CAN LEADERSHIP STYLES INFORM SAFETY OUTCOMES IN SAFETY-CRITICAL ORGANISATIONS? A REVIEW OF LITERATURE

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ABSTRACT

Safety-critical organisations (SCOs), such as the military, fire service, aviation, emergency services, and construction, are characterised by being organisations with high potential for stress, accidents, and injuries. Environments where safety is highly critical (i.e., high exposure to risk and likelihood of an accident) - poses particular challenges for leaders. Thus, such environments call for specific leadership/ leadership style, which differ from those most effective in less safety-critical environments. Most research literature seems to associate leadership with traditional, linear models, which are incongruent with the behaviour of a complex system, such as the construction industry. Thus, the objective of this paper is to fill this research gap by: (1) critically reviewing relevant literature; (2) investigating the effect of leadership styles (LS) on safety outcomes, with emphasis on SCOs; and (3) developing a conceptual framework for empirical testing. A survey design will be applied to collect data from project managers in the construction industry within the Australian context. This paper presents a brief description of the effect of various LS on safety outcomes, using the principles of complexity science. The results of this study will present the effect of riding on the principles of complexity science to provide the premise for flexible responses to emerging patterns and opportunities in the construction industry.

Keywords: *Complexity Science; Leadership Styles; Safety Leadership; Safety Outcomes.*

1. INTRODUCTION

The way safety is managed in an organisation depends heavily on the beliefs and assumptions the management and personnel have concerning organisational behaviour and safety. Both researchers and practitioners within the safety field have tended to focus on an absence of negative events as being a proof of safety. Variance in human activity has been a major causal factor in accidents and incidents. Safety management has thus focused on identifying the possible ways things can go wrong, and then seeking to prevent such possible deviations by implementing barriers, emphasizing procedural adherence, creating redundant systems, supervising work and making clear the distribution of responsibilities. The numbers of accidents and other negative events, such as breakdowns, adverse events and process leaks, have been used as indicators of safety. This classical safety management paradigm views organisations as machine-like entities (Reiman et al., 2015). However, disappointments in the results achieved by the classical safety management paradigm together with the evolution in several scientific disciplines have led to an emerging view of safety as something more than the negation of risk. This new paradigm for safety management is supported by an increased application of complexity theories in safety science (Dekker et al., 2011; Dekker & Pruchnicki, 2014; Goh et al., 2010).

Researches in various safety consultancy projects in different safety-critical fields has led to the realization that many managers and experts in safety–critical domains experienced contradicting demands but lacked a theoretical framework to conceptualize what management principles they needed for trade-offs and balancing (Quinn & Rohrbaugh, 1983; Quinn et al., 2006). Thus, an investigation into how various LS can inform safety outcomes in SCOs is of paramount importance.

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2. LITERATURE REVIEW

The literature review provides a clear understanding of the research topic by giving details of various LS by their key characteristics. A breakdown of the technical components of safety are also discussed. Finally, the current state of complexity science is reviewed; in the light of how LS can determine safety outcomes in SCOs.

2.1. SAFETY

Most people think of safety as the absence of accidents and incidents (or as an acceptable level of risk). Hollnagel et al., (2013) defined safety as a state where 'as few things as possible go wrong'. A condition where the number of adverse outcomes (accidents/incidents/near misses) is as low as possible. This is achieved by trying to make sure that things do not go wrong, either by eliminating the causes of malfunctions and hazards, or by containing their effects. According to this definition, things go wrong due to technical, human and organisational causes – failures and malfunctions. However, since work situations are increasingly intractable, despite the best intention to avoid that, another definition of safety could be 'ensuring that everything goes right' (Hollnagel et al., 2013). This is a condition where the number of successful outcomes is as high as possible. It is the ability to succeed under varying conditions. And this is achieved by trying to make sure that things go right, rather than by preventing them from going wrong.

