Organizational Errors and Individual Errors: Perspective on Accident Causation

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Abstract. The development of human-machine system has brought better economic benefits, but simultaneously resulted in more serious accidents. What is more notable is that similar accidents may happen repeatedly in the same organization, and cannot be avoided even though different individuals are employed at the same position. The causes are attributed to individual errors but not organizational errors in most instances, since individual errors are much more apparent than organizational errors. Herein, we distinguish individual errors and organizational errors, by proposing the definition and characteristics of organizational errors and individual errors from the perspective of accident causation. Organizational errors refer to the latent errors in organizational level and organizational function, which will lead to individual errors and violations of these deviant behaviors, while individual errors refer to individual unconscious deviant behaviors.

Introduction

As modern human-machine systems are getting more complex, dangerous, automated, opaque, and have more defensive measures, the possibility of catastrophic accidents caused by technology or individuals has been greatly reduced (Reason, 1990). However, various accidents still occur frequently, for example, Shangqiu fire in Henan province, explosion in Tianjin Binhai. And the accident causes are still used to holding individual accountable, since individual errors are easy to find out. Nevertheless, the accidents cannot be avoided and repeatedly happened in the same organization even though different individuals are employed at the same position. This suggests that people can neither find out the real cause of accidents nor learn from them effectively. Some studies indicate that accidents are related to the undetectable organizational errors, which are usually behind the behavior of technical failures and individual errors (Gordon, 1998). To date, people are still confused with organizational errors and individual errors, and they always simply attribute the consequences of organizational errors to the consequences of individual errors. The direct cause of the accidents, i.e., the wrong behavior of the "sharp end" operator is easier to be detected, while the deep reason behind the behavior is difficult to find out and easy to be ignored. In addition, there is no research that has clearly pointed out the definition and characteristics of organizational errors and individual errors. Therefore, it is important to clarify the differences between organizational errors and individual errors.

In this paper, we distinguish the organizational errors and individual errors from the perspective of accident causes, by proposing the definition and characteristics of organizational errors and individual errors, at the organizational level and organizational function. First, we focus on the organizational errors at the organizational level, including organizational culture, strategic target and business model. The consequences of organizational errors are not only limited to the organizational level, but also may occur at the individual level. Second, the organization is also a function, which involves the planned distribution or combination of enterprise activities and production factors, such as the distribution of authority and the design of management width, so it plays an important role in exerting collective strength, rationally allocating resources and improving labor productivity (Zhou, 2009). The research on organizational errors renders a deep and specific study on the accident causes, since previous studies were almost concentrated on extensive management functions, among which organization was only one function. This paper can further
enrich the study of organizational errors, meanwhile, help people find the root causes of accidents and guide the division of accident responsibilities.

**Literature Review**

With the development of human-machine system, people gradually realized that main causes of accidents are not just due to personal insecurity. Bird (1974) believed that the root cause of accidents were management defects; Adams (1975) pointed out that people's unsafe behaviors and the thing's unsafe state were caused by management errors of leaders and safety technicians. Although the early theory introduced the concept of "management error" and emphasized that it was the main cause of the accidents, but it has not been analyzed and studied as an independent factor.

Since Reason (1990) first proposed the concept of latent failures, scholars began to study managerial factors that have impact on accidents. Amalberti (1993) pointed out two neglected organizational errors by analyzing civil aviation and military aviation flight accidents: inadequate training under automation and the unhealthy culture and atmosphere in the aviation organizations. Grabowski (1996) put forward five factors that restrict accident prevention in large-scale systems: decision making, communication, culture, human-machine interfaces, and organizational structure.

Although many scholars have studied the managerial factors from different perspectives, but these factors are only possible manifestations of organizational errors and cannot help people understand the nature of organizational errors, therefore, scholars began to focusing on the study of organizational errors. On the one hand, scholars study the concept of organizational error. Reason (1990) though that "organization errors" refer specifically to management errors. Goodman et al. (2011) pointed out that organizational errors refer to the actions of multiple organizational participants that deviate from organizationally specified rules and can potentially result in adverse organizational outcomes. On the other hand, scholars study the difference between organizational errors and individual errors. Li (2014) pointed out that individual errors directly manifested in activities, and its impact were immediately apparent. Organizational errors always appeared in various rules, regulations and mechanisms, were difficult to detect, and their impacts were more far-reaching and not immediately apparent. Goodman et al (2001) pointed out that the distinction between an organizational error and an individual error is the difference between explaining a pattern of errors involving multiple individuals and explaining the idiosyncratic actions of a single individual in an organization.

