Evaluating attitudes to safety leadership within rail construction projects

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Abstract

Safety leadership is widely discussed, commonly relating to improving safety performance within an occupational environment. Whilst there is considerable research on the characteristics of positive and negative safety leadership behaviours, research to date does not evaluate these in the context of rail construction projects, with no specific consideration of the complex interfaces and challenges faced by temporary configurations of Client, Principal Contractor and Supply Chains within this sector. Twenty-one in-depth interviews were undertaken with representatives from Client, Principal Contractor and Supply Chain, to identify attitudes to safety leadership and consider how this may impact on safety performance. The level of understanding of safety leadership as a topic was evaluated against how well the study participants could explain the concept, and whether they could provide any examples of real world application. A total of 26 different examples of safety leadership interventions from the rail construction sector were identified from this study. These mostly aligned to nine good safety leadership areas identified within the literature, such as increasing visibility around safety, workforce involvement, providing recognition for good safety performance and ensuring effective communications. Half of the intervention examples provided were based around communications, in particular opportunities for leader engagement or the sharing of information. This study has identified that there are numerous safety leadership interventions being deployed within the rail construction sector, with the likely success of these leadership interventions being influenced by five themes; context, preparation, communication, leadership behaviour and style, and action.

Key Words

Safety leadership, project, construction, rail

1   Introduction

Construction activities that either enhance or maintain the railway infrastructure are undertaken trackside, within metres of trains travelling up to 125 mph and 25,000 kV high voltage electric supplies, making the rail construction industry the second most high-risk industry in the UK (RSSB 2004, 2005). Occupational health and safety performance is measured by the industry using accident data, with trends showing an increase in accidents. The RSSB Annual Safety Performance Reports discuss safety performance, and identify necessary actions for the railway industry, which states the risk to track workers undertaking construction activities track-side is 3 times the rail industry average (RSSB 2005).

Over the years the traditional measures of occupational safety performance have indicated that the sector has reached a plateau (Network Rail 2007). The sector has extensive standards, processes, and an advanced competence management system, yet the next step change in safety performance has not been achieved. This is typical of high hazard industries (Dekker and Pitzer 2016) where the focus has been on compliance with written documents, consistency and quantification of safety performance data, rather than on the management of risk in complex, uncertain and changeable socio-technical systems, and empowerment of those individuals exposed to risk. This is supported by Fleming and Lardner (2008) who state that this is a stage of cultural development of the industry; with standard safety arrangements in place, the focus should be on improving behaviour and culture to achieve the desired step change in safety performance.

Since the 1970s there have been numerous studies to better understand the common factors associated with organisations that have high levels of safety performance (Cohen 1977, Mearns et al 2003, DeJoy et al 2004). These studies identified that high levels of safety performance are common in organisations with a good safety culture. Further studies have identified a number of factors that explain a good safety culture. A genuine and consistent management commitment to safety is one of the key factors that have been identified (Schein 2010, Clarke 1999, Zohar 1980, Mearns and Flin 1999). The role of leadership is evident in the work of Schein (2010), who states that safety culture is the output from an organisation's adaptive processes in response to both internal and external factors, and that this response is steered by a leader.

More recently a new strategy document was published (HSE 2016a) that identifies the UK health and safety regulator's main priorities for all businesses. Within this sector of industry, challenges include the division of corporate and project leadership amongst the Principal Contractor and Supply Chain in relation to safety and the impact of corporate safety leadership and integration of the Supply Chain in project safety arrangements in relation to large projects. Whilst the larger companies tend to demonstrate safety leadership internally, this often fails to be followed through their Supply Chain

(HSE 2016a). This is important for Rail Industry Construction Projects, where the majority of participating organisations are Small to Medium-sized Enterprises (SMEs), accounting for 80% of the cost of a construction project (Constructing Excellence 2004). Therefore, if safety culture in rail construction is to improve, the issue of safety leadership must be addressed across a range of stakeholders involved in construction projects.

The aim of the study presented in this paper was to investigate how to deliver effective safety leadership interventions in rail construction projects. The paper presents in-depth interview analysis of the current understanding and implementation of leadership at different levels of a rail construction project. Content from the interviews are analysed to determine what is understood by the term leadership, to identify the types of intervention that are currently implemented and understand factors leading to success of these interventions. These findings are interpreted using literature from Zohar (2002a), Donovan et al (2016), and Lekka and Healey (2012) to reflect strategies for leadership interventions. As such, the study contributes:

1. New data on perceptions of safety leadership, relevant to rail construction projects
2. Critique and extension of safety theory (Zohar [2002a], Donovan et al [2016] and Lekka and Healey [2012]), with a view to contextualising that theory for rail construction projects, and potentially for other project-based industries
3. The basis for effective future safety leadership interventions on rail construction projects.

2 Background

2.1 Characteristics of Rail Industry Construction