

# Abstract

Time-to-market pressures, accelerating technologies, innovation, resource limitations, and technical complexities, social and ethical issues are key characteristics of a high technology organizations. They are complex, dynamic and more cross-functionally transparent. Rapid changes in technology, demands new learning and adjustments at workplace. Errors are likely to be made under these stressful, time-pressured situations. These may result in staggering economic loss for individuals, organizations, industries, and countries. High-reliability organizations (HROs) looks for experts in managing the unexpected to operate error free. HROs are defined as complex and technologically sophisticated, wherein a system failure may result in catastrophe. Team operating in HROs are referred as High Responsibility Teams (HRTs) that have a high responsibility for people and the environment.

The team as a social system broke the tradition of autocratic basis of work environment, this was a new window for researchers to understand human factors in automation, complexity and dynamic systems. With the emergence of high-end technologies and tightly coupled systems, managing and steering group of people from one social institutions to another demands the development of novel strategies for monitoring, understanding and responding to changing environment. HROs are accustomed to work under complex processes to manage complex technologies and adapt quickly by building creative responses to failure. The synergy among HRTs is critical, therefore the present study have driven to understand the nature of HRTs. Hence understanding the characteristics of HROs is essential to explore how teams are studied in different HROs.

## Literature Review & Defining Objectives of the study

The study began with review of literature contemplating on three major aspects (a) To identify concepts, structure and processes that account for on organization's high safety & reliability levels in HRO literature (b) Understand the team work group and team literature emphasizing on future research needs (c) Provide a range of studies focused on understanding the nature of teams in HRO literature across different organizations. During the literature review, we observed how medical care is borrowing the principles of HROs to improve patient safety. This gave us to insight about teams working in emergency medical care.

The literature reflected that most of HRO research studies were observational, case studies, exploratory and simulation based. Studies on HRTs highlighted methodologies adopted and few researchers focused on team context, structure and process. There is a pressing need for research to provide a more nuanced, contingency framework to identify HRO practices that fit their teams efficiently. With these insights, we defined our objectives of the study (a) To develop an integrated framework through descriptive case studies to understand the context, structure and process of HRTs (b) To measure and validate constructs of context, structure and process of HRTs (c) To compare and contrast functioning of HRTs in relation to context, structure and process across organizations. Multiple case study with contextual inquiry was

carried out in four HROs. We focused on four major areas (a) Context of Organization (b) Workflow (c) Roles & Responsibilities (d) Hierarchical Differentiation and (d) Operational challenges faced by the team. The findings & observations from the case studies were linked to theoretical prepositions and items to measure theoretical constructs were developed with help of HRO experts. The measurement tool was developed at three phases. Through case studies we observed HRTs at their work environment with a set of queries. In what context does a team operate? What is the structure of a team? What is the process of a team? With this background, a clearly delineated, but theoretically and empirically connectable set of measurement scale was developed.

## Major Findings

A sample of 306 from Airport Rescue Fire Fighters (ARFF) and Emergency Medical Care (EMC) teams representing from two international airport and two multispecialty hospitals. Exploratory & Confirmatory factor analysis was computed to validate emerging constructs. Five factors were emerged from EFA to represent Work Environment and five factors emerged to represent Dynamic Systems and complexity of developed High Responsibility Team Context Scale (HRTCS) to measure **HRT context**. In understanding the structure of HRTs four factors have emerged from the factor analysis to represent Task Structural Response and four factors emerged from the Teamwork measuring **HRT structure**. Four factors have emerged from team learning behaviour scale to represent collective team learning behaviour and three factors emerged to represent individual cognitive style of processing information and decision making to measure **HRT process**.

The extracted factors were subjected t test to determine significant difference between ARFF & EMC teams. Significant differences were observed with latent factors measuring context, structure and process of HRTs. There was no significant difference among the group on Deference to expertise, Emergency Response, The Prepositive and Collaborative at 0.01 & 0.05 level indicating the characteristics of HRTs operating in HROs. After establishing reliability and validity. We explored how these latent factors inter-related in the interest measurement development and how the observed data reflects integrated framework, which is theoretically driven, hence we used Structural Equation Modelling (SEM) technique to perform Confirmatory Factor analysis (CFA) for measurement model.

The results showed that items measuring the latent constructs driven from integrated framework explaining context, structure and process of HRTs were loaded statistically significant ( $P < .05$ ) by considering the traditional criterion of  $CFI \geq 0.90$ . The two developed scales were acceptable model to explain K.M., & Weik, K.E, (2007) HRO's principles of work environment and La-Porte & Consoling (1988) task structural response. The scale measuring dynamic systems and complexity failed to achieve minimum model fit, this gave us an insight to reflect to the tool and respondents' views. Further, new factors emerged from adopted tools have found to be loaded significantly ( $P < .05$ ) and their measurement model had obtained acceptable indices (Team learning behaviour and cognitive style).

## Conclusion

The objective of present study was to (a) To develop an integrated framework through descriptive case studies (b) To measure and validate constructs of context, structure and process of HRTs and (c) To compare and contrast functioning of HRTs in relation to context, structure and process across organizations. The developed integrated framework with set of interrelationships attempt to blend ideas, theories and results from areas HRO, Medical care, Groups and Teams, Human factors and ergonomics, Aviation Psychology, Human Computer Interaction, Technology management and Organisation Psychology. With respect to the specific contribution in these areas, the present study has empirically identified, set of reliability enhancing characteristics and attempts to understand social and environmental contexts in which teams operate under complex and tightly coupled environment. By proposing an integrated framework to measure HRTs context, structure and process is a primary step towards measurement development.

Familiarization, Flexibility, Preoccupation with Safety, Preoccupation with failure and Deference to expertise are the key factors which governs work environment of HRT. The HRT structure is directed by the nature of task operated at three different modes of HROs namely Routine or Bureaucratic, High Tempo or Peak and Emergency mode respectively. The fundamental structural unit of HRT is teamwork which is achieved through Communication & Co-ordination, Participative Decision Making, Recognition of Stressor effects and Shared Command Responsibility. The key factors emphasising the process of HRT are Collective reflection on process & outcomes, Collective Feedback & Evaluation, and Error communication at team level. At individual level members of HRTs prefers confirmative style to favour group dependency in approaching decisions and problems, followed by prepositive and collaborative style. Next stage of this research should be to come up with validation of developed instrument and focus on other HRO domains.