To sum up, organizational errors play an increasingly important role in analyzing the reliability and safety of modern human-machine systems. However, the research on organizational errors is still at an early stage of exploration, and there is no unified definition and characteristics of organizational errors. Only Goodman put forward the definition of organizational errors. However, it is just a conceptual extension at the phenomenon level. In practice, organizations do not have enough time and enough opportunities to verify whether such errors will lead to similar deviant behaviors among different individuals. In addition, people cannot judge what organizational errors are, since conceptual extension is not description of unique attributes of organizational errors.

**Definition of Organizational Errors and Individual Errors**

The traditional studies of human errors are mainly aimed at individual. Reason (1990) proposed that human error refers to people's intentional plan or action fails to achieve the desired results or goals without external intervention. Senders and Moray (1991) defined them as operator behaviors that caused tasks or systems to exceed acceptable thresholds without the intention, rules or expectations of external observers. Although there are different definitions, there is a common view that human errors include deviants, and such deviants do not exist operator's subjective intention. Contrary to this, violations represent a deliberate choice of an individual to deviate from rules (Hofmann, 2011); violations were defined here as the deliberate deviant of actions from socially recognized norms of conducts (Reason, 1990). With the deepening of the research, the study of human errors have turned to the study of organizational errors. Reason (1990) interpreted organizational errors as
management errors. Baram (1993) said that management and organization errors refer to wrong decisions made by equipment managers and organization officials, which were limited to the core personnel level of the organization and were caused by their decisions. Goodman et al. (2011) pointed out that organizational errors were the actions of multiple organizational participants that deviate from organizationally specified rules and can potentially result in adverse organizational outcomes.

Through the analysis of previous studies, individual errors can be understood as the individual unconscious deviant behaviors, while violations are subjective and conscious deviant behaviors. Individual errors include following meanings: ①The individual does not know that deviant behavior may cause errors in the current environment. ②Individual error is a kind of behavioral deviation.

Organizational errors refer to latent errors in organizational level and organizational functions, which will lead to individual errors and violations. Organizational errors include following meanings: ①Organizational errors are latent errors; ②Organizational errors as an organizational-level construct that is related to but distinct from individual errors; ③Organization also is a management function which includes organization design and staffing.

The Characteristics of Organizational Errors and Individual Errors

Individual Errors Are Unconscious Deviant Behaviors, while Violations Are Deliberate Deviant Behaviors, and Organizational Errors Are the Roots of Individual Errors (Not Necessarily the Roots of Violations).

Individual errors refer to unconscious deviant behaviors, while violations involve deliberate deviants from some regulated codes of practices or procedures (Reason, 1993). Organizational errors are the roots cause of individual errors. While organizational errors are one of the reasons for violations, which is mainly related to personal characteristics. Since no matter how well the organization is designed, organization still cannot stop people intentionally deviate from specified rules.

Although organizations cannot eliminate individual errors and violations, but organizations can weaken them. From Taylor's to Hawthorne's experiments, we can see that people are "social people" rather than "economic people", that means people are irrational and there are all kinds of unexpected situations. Thus, we should not only have rigid rules in organization design and management, but also should consider human nature. There have two ways to manage errors. The first is prevention, i.e. identify all possible causal precursor events or conditions that may lead to these errors, and then create a set of procedures for avoiding or preventing them (Wildavsky, 1991), or design some redundancy to ensure that there are several ways to catch the problem before it becomes a disaster (Roberts, 2001). The second approach focuses on resilience, the ability to maintain positive adjustment or to bounce back under challenging conditions (Sutcliffe, 2003). Scholars in this tradition argue that in addition to trying to preclude or prevent errors, error management entails finding ways to cope with, circumscribe, or contain errors as they occur, before their effects escalate and ramify (Hofmann, 2011).

Individual Errors Are Representation of Organizational Errors, which Cause the Same Individual to Make the Same Error Repeatedly, or Multiple Individuals Have Same Errors.

A basic feature of an organizational error is that multiple individuals deviate from the expected organizational practice (Goodman 2011), that is to say organizational errors have consistency and chronicity. The mainly reasons are as follows. Firstly, organizational errors are difficult to detect while individual errors are easy to see, therefore, people are used to attributing responsibility to the individual who caused the accident. In fact, the top operators often are the accident trigger rather than causer, meanwhile, the root causes of the accident should be traced back to latent organizational errors that caused by internal problems of the system. Secondly, it is related to the external environment, such as strategic partners, competitors, customers, and so on. The accident
risk depends on the external environment (Fabiano, 2002), which can influence error-related processes through regulation and scrutiny of organizational operations. Thirdly, it is also related to organizational hubris. People are used to having no problems and think that everything is under control, and they don't worry about what they don't know, because they are comfortable that the designers have anticipated and precluded all potential problems in the system design and assume that their operators will generally operate within those design parameters. (Robert, 2001).

Organizational errors also have latency. That is to say, organizational errors are reflected in various rules, regulations and mechanisms, but it will not destroy the system's defensive and cause accidents immediately, unless they are combined with local triggering factors (Reason, 1990). But in the long run, organizational errors will surely lead to accidents.

