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Evaluation of Organization Regarding Safety Behavior in Projects: Bayesian Network Approach

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ABSTRACT:
Numerous investigations on most occupational accidents show the influence of the role of organizational factors in these accidents. Research and evidence show that root causes are more effective than technical or human error in these incidents. Therefore, organizational factors are an important issue in safety, and focusing on them is a tool to reduce risk in the workplace. The construction industry accounts for a major share of the industry in different countries. The rate of accidents and casualties in this part of the industry is much higher than in the entire industry. Safety is a main concern in the construction industry, including the construction of high-rise buildings, where Bayesian networks determine the effect of each group of factors affecting the safety of the project through the proposed modeling. As the results show, leadership, commitment, management, participation, and supervision of the safe process are the most influential factors in the safety level of projects.

Keywords: organizational components, employee behavior, Bayesian network approach

INTRODUCTION:

Situational and accidental events do not always necessarily lead to the loss and destruction of the company but also lead to a decrease in the morale of employees, productivity, quality of goods and services, and ultimately the popularity of the organization. The rate of accidents and deaths in this part of the industry compared to other active industries has been significantly higher. For example, the American construction industry, having almost 40% of the total labor force in the industry, includes 19% of casualties. While almost 29% of workers are working in the industry, nearly 40% of accidents in Iran have belonged to these accidents.

Safety is one of the main goals of any project. Safety incidents in the work environment can have many adverse effects on other project goals, such as reducing productivity, delaying the schedule, prolonging activities, increasing costs, and reducing the final quality level. Here, it is noteworthy that we should not consider individuals only as involved components; but also we should recognize organizational components as tools of emergence and events that lead to the improvement of safe work behavior on the project in the workplace.

Statement of the problem

Preventing accidents is only possible with a proper understanding of the factors that play a key role in their occurrence. Thus, many researchers tried to identify and investigate the causes of accidents in a wide range from individual levels to organizational levels. Human errors and lack of safety training for the individuals present in the workshop are associated with the most important and root causes of accidents in poor planning, defects in laws, hidden dangers created by others, the inability and inadequacy of workers to perform project work activities, etc.

Modeling of incidents

Since the need for safety is a physical and psychological foundation for humans, many researchers have tried to provide different models and theories about the origin of accidents. We have described below the two well-known and widely used theories: the domino theory and the Swiss cheese model. Other cases of modeling are multiple causality theory, behavioral models, human factors approach, Ferrell's theory, modified loss causation model, etc.

Domino theory: It considers the occurrence of accidents as only one of five consecutive factors leading to injury or death. The domino theory considers a person's race and social environment as the birthplace and platform for learning his skills and sees individual errors and carelessness caused by his race and social environment. They are rooted in his culture and unconscious, which leads to the emergence of unsafe behavior or unsafe conditions. This behavior can end in an accident, just like what happens in the arrangement of dominoes in reality. Eliminating each of the dominoes can stop the chain of damage.

Swiss cheese model: It is another model of the causes of accidents; it uses risk analysis, transportation safety risk management, medical engineering, and security

systems. This modeling likens human systems to several pieces of Swiss cheese put together, whose weaknesses in each layer are like holes in the cheese. The threat that is being realized is mitigated by successive layers that have different defensive powers in nature. This model sees the occurrence of accidents as a consequence of weakness in all levels because if there is no weakness in even one layer, no accident does occur.

METHODS:

First, accidents that cause serious injury to workers have been identified by studying the unofficial statistics of accidents in the country to achieve the goals of the research. Since we use the presence or probability of occurrence of these types of risks as a criterion for determining the level of safety, the high number of occurrences of these incidents or the high probability of their occurrence in a project indicates the low level of safety of the project and vice versa. The factors that influence the safety level of the projects have been identified and selected in the next step by reviewing the literature and looking at the unofficial statistics of the country's accidents. The collected information was entered into the Bayesian network and processed to find a relationship between the factors in safety and its level.

