A DESCRIPTION OF SAFETY TRIAD MODELS OF SAFETY CULTURE AS A TOOL IN HUMAN PERFORMANCE RESEARCH

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The human factor plays a decisive role in most accidents, but the problems caused by them are still unresolved. Understanding safety culture will help the industry to allocate safety resources and improve occupational health and safety performance. The paper presents an overview of the main existing triad models. The models in this paper can be used to illustrate components of the system, psychological elements of the people in the system and their individual and collective behaviours in terms of system performance. Some models describe 'components' of culture, others attempt to explain the relationship between safety culture and outcomes, and some models in the area describe the factors that interact to cause workplace safety incidents.

KEYWORDS

safety culture model, reciprocal determinism, organization culture, human performance.

1 INTRODUCTION

The emphasis on human performance is based upon its contribution to the occurrence of significant events and, consequently, to the overall performance of the industry. For example, at nuclear power plants, 80% of significant events can be attributed to human error, while only 20% of significant events can be accounted for by equipment failure. The historical belief has been that human error is an individual-focused phenomenon or motivational issue, promoting the idea that failures are introduced into the system only at the lowest level [IAEA 1999], [IAEA 2009], [IAEA 2014]. However, it has recently been identified that weaknesses in organizational processes and cultural values have contributed significantly more to the occurrence of nuclear facility events than have individual mistakes [US Govt 2002]. From statistic, 70% of human errors (or 56% of all events) at nuclear plants were found to be the result of organizational, rather than individual, weakness [IAEA 1999]. While these organizational deficiencies are often hidden in management processes, values or organizational structure, they can create workplace conditions that lead to a human error or degradation in the integrity of defences, such as quality of procedures or reliability of systems.

Several fields are showing increasing interest in safety culture as a means of reducing accidents in the workplace. The literature shows that safety culture is a multidimensional concept.

The International Atomic Energy Agency (IAEA) defines safety culture as follows: 'Safety culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance' [IAEA 1999]. The aim of a positive safety culture is to create an atmosphere in which employees are aware of the risks in their workplace, are continually on guard against them [Ostrom et al. 1993], and avoid taking any unsafe actions.

The interaction and relationships between individuals or groups of people in the organization we can consider in case of psychological research. Review of previous studies will be discussed in the following chapter.

2 MODELS OF SAFETY CULTURE

Social Learning Theory (SLT) [Bandura 1977] and Social Cognitive Theory (SCT) [Bandura 1986] are the first two theories resorted to explain the psychosocial functioning in terms of individual factors and environmental factors in personal behaviours engagement [Woolfson et al. 1999]. Bandura described a triad consisting of the person, environment (situation) and behaviour in the model of reciprocal determinism. Bandura stated that the reciprocal influences between these factors didn't operate simultaneously nor were they necessarily of equal strength, however, there was a process of action and reaction, or one of 'perpetual dynamic interplay'. In other words, situations are as much the function of the person as the person's behaviour is a function of the situation [Fang et al. 2013], indicating that people self-regulate their own behaviour, in so far as they rely on cognitive supports and manage relevant environmental cues and consequences [Woolfson et al. 1999]. These same principles are equally valid within organisations [Fang et al. 2013], particularly in the domain of managerial decision making which is one of the key routes by which 'pathogens' or 'latent conditions' are introduced into organisations [Reason 1997].

Later, Geller proposed a 'Total Safety Culture' (Figure 1) model that includes 'the safety triad' and recognizes the dynamic and interactive relationship between person, environment and behaviour [Geller 1996].

