

# Chapter 49

## Socio–Technical Approaches for Optimal Organizational Performance: Air Navigation Systems as Sociotechnical Systems

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### ABSTRACT

*In this chapter, the authors present a socio-technical system for optimal organizational performance at aviation enterprises such as air navigation system as socio-technical system. The authors made an analysis of the International Civil Aviation Organization documents on risk assessment and the impact of the social environment on the aviation system. The authors obtained the results of the evaluation of non-professional factors: determination of the social-psychological impact on decision making of human-operator by identifying the preferences for organizational performance. The structural analysis of internal and external management environment of aviation enterprise was carried out. And, as follows from the analysis, inhomogeneous factors that influence the aviation activity were classified, formalized, and systematically generalized using set-theoretical approach. The influence of factors of internal and external management environment on the aviation enterprise's activity was determined.*

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## **INTRODUCTION**

Air Navigation System (ANS) in conformity to the principles of functioning may be referred to Socio-technical System (STS) within which close co-operation between human and technological components occur. The distinguishing feature of the STS is an availability of the hazardous kinds of activity as well as usage of the high-level technologies in production. Since operations in STS generally involve high-risk / high-hazard activities, the consequences of safety breakdowns are often catastrophic in terms of loss of life and property (International Civil Aviation Organization [ICAO], 2004). The more a human-operator (H-O) is trying to control a production process being aided by high-level technologies, especially in case of distant operation, the more non-transparent becomes the result of the operation of a system, which is accompanied by a high degree risk of the catastrophe causing (ICAO, 2002). Most researches were conducted with a view to the provision of safety in nuclear power production (Keating, 2001; Bertsch, 2007; Flueler, 2006). The provision of flight safety in the ANS by means of high-level technological processes depends primarily on the reliability of H-O as well as his timely professional decisions. Currently, one of the main strategic problems of mankind on the path to sustainable development is the safety and stability of technogeneous production (ICAO, 2013a). As noted technogeneous production is a complex system that contains interrelated technical, economic and social objects. It has a multilevel hierarchical structure and a high level of risk. Recent results show that there are frequent and common emergency such as disaster, accidents, crashes in hydraulic engineering, chemical and military industries, gas and oil pipelines, nuclear power plants and transport (Clegg, 2000; Keating, 2001; Flueler, 2006; Carayon, 2006; Bertsch, 2007; Baxter, 2011).

## **BACKGROUND**

Sociotechnical systems theory is a theory about the social aspects of people and society and technical aspects of machines and technology (Kuchar, & Yang, 2000). Sociotechnical refers to the interrelatedness of “social” and “technical” aspects of an organization. The sociotechnical theory, therefore, is about “joint optimization”, with a shared emphasis on achievement of both excellence in technical performance and quality in people’s work lives. The sociotechnical theory, as distinct from socio-technical systems, proposes a number of different ways of achieving joint optimization. They are usually based on designing different kinds of organization, ones in which the relationships between socio and technical elements lead to the emergence of productivity and wellbeing (Kuchar, & Yang, 2000).

Statistical data show that human errors account for up to 80% of all causes of aviation accidents. A significant part of aviation accidents (33%) is in violation by crew members of the laws, rules, and regulations, as well as violations of preparation for training (42%) (Leychenko, Malishevskiy, & Mikhalič, 2006). The existing approaches to checking separate aspects (psychophysiological, behavioral, ergonomic, professional, etc.) do not consider the functional state of H-O in the conditions of the dynamic change of external and internal factors (Makarov, Nidziy, & Shishkin, 2000). Representation of the ANS in the form of STS first makes possible to take into account the influence of the social, cultural environment of people who decision making (DM). Culture surrounds people and affects their values, convictions, and behavior, which they share along with other members of different social groups. Culture serves to bind us together as members of groups and to provide clues as to how to behave in both normal and unusual situations. The psychologist Hofstede suggests that culture is a “collective programming of the mind”

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