Hollnagel et al., (2013) concluded by emphasising that both ways of thinking represent two complementary views of safety rather than two incompatible or conflicting approaches. The specific balance of both approaches depends on the nature of the work, the experience of the people, the organisational climate, management and customer pressures, and a number of other variables.

2.2. LEADERSHIP

Leadership is a personal relationship in which one person directs, coordinates and supervises others in the performance of a common task. Leadership is a matter of aligning people towards common goals and empowering them to take the actions needed to reach them. The ability to influence individuals/group towards the achievement of a common goal (Yukl, 2013; Khan et al., 2015).

Leadership is increasingly being recognised as a key factor in supporting successful performance across a range of domains (Cameron & Quinn, 2011). Leadership can also be defined as a process of social influence in which a person can enlist the aid and support of others in the accomplishment of a common goal (Donovan et al., 2016).

2.2.1. LEADERSHIP STYLES AND THEIR KEY CHARACTERISTICS

The terminology style is roughly equivalent to the *leader's behaviour*. It is the way in which the leader influences the followers. There are many ways to lead and every leader has his/her own style. A thorough literature search was conducted by Hassan et al., (2016) to identify the existing LS and derive a framework for systematically arranging these styles into groups. The leadership labyrinth under the realm of three main scientific paradigms i.e. Trait, Behaviour and Contingency has extended to various styles. The constituent leadership styles of the three paradigms, frequently discussed and comparatively well-articulated in literature include autocratic, bureaucratic, charismatic, democratic, laissez-faire, transactional and transformational LS. Other forms are ethical, authentic and adaptive LS (Hassan et al. 2016).

In the past several decades, management experts have undergone a revolution in how they define leadership and what their attitudes are toward it. These experts have defined leadership from a very classical autocratic approach to a very creative, participative approach. Somewhere along the line, it was determined that not everything old was bad and not everything new was good. Rather, different styles were needed for different situations and each leader needed to know when to exhibit a particular approach (Khan et al., 2015).

The unabridged list of LS mentioned above is presented in Table 1 enlisting the characteristics of each style along with few references.

Table 1: List of Leadership Styles and their Key Characteristics (Adapted from Hassan et al., 2016)

Leadership Style	Key Characteristics	Referred by
1. Autocratic leadership	Punitive, less concerned for socio-emotional dimension of group, dominating, dictatorial, unilateral decision making	Foels et al. (2000); Van Vugt et al. (2008)
2. Bureaucratic leadership	Follows rules vigorously, ensure that subordinates also follow procedures precisely	Schaefer (2005); Santrock (2007)
3. Charismatic leadership	Strategic vision, unconventional behaviour, agents of exchange, sensitive to the needs of followers, risk oriented, extrovert	Hunt (1999); Gregory et al. (2004); De Hoogh et al. (2008)
4. Democratic leadership	Considerate, participative, concerned with maintaining relationships with others, group decision making	Gastil (1994); Foels et al. (2000); Woods (2004)
5. Laissez-Faire leadership	Lack of involvement, avoidance of responsibilities, resistance in discussing critical issues	Bass (1997); Skogstad et al. (2007)
6. Transactional leadership	Leader-Follower exchanges, clarification of subordinate responsibilities, contingent rewards	Bass et al. (2003); Van Vugt et al. (2008)
7. Transformational leadership	Vision, inspirational communication, intellectual stimulation, influence, empowerment, high performance expectations	Bass (1997); Avolio et al. (1999); Jung and Avolio (2000)
8. Ethical leadership	Awareness for others, considerate, honest, altruistic, caring, principled, internal locus of control, proactive, co-operative	Brown & Trevino (2006); Toor & Ofori (2009); Walumbwa et al. (2011)
9. Authentic leadership	Morally courageous, pro-social behaviour, reliable, honest, social justice and equality, optimistic, self-disciplined, self-expressive	Avolio & Gardner (2005); Hannah et al. (2011)
10. Adaptive leadership	Influences change (changes behaviour in appropriate ways as the situation changes), taps into human potential to make positive change, sees organisations as living – not mechanical – systems.	Bryman (1996); Lichtenstein et al. (2006)

2.2.2. REPRESENTATIVE LEADERSHIP STYLES

Below (see Table 2) are five representative styles (LS1-LS5) which are non-mutually exclusive. These representative styles have been developed by utilizing a common frame of reference i.e. focus on leader and centralization of decision making (Hassan et al. 2016).

