tool used for safety improvement is guaranteeing compliance with prescriptive regulations (ICAO, 2009:2–32; ICAO, 2013:3–10, 3–11; Zimmermann et al., 2011; Maher et al., 2011). This mode of safety management approach using prescriptive regulations can be defined as the 'regulatory compliance-based approach'.

Prescriptive regulations undoubtedly play an important role in improving aviation safety. They mandate controls in response to hazards in the aviation system. They are important since they ensure that a fundamental set of hazards is addressed. On the other hand, prescriptive regulations are general tools that cover all relevant service providers at the national, regional and international level. This is why they may not address all the specific hazards that are likely to exist in different aviation organizations and contexts, and may not be effective enough against certain specific hazards and risks that may arise, specific to a context, in organizations, each of which may be considered a socio-technical system (Safety Management International Collaboration Group, 2010). Therefore, although regulatory compliance is achieved, organizational and contextual factors may cause people to make errors and thereby imperil safety.

Reflecting on this approach we can see that human beings within a normatively designed system can always carry out duly that is required of them in all contextual conditions. The main means of guaranteeing expected human behavior is a disciplinary system. In the case of undesirable behavior, blame and punishment come to the fore; punishment and training are regarded as the main mitigation of safety risks. However, human beings, the most important components of the system, may make errors due to a number of factors (Wiegmann and Shappel, 2003). Furthermore, for many reasons, an organization itself is likely to cause people to make errors unintentionally (Reason, 1997). In the same vein, McDonald et al. (2000) suggest that extensive analysis of certain aircraft accidents and incidents has shown that aircraft maintenance related accidents are not simply a consequence of direct technical failure or incorrect operational procedures. The underlying causes are deeply rooted in organizational and management factors (McDonald et al., 2000:154).

On the other hand, technology may not always operate as defined; procedures may not be executed as planned under certain contextual factors, and the introduction of changes to the system, or interaction with other systems, may create new hazards and safety risks. With only a prescriptive regulatory based approach, implementers may not reveal these contextual specific hazards and mitigate associated risks, since they may focus on achieving compliance, rather than focusing on effectiveness (Maher et al., 2011). As a consequence, it is likely that a drift from an ideal world design occurs and the aviation system may not operate as it is designed to (ICAO, 2013:2–6, 2–7).

On the other hand, in general, prescriptive regulations make use of reactive tools to manage safety. When only reactive tools are used in safety management, the data obtained is restricted to accidents or incidents examined, and there is no adequate data to identify tendencies or to predict the future (The Industry Safety Strategy Group, 2005:2; Stolzer et al., 2008:50–51; Zimmermann et al., 2011; May, 2010). Using only this approach requires accidents or incidents in order to gather the data required for safety improvement efforts. As a result of reactive processes, new regulations and procedures are generally introduced to improve safety, and this is again required to comply with new prescriptive regulations. Compliance is controlled firmly and closely with the expectation that compliance with regulations brings safety improvements (ICAO, 2009:2–2, 2–5; ICAO, 2013:4–11; Zimmermann et al., 2011).

A prescriptive regulation approach uses audits on paper based on recorded documentation, not based on processes and real life safety performance. It fails to view the system as a whole, disregards sub-system interactions, and resorts to reactive tools for analysis. Safety is deemed to improve when regulations that guarantee an ideal world order are implemented. However, it would not be realistic to expect that, with only a prescriptive regulation based approach, the aviation system operating in a sociotechnical environment, functions in the way it is designed to, without any deviation from predetermined objectives.

2.2. Safety management system

The ICAO has embarked on new quests, realizing that a prescriptive regulatory based approach alone – a deterministic management approach which views the world as it should be – is not sufficient to improve safety (Transportation Research Board, 2009:7; ICAO, 2009:3–13). As a result, the ICAO decided to complement the existing safety management approach with the SMS, the product of a new paradigm that sees the world as it is. The new paradigm goes beyond compliance with regulations and the paradigm shift offers system and performance-based approaches, in addition to a regulatory compliance-based approach (ICAO, 2009:3–13; ICAO, 2013a:2–5, 2–32; Oster et al., 2013; Zimmermann et al., 2011; Lofquist, 2010).

The systems approach takes into consideration hazards and risks emanating from hardware and liveware interaction increasingly becoming more complex. According to this approach, the definition of system goes beyond being a whole of parts (Lofquist, 2010). Thanks to this, it is possible to determine hazards and risks deriving from the interaction of sub-systems and systems. Seeing the world as it is, basically means evaluating the role of human factors – the most important component of the system – (Lofquist,

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