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CLASSIFICATION OF ORGANIZATIONAL FAILURE ROOT CAUSES PRODUCING HUMAN ERROR

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Abstract- The formal study of human error is relatively recent, especially in medical domain, and is tied closely to a several other relatively new fields. Organizational root cause of human error is less considered. Despite growing social, industrial and scientific interest in the organizational causes of incidents, the concept of organizational failure and related tools are still less considered in many developing countries e.g. Iran. Also, there is few incident record-keeping in medical domain on human error. Therefore, this study draws on case study research to investigate the applicability of a European taxonomy of organizational failure in Iran, in aviation domain with a fair incident record-keeping. This case study resulted in 10 incident in-depth descriptions, which occurred during one year in a part of civil aviation due to operator error. Within each case study, an explanation building method is used to develop a tool for classifying organizational root causes. Results include 100 root causes. The distribution of organizational root causes over the main categories of the former taxonomy shows a need to add a new sub-category to improve its applicability in Iran. The new sub-category is related to culture.

INTRODUCTION

The past decade has seen that the problem of medical error come to light. It is estimated that 98,000 deaths per year occurring in the US hospital system are attributable to medical error. Medical errors are the 5th cause of death in the US, and cost $24 billion annually (1). There is growing recognition that it is more due to errors and incidents (*i.e.* accidents and near misses) than blaming the person involved (2).

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Reason (1991) clearly shows a change in scope in incident investigation, which is at any time determined to a large extent by the kind of preventive measures preferred. In current incident investigation, it is common to subdivide the causes that lead to an incident into the following three groups of failure: technical, human and organizational failure (3). Risk management is receiving interest from researchers in industrial engineering, management sciences, psychology and human factors in both developed and developing countries.

Despite growing social, industrial and scientific interest in the organizational causes of incidents, the concept of organizational failure and related tools are still less considered in many developing

countries *e.g.* Iran. To cope with the increasing demand for risk management methods and tools in this area, this article will discuss the application of a taxonomy of organizational failures, which is originally developed in Europe, in Iran. Therefore, a basis for analyzing of organizational causes of safety-related incidents will be provided. The initial taxonomy was presented by Vuuren (1999) and was followed both by a top-down (theoretical path) and a bottom-up (empirical path) approach. The study was carried out by six cases in two different domains; the Dutch steel industry (coke producing and steel production plant); and the medical domain (both in England and The Netherlands, including accident and emergency, anesthesia, intensive care unit, and care of the mentally handicapped). This taxonomy is presented in Table 1.

Despite maximum variety domain in Vuuren study, additional exploratory research may need to ensure transferability of this taxonomy to developing countries. The initial intention of this research was to study human error induced by organizational failure in medical domain in Iran. Due to lack of incident record keeping, it shifted to civil aviation. Formal incident investigation and record keeping, high-technology work environment and the importance of human error in aviation persuaded the authors to work in this domain for the first attempt.

Table 1. The taxonomy of organizational causes of safety related incidents, developed by Vuuren (3)

Main categories	Subcategories		Definitions
Structure	Task demands	OS1	Refers to failures related to the wrong fit between the capabilities of the worker and the demands of the job.
	Responsibilities	OS2	Refers to failures related to the absence or inaccurate allocation of responsibilities among departments, groups and persons.
	Skills and knowledge	OS3	Refers to failures resulting from inadequate measures taken to ensure that situational or domain specific skills and knowledge are transferred to all new or inexperienced staff.
	Working procedures	OS4	Refers to failures related to the quality and availability of the working procedures within the department (too complicated, inaccurate, unrealistic, absent, poorly presented).
	Supervision	OS5	Refers to failures related to the absence of supervision on work with increased risks.
Strategy and goals	Management priorities	OG1	Refers to failures resulting from management decisions in which safety is relegated to an inferior position when faced with conflicting demands or objectives.
Culture	Norms and rules for dealing with risks	OC1	Refers to failures resulting from the absence of explicit or tacit norms and rules for dealing with risks.
	Safety attitudes	OC2	Refers to failures related to the collective beliefs about risks and the importance of safety, together with the motivation to act on those beliefs.
	Reflexivity on safety practice	OC3	Refers to failures related to an inadequate learning of the organization from its own safety experiences.

MATERIALS AND METHODS

This paper draws on case study method well-defined by Yin. Case study is a kind of non-statistical methodology, which has been widely used in social sciences for more than a century. Applying this methodology, however, in other fields is relatively new (4). According to Yin, a fatal flaw in doing case studies is to conceive statistical generalization as the method of generalizing the results of a case. In statistical generalization, an inference is made about a population on the basis of empirical data collected about a sample. However, cases are not sampling units and should not be chosen for this reason. Rather, individual cases are to be selected as a laboratory investigator selects the topic of a new experiment. Multiple case studies should be considered like multiple experiments. Under these circumstances, the method is analytic generalization, in which a previously developed theory or taxonomy is used as a template with which to compare the empirical results of the case study.