Table 2: Representative Leadership Style **(**Adapted from Hassan, et al., 2016)

Critical Areas	LS1	LS2	LS3	LS4	LS5
Role of Leader	Clearly defined instructions and performance standards	Encourage participation	Seek highest standards of excellence	Assist followers	Leave followers to do task themselves
Leader's concern for others	Little	High	High	Very high	Little or None
Distance from followers	High	Moderate	Low	Low	High
Leader's decision-making style	Unilateral	Shared decision making through followers	Shared decision making by persuasion	Shared decision making in the interest of followers	Minimal or no role in decision making
Followers' motivation	Followers are incapable of performing tasks themselves and are moderately motivated	Followers are equal with the leader and are highly motivated	Followers identify with the leaders and are highly motivated	Followers try to reach their level of self-fulfilment	Followers are frustrated and unmotivated

Critical Areas	LS1	LS2	LS3	LS4	LS5
Focus on followers' growth	None as leader emphasizes followers only to follow instructions	Moderate as leader provides training and development to the followers	Moderately high as leader focus on the competence development of followers	High as leader's top priority is to help others achieve their goals	None as leader remains uninvolved

*LS1-LS5 indicates leadership styles 1-5

The six critical areas (i.e. role of the leader, leader's concern for others, distance from followers, leader's decision-making style, followers' motivation and leader's focus on followers' growth) have been selected to view the difference in the five different styles, as they all are essential components of leadership.

Based on these characteristics of representative leadership styles, an amalgamation of the 10 LS identified are shown in Table 3 below.

Table 3: Leadership Styles Clustered into Five Representative Styles Based on Common Characteristics (Adapted from: Hassan et al., 2016)

LS1	LS2	LS3	LS4	LS5
Autocratic	Democratic	Transformational	Ethical	Laissez-faire
Transactional		Charismatic	Authentic	
Bureaucratic			Adaptive	

*LS1-LS5 indicates leadership styles 1-5

2.3. SAFETY LEADERSHIP

Safety leadership is a sub-system of leadership and can be defined as "the process of interaction between leaders and followers, through which leaders can exert their influence on followers to achieve organisational safety goals under the circumstances of organisational and individual factors" (Wu et al., 2016). Leadership is fully implicated in safety. Safety leadership is an important factor in supporting safety in SCOs.

Safety literatures demonstrate a clear positive link between leadership and *safety outcomes* (Kelloway et al., 2006; Zohar 2002). Some authors claim that active *leadership behaviour* (which includes aspects of surveillance, proactive behaviours towards potential deviances, and feedback about mistakes) is also a critical dimension that should be empirically studied (Clarke, 2013). Positive links have thus been established between various forms of *safety leadership*, and a range of individual and group *performance* and *outcome* variables, such as workforce *compliance* and *participation* (Clarke and Ward 2006; Martínez-Córcoles et al., 2012), and *safety climate* (Hystad et al., 2013; Zohar & Luria, 2005). Martínez-Córcoles and Stephanou (2017) defined *Safety climate* as the employees' shared perceptions about their work environment in terms of safety. Spencer and Spencer (2008) defined *competence* as a personal trait which can influence behaviour and performance. Boyatzis (1982) also defined it as the "underlying characteristics of a person that leads to or cause effective and outstanding performance".