Different Level: Individual Errors Are in Superficial Behavior Level and Organizational Errors Are in Deep System Level.

Individual errors are obvious on the surface, while organizational errors deeply embedded in the organizational system and spreading problems from the root, which produce direct threats to the security or long-term erosion to the defensive functions of the system (Reason, 1990). These latent errors are generated from organizational top and are related to management and supervision structures (Li, 2008). Thus, organizational errors can be improved by playing organizational motility rather than depending on “sharp end” operators. As deeply errors, organizational errors may be due to the following defects in system.

Firstly, the strategic goal is mainly results that expected from organizational business activities. Traditional organizations regard maximize profit as their ultimate goals, but excessive emphasis on profit will mislead managers and even threaten the survival of organizations. Therefore, many factors should be considered when formulating the strategic goal, such as safety, social responsibility. Secondly, the business model is an explanation of how the organization works. A good business model is still indispensable to any successful organization, whether it is a new or an old organization (Magretta, 2002). Thirdly, pay attention to the issue of personnel allocation. As a basic function of management, organization not only designs organizational structure, but also need to staff (Zhou, 2009), which includes selecting the right person, training staff and accepting training results. Good training can help employees to have ability that match the corresponding positions, in addition, it can intensify staff’s understanding about organizational cultures and objectives.

Although the injury may happen suddenly at a certain moment, but casualty accidents is not an isolated event, rather than the result of a series of events (Adams, 1985). Since organizational errors are deep systematic errors, it can lead many place be filled with errors, and this series of neglected errors will eventually lead to casualties.

The Roots of Organizational Errors Are Safety Culture.

Safety culture is the root of organizational errors. Cox et al (1911) believed that Safety culture is the sharing of employee's attitudes, beliefs, perceptions and values on safety-related issues. Safety culture originated from organizational founder's vision, and then it is maintained through employee selection behavior, senior manager's behaviors and socialization process. Safety culture really be formed only when the values and behavioral standards advocated by the founder are widely accepted and consciously serve as the basis for employees own behavior. Safety culture is an important part of organizational culture, and organization culture is divided into strong culture and weak culture. Compared with the weak culture, strong culture can make the organization's values widely accepted by members, thus always have a greater impact on employee's behavior and have higher organizational performance, but except this situation that strong culture cannot ahead of other enterprises adapt market environment change (Kotter, 1997). Safety culture is more important than rules in complex dynamic systems, since the organization's safety rules cannot foresee new accidents, but the behavior of operators can be changed from organizational control to social control through a good safety culture (Wilpert, 1993).

Safety culture can be analyzed by Schein's organizational culture model. Schein (1992) divides the organizational culture into three levels, flower and leaf - artificial ornament culture, which is an
explicit form of culture and shows the material and social environment created by culture, such as organizational structure, system and procedure. Stem - value culture, including strategy and goal, but it emphasizes should, not the actual situation, so this culture is not necessarily consistent with action. Root - the basic deep hypothetical culture, which is the ultimate source of values and actions. When member’s actions succeed again and again through some ways or principles, these ways or principles will be taken for granted and beyond doubt.

**Conclusion and Discussion**

In conclusion, this paper studies organizational errors from the perspective of accident causation, and proposes the definition and characteristics of organizational errors and individual errors. Compared with previous studies focusing on managerial factors that related to accidents, this paper concentrates on organizational errors themselves. Firstly, organizational errors refer to latent errors in organizational levels and organizational functions, unlike individual errors that can be attributed to individual's unconscious deviant behaviors. Secondly, organizational errors have latency, chronicity, severity of consequence and consistency compared with individual errors. Thirdly, individual errors only are manifestations of organizational errors, which root from safety culture. Therefore, the unconscious behaviors of individuals should not be punished, while previous studies only pointed out that organizational errors are the latent reasons behind accidents, but still punish individuals who make errors.

Our study has significant importance in theoretical study and in practice concerning organizational errors. Theoretically, this paper opens a basic study of organizational errors, with unambiguous definition and characteristics. In practice, this paper helps people to find out in-depth reasons of accidents by distinguishing organizational errors and individual errors, strengthens people's consciousness of identifying organizational errors, and guides the division of responsibility including accident investigation reports and legal sentences. Since organizational errors have increasingly important impacts on the security of modern systems, some suggestions are provided to better prevent organizational errors. Firstly, organizations should aggressively seek to recognize what they don't know. Secondly, safety culture itself should be strengthened, and the importance of it should be widely disseminated. Third, a reasonable reward and punishment rules should be established, since employees will ignore latent errors they see in order to be rewarded by obeying orders blindly. Finally, humanity should be taken into account in organizational design, since people are not like machines, and individual errors are unconscious behaviors.

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