Cooper presents a model that recognizes the presence of an interactive or reciprocal relationship between psychological, situational and behavioural factors of safety culture. Subcomponents of safety culture according to Cooper's definition that 'culture is a product of multiple goal- directed interactions between people (psychological), jobs(behavioural) and the organization (situational); while safety culture is that observable degree of effort by which all organizational members

Figure 1. Geller's Total safety culture model [Geller 1996]

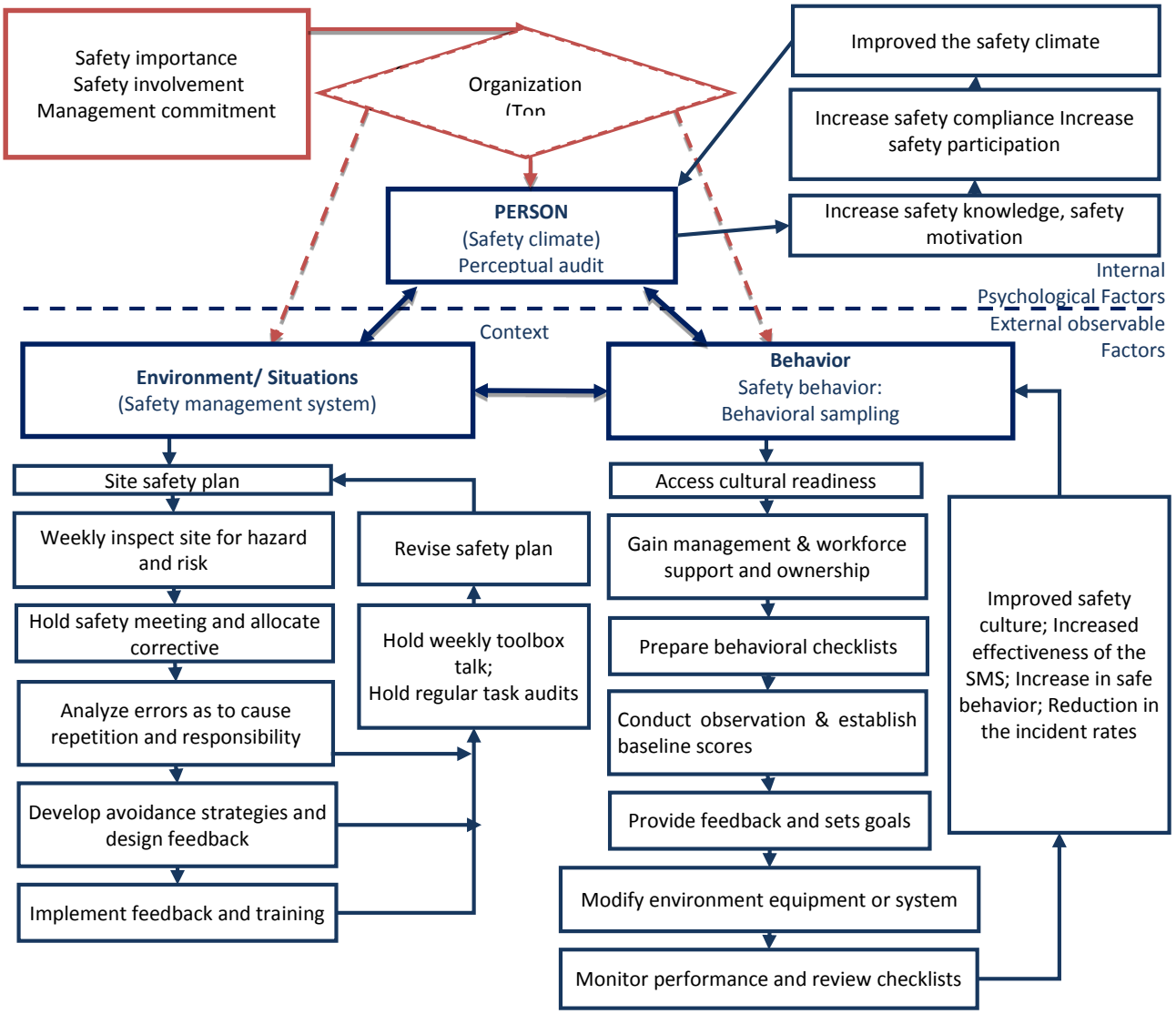

Figure 2. The Choudhry's model with additional component in red color that need to be ad-dressed [Alasamri et al. 2012]

directs their attention and actions toward improving safety on a daily basis' [Alasamri et al. 2012], [Cooper 2000]. Choudhry et al. adopted Cooper's model with some modification main order to make it suitable for use in the construction industry [Choudhry 2007].