Within each case study, a similar iterative nature of 'explanation building' is used to develop a tool for classifying organizational root causes. This approach results in the following steps to be carried out:

• Make an initial tool for classifying organizational root causes of safety related incidents;

• compare the findings of an initial incident against this tool;

• revise the tool;

• compare the revision to the findings of the second, third or more incidents; and repeat this process as often as needed.

It is not the main goal of this study to gain insight into the relative importance of the individual organizational failure factors. Implementing corrective action was not part of the project.

This study investigates 10 incidents which occurred during one year in a part of civil aviation due to operator error. Two sources of information were used. The first is formal reports of each incidents investigation. The investigations were performed by a committee of experienced members in that organization. The second source includes interviews with those who were involved in the incidents and were blamed by the Committee.

Interviews were conducted according to Critical Incident Technique developed by Flanagan (1945). This technique was originally developed to identify critical job requirements including those which have been demonstrated to make the difference between success and failure in carrying out an important part of the job assigned in a significant number of instances. To obtain valid information regarding critical requirements for success, procedures were developed for making a systematic analysis of causes of good and poor performance (2). A series of questions suggested by Dekker (5) were used for interview.

Methods of triangulation involved looking for consistency across the entire data set; comparing data collected from the initial interviews with data collected from observations and interviews of instructors and trainees interviewed on multiple occasions; and comparing data from interviews, observations and secondary sources. Triangulation of sources was achieved by checking for consistency in what respondents said over time in multiple interviews. Triangulation through multiple analysts was obtained by inviting those studied to review the findings (6).

RESULTS

This case study resulted in 10 incident in-depth descriptions, containing 100 root causes. The distribution of the root causes over the main categories of Vuuren taxonomy are shown in Table 2. The unclassifiable root causes include human error (skill-based and rule-based) or root causes related to situations that operators complain about a non work-related stress.

Table 2. Distribution of all root causes over main categories of Vuuren taxonomy

	Structure	Strategy and goals	Culture	Non-organizational	Unidentified	Organizational/ Unclassifiable	Total
No. of root causes	13	16	42	6	15	8	100

Table 3. Distribution of organizational root causes over main categories of Vuuren taxonomy

	Structure	Strategy and goals	Culture	Organizational/Unclassifiable	Total
No. of root causes	13	16	42	8	79
Percentage	%17	%20	%53	%10	100

Since this study focused on organizational failure, other root causes were omitted. The distribution of organizational root causes over the main categories of Vuuren taxonomy are shown in Table 3. Table 3 shows the main categories of Vuuren taxonomy well covered the organizational failures in this study. Only 10% (8 root causes) can not be classifiable by it. All of these organizational-unclassifiable root causes were related to culture. Therefore, a new sub-category is added. It is national culture (OC4) and refers to failures resulting from an insufficient recognition by the organization of the effects of country specific norms or values on behavior. In this study OC4 manifested in situations such as *excessive corporation* or *sensitivity to respect older people*. During interviews, the interviews, themselves, referred to these kinds of behaviors as "reserved culture" of eastern countries.

DISCUSSION

In this study, a step is made towards a better understanding of organizational failure. Findings of this study show influence of national culture on safety culture. According to Gibson and ZellmerBruhn (2001) individuals bring cultures of origin to work that reflect their particular ongoing histories in various cultural contexts, such as national culture. Cross-cultural research has established that national culture explains between some degrees of variation of social behavior such as aggression, conflict resolution, social distance, helping, dominance, conformity and obedience (7). As Hofstede showed, ranking of individuality (IDV) for Iran is at 41. The low ranking on this dimension indicates the society is collectivist as compared to individualist. This is manifested in a close long-term commitment to the member 'group', is that a family, extended family, or extended relationships. Loyalty

in a collectivist culture is paramount, and over-rides most other societal rules and regulations (8).

This paper shows that national culture can be a source of non-adherence to procedure. Therefore, it is necessary for organizations such as hospitals and health care system to consider specific national culture to improve their safety culture. Cultures can enhance learning, though they may also sustain existing patterns of belief and thereby learning to conformity, or non learning (6). However, organizational and national cultures are not simply parallel construct at two levels of analysis; rather, they have distinct contents and influences (7). This study provided a basis for analyzing of organizational causes of safety related incidents which can be applied to medical domain. However, further research is needed to take up this exploratory study and move on to a full understanding of organizational failure effects on human error. Given the results of this study, it is concluded that additional exploratory research is not likely to provide new insights. Different research designs are needed in order to be able to explain and test the impact of organizational failure factors on human error.

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Conflict of interests

We have no conflict of interests.

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