Gaining an understanding of the factors that influence employees' *safety performance* can prove vital for reducing the incidence of job-related injuries (Neal & Griffin, 2006). Neal et al. (2000) have highlighted two dimensions of *safety performance*: *safety compliance* defined as ''adhering to safety procedures and carrying out work in a safe manner'' and *safety participation*, defined as ''helping co-workers, promoting the safety programme within the workplace, demonstrating initiative and putting effort into improving safety in the workplace''. Specifically, *safety compliance* consists of behaviours that are viewed as part of employees' formal job description, while *safety participation* includes behaviours, which are discretionary and extend beyond employees' formal work role (Neal et al., 2000; Neal & Griffin, 2006).

2.4. PRINCIPLES OF COMPLEXITY SCIENCE

Leadership continues to be associated with traditional, linear models, which are incongruent with the behaviour of a complex system, such as the construction industry. However, Plsek and Greenhalgh, (2001) suggest

abandoning models of linearity for complexity science, which provide the premise for a flexible response "to emerging patterns and opportunities".

Traditional LS remain entrenched in current bureaucratic structures that emphasize trait-based models and the "dyadic relationships between leaders and follower" (Weberg, 2012). Weberg's review of traditional leadership theories implies that the goal for a leader is to "control uncertainty and work toward absolute stability". He goes on to say that it is these very linear traditional leadership models that have produced the fragmented systems that we have now. He suggests that leadership based on complexity science can provide a different and improved way of leading in organisations.

As the study of complex systems primarily focuses on the relationships between parts, patterns of behaviour and interdependencies within a dynamic system, applying the same principles to safety and leadership provides guidance in practice and presents an alternative leadership model that enables managers to embrace leadership suitable for the twenty-first century. There is greater demand for leadership that understands and values the nature of this high level of interactivity. Strategies to develop leaders who are able to function well in this complex system which is based on complexity science are likely to be more relevant than using traditional hierarchical approaches to leadership. These traditional approaches are not only outdated but incongruent with system (organisational) behaviour. The scientific principles of complexity views leadership as a process that involves many individuals. Complexity science emphasizes the adaptability, creativity and flexibility of leadership, not as a set of values existing in any one individual. In the words of Gareth Morgan, "Leadership is a verb and a process, not a noun" (Morgan, 2006).

The five principles of complexity science are connectivity, interdependence, feedback, exploration-of-the-space-of-possibilities and co-evolution. Based on Mitleton-Kelly's (2003) work, the five principles are grouped into three areas: relationships between agents (encompassing connectivity, interdependence, and feedback), patterns of behaviour (exploration-of-the-space-of-possibilities) and enabling functions (co-evolution).

2.4.1. Relationship Between Agents

The concepts of connectivity, interdependence and feedback will better help to understand the quality of relationships between agents; in this case, LS in safety-critical organisations, and its effect on safety-outcomes. According to Mitleton-Kelly (2003), "connectivity and interdependence means that a decision or action by any individual (group, organisation, institution, or human system) may affect related individuals and systems". Thus, LS can be seen as influential in fostering crucial relationships and play a valuable role as agents to determine safety outcomes.

2.4.2. Patterns of Behaviour

Generating variety in strategies is referred to by Mitleton-Kelly (2003) as exploration-of-the-space-of-possibilities. Less dependent on "pin-point forecasting, top-down planning, or elaborate controls" (Weberg, 2012), natural system behaviour morphs to create a new structure through exploration. The ability to explore allows organisations to identify multiple strategies before a significant investment of resources is made. Exploring the space of possibilities and generating variety through the lens of new strategies and new ways of doing things is suitable for SCOs.

Behaviour patterns in teams are formed over time and processes can become ingrained. The dynamic nature of complex systems requires that processes change as needed and that teams demonstrate a nimbleness that can provide the fluidity to adapt. Leadership behaviour is instrumental to either the encouragement or discouragement of a team's ability to embrace change, including its capacity for generation of new ideas or to be innovative.