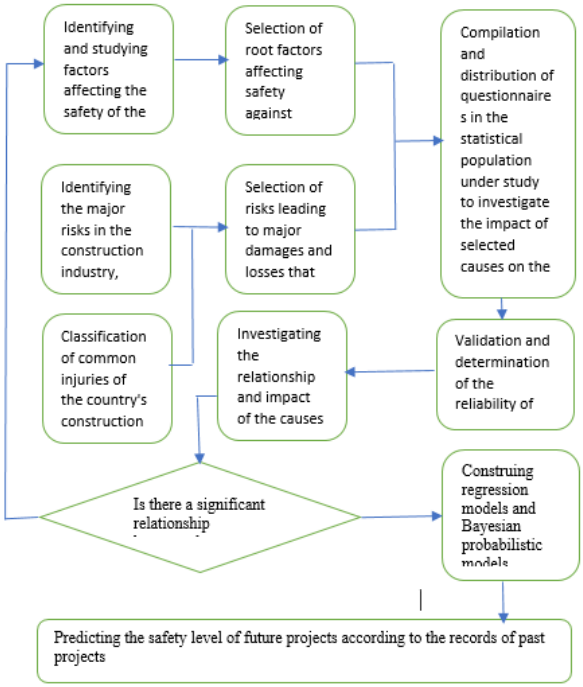


Diagram of Methodological workflow

Organizational components

Comprehensive management of individuals includes 5 key components. These components can effectively create an environment for employees that encourages their participation and thereby retain and improve the best talents.

The key components of organizational management are:

1. Creating: hiring a workforce that will create a better future for the organization.
2. Understanding, a better understanding of the present and future.
3. Interaction, opening doors for effective communication
4. Faster and stronger intelligent collaboration
5. Optimizing differences

The success and failure of the organization strongly depend on the relationships of all departments with each other and determine how an organization integrates with employees within the environment in which they operate.

Communications:

As many managers strongly insist, the process of mutual communication constitutes trust based on collaborative safety activities between different stakeholders in projects. An example of the implementation method of communication and consulting in the field of HSE is the effective communication of the company between internal and external elements. Communication and consulting are easy because of the explosive growth of means of information exchange between individuals. These acceptance measures support risk control and any safety initiative.

Commitment of management

Commitment at this management level motivates and pays attention to HSE issues at the organizational level. Allocating time, financial, and human resources and supporting HSE programs is the best way to demonstrate commitment. The humanitarian approach to work relations and dealing with work problems by managers has a significant impact on promoting the organizational culture of HSE. The HSE management system was seriously placed on the agenda of the Ministry of Petroleum around 2001, with the presence of major oil companies, including France's Total, in major national and country projects in the Bushehr province, especially the cities of Asaluyeh and Khark Island, which are the main and vital veins of the oil and gas industry and national income. It was communicated to all organizations in 2002 by the then-minister. Therefore, management, as known for a long time and widely agreed upon, is a key and main element of the organization's success in competition, product quality, job satisfaction, and safety.