Nevertheless, this model does not adequately represent the national culture context (of the Saudi Arabia) and has fundamental limitations through absence of organizational (top management). This will be considered and developed as separate components before implementing the model within the Saudi construction sites as illustrated in Figure 2 [Alasamri et al. 2012]. This is due to the fact that safety perceptions of those in upper level management of organization, for example president, chief, senior executives, etc., and their decisions that influence the firm level is considered a significant element to keep the safety culture balanced without any collapse [Molenaar et al. 2002]. The main parts of models:

- The person. Neal indicated that one of the main influencing keys of the safety climate/culture is the perceptions of senior management through considering the safety as important [Neal et al. 2000]. Thus, when the organization have great understanding of the safety importance then it reflects their ability to improve safety climate by in-creasing employee's knowledge and the provision of motivation for compliance, and participation in safety activities [Alasamri et al. 2012].
- Behaviour (safety behaviour). It is useful as a starting point to mention the funda-mental of behaviour, which refers to 'How people think, behave, respond to a situation and how the environment influences people's behaviours'. Therefore, when there is a shortcoming of understanding the value of safety and its priority within the workplace, then unsafe behaviour that leads to 80-90% of accidents will likely be the result, as past studies have indicated [Philips 2005]. In addition, Slates indicated that the positive and negative attitudes towards safety of the top management have a great impact on people's behaviour [Slates et al. 2008]. In contrast Wu considered the relationship between the senior leadership and followers to be a process to achieve the organisational safety target [Wu et al. 2008]. Therefore, the top management plays a major role in the promotion of safe behaviour for workers directly through their perception and behaviour [Fernandez-Muniz et al. 2007].
- Situation/ environment (safety management system). Situation/ environment refer to the quality of operations of the organization's safety management system at the construction site [Choudhry 2007]. The main function of this system is to provide a process for planning, implementing, and monitoring and reviewing safety performance. Nevertheless, the safety management system will not be effective without support from the senior leadership who

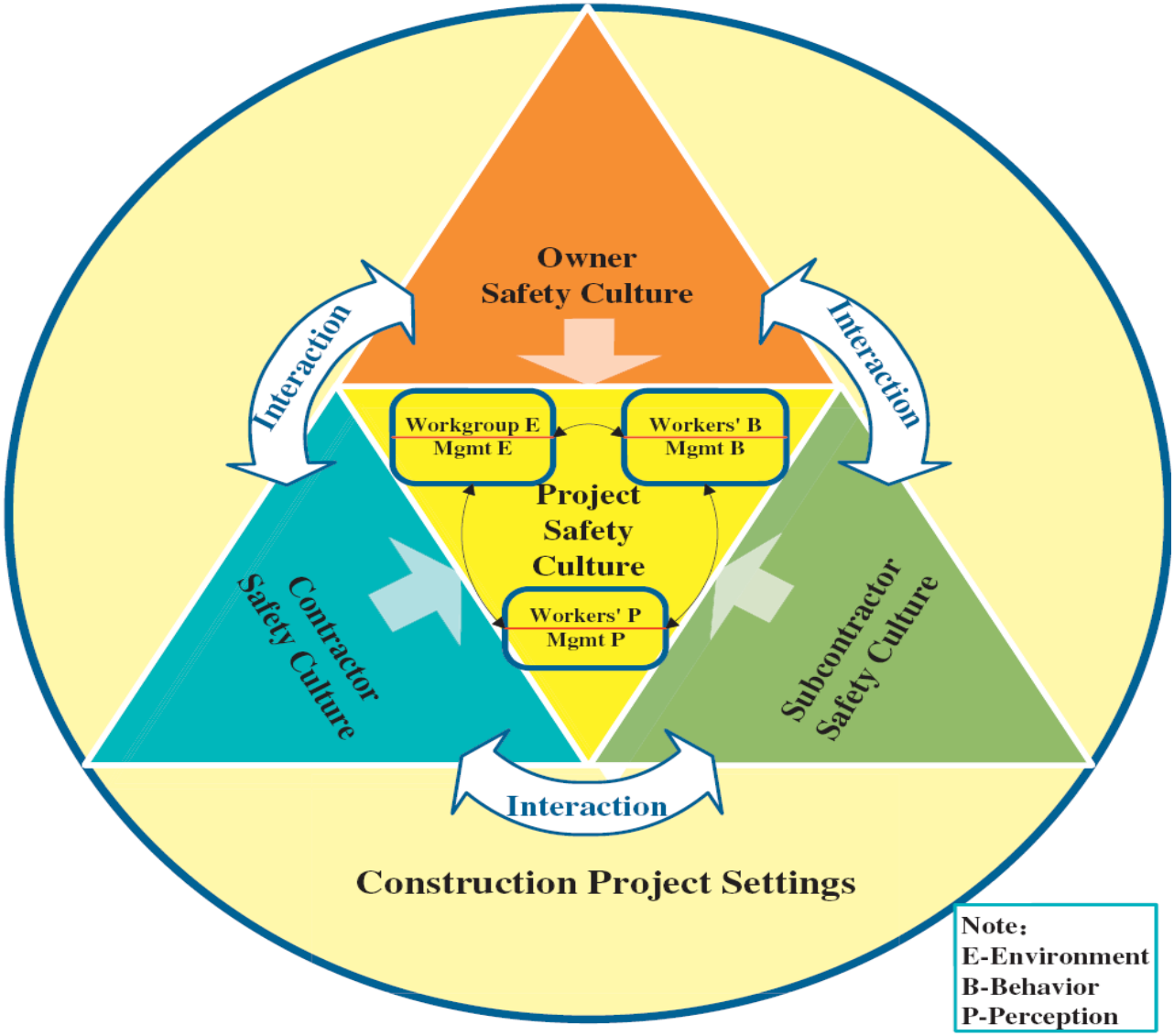

Figure 3. Safety culture interaction (SCI) model [Fang et al. 2006]

are considered as a vital element [Fernandez-Muniz et al. 2007].

One more point of view on Construction industry was considered by Dongping Fang it is Safety culture interaction (SCI) model. The inputs aforementioned are indicated by the three single-headed arrows in Figure 3 and the composite influence from these three parties could represent the construction project safety culture [Fang et al. 2006].

Taking a mixed approach of theoretical development and case-based development, the SCI model as a framework for construction safety culture study is proposed as shown in Fig. 3.

3 CONCLUSIONS

In this paper, we have seen that review of the triad models concept have the similarities and differences. Each type of model has some utility for understanding aspects of safety culture, or a version of the relationship between organization culture and safety outcomes and individual, group or organisational levels, it is still possible to identify key components - three elements which include subjective internal psychological factors, observable ongoing safety-related behaviours and objective situational features. In this variation, the internal psychological factors (i.e. perceptions and attitudes) are measured via safety culture questionnaires. Since each of these safety culture components can be directly measured in their own right, or in combination, it becomes possible to quantify safety culture in a meaningful way at many different organisational levels, which previously has been somewhat difficult. However, it is rare that a framework incorporates all of these facets, and it is even rarer that a methodological approach is defined for applying the framework in an industry setting.

Based on literature review one of weakness of the safety culture domain is that most studies focus on the individual and organizational components of safety culture but generally do not address the engineering model. This means that organizations are relying on individual employees to change their behavior in order to change the overall safety culture, which is difficult to achieve. Further, a focus on the organizational components such as management oversight and chain of command are only a part of the safety culture system. Thus, changes in overall safety culture may not be fully realized until changes across all three modules are addressed [Cole 2013]. There is a need for further research that utilises complementary models to provide an encompassing framework for understanding and measuring safety culture and relationships.

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