2.4.3. Enabling Functions

Mitleton-Kelly (2003) differentiates between co-evolution and adaptation as change that is seen in relation to "all other related systems" and not simply adapting to a "separate and distinct environment". For instance, in a social system, each "fully participating agent" "both influences and is influenced by" the related agents or organisations. Within SCOs, leaders are influenced by unique forces because of their specific tasks, their professional affiliations and their role in the organisation. Looking at how each co-evolve and influence change

can provide some insight on how best fit can be determined and where collective leadership capacity can be most valuable.

Interactions among team members, external influences, such as government or suppliers, and political, cultural or economic forces vary all the time with each entity evolving constantly but together or co-evolving. The evidence indicates that "systems thinking" is required for effective leadership and that chaos should be seen as opportunity.

Agents within a complex system are sensitive to fluctuations in the environment. Agents are both the initiator of change and the receiver of influences from other actions within their environment. A heightened sensitivity to the dynamics of complex systems allows for the co-evolution necessary for change and movement within a SCO. According to Anderson and McDaniel (2000), it is when problems become more complex, as in SCOs, "managers need all of the different points of view they can muster".

3. RESEARCH METHODOLOGY

The preceding literature review gave a detailed explanation on how leadership styles can inform safety outcomes in safety-critical organisations. It also emphasised that most literature seems to associate leadership with traditional, linear models, which are incongruent with the behaviour of a complex system - such as the construction industry.

This is a quantitative study in which a survey will be carried out to validate the conceptual model and data analysis carried out. The survey design will be applied to collect data from project managers (research population) in the construction industry within the Australian context. Figure 1 depicts the conceptual research model for this study.

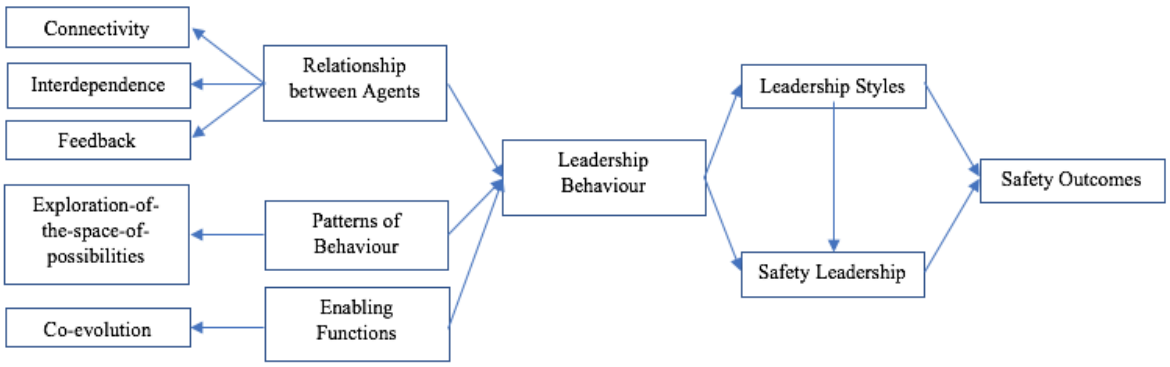

Figure 1: Conceptual Research Model

Relationships between agents, entails ways in which *leaders* can foster relationships, build trust and promote effective feedback to improve *safety outcomes* based on the principles of connectivity, interdependence and feedback in SCOs. *Patterns of behaviour*, explore how *leaders* can encourage team members to try new strategies based on the exploration-of-the-space-of-possibilities principle. *Enabling functions* identify how a *leader* may be an agent of change within an organisation premised on the principle of co-evolution.

4. CONCLUSIONS AND THE WAY FORWARD

This study will shed light on the understanding of the behaviour of various LS, and how they can inform safety outcomes in SCOs. The Structural Equation Modelling (SEM) which is a well-known technique for estimating, analysing and testing models that specify relationships among observed and latent variables (Kline & Santor, 1999) will be used to analyse the relationship between LS and safety outcomes in SCOs. The results of this study will present the effect of riding on the principles of complexity science to provide the premise for flexible responses to emerging patterns and opportunities in the construction industry.

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