Organizational learning

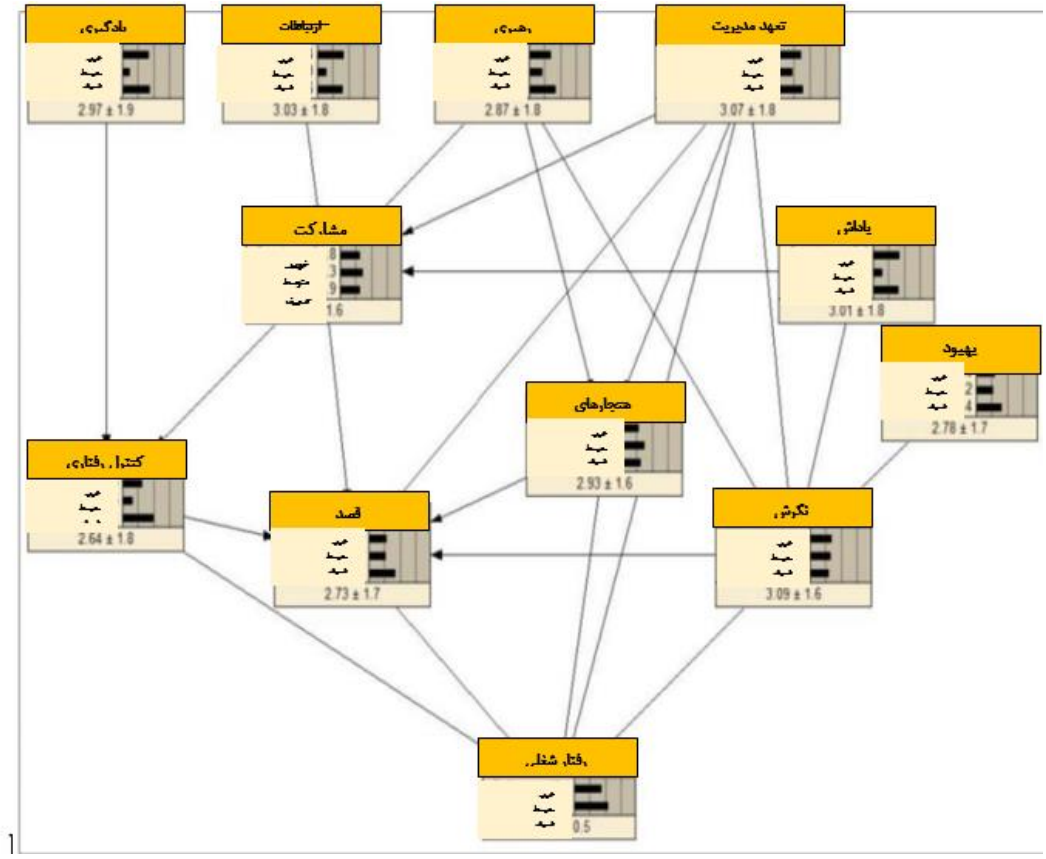
Another important issue in this system is the continuous maintenance of employees' awareness of organizational learning. It requires that all members of the organization throughout the organizational departments think about the emergence of new ways and learn new values and attitudes. Learning strengthens the creation of organizational

environments and encourages human resource development to achieve organizational usefulness and organizational versatility. There is a partial correlation between proactive views and risky and inhibitory behaviors. Thus, construction projects that use the concepts of learning at work are more likely to witness risky behaviors at work and this promotes safe work behaviors.

Development of Bayesian Belief Network (BBN)

The Bayesian network approach provides important capabilities for establishing such complex relationships. This graphic network can identify and estimate complex relationships about specific events in the construction environment. So this research has applied and adapted this technique in line to provide an attitude of influence of organizational components and psychological possibilities for safe work behaviors in projects. The main goal of implementing the Bayesian network approach was perception-based research of frontline/operational workers in construction projects to develop the network in predicting and estimating safe work behaviors and achieve individual attitudes, beliefs, and true concepts of organizational components, which take into account occupational health and safety. The development of the network expresses the possibility that the specifications and characteristics of the organization cannot be estimated in the expected schedule.

This risk focuses on the communication of the project unit and the development of the network in the advancement of the project. It depends on the research and development capability, participation, and complexity of the organization. Moreover, since past experiences may be useful in designing a new program, the complexity of the organization depends on the amount of effort it puts into project research and development.



Bayesian belief network

RESULTS AND SUGGESTIONS:

The main goal of this research is to create a framework that can provide a step-by-step preliminary estimate to determine the level of current projects based on information from previous projects. Examining the past research on the application of the Bayesian network in the management of construction projects has identified the general framework ruling on these networks to analyze and manage risk in the project. The lack of comprehensive information in the initial phases of the project, when managers and officials make important decisions about project planning, has made inevitable the use of expert teams, predictions, and conclusions based on incomplete data.

Bayesian networks are identified as a source of uncertainty, then their relationship with other existing uncertainty factors is checked, and the appropriate risk response can be predicted accordingly. Applying this modeling method in the remaining fields can also provide a practical and accurate model. Likewise, one of the most obvious advantages of the

Bayesian network over other models is predicting the future safety level of future projects. It is possible to predict when the information of some factors is available in a project and the project is faced with a lack of information about other factors. Thus, the Bayesian model has high probabilistic power in predicting the level of the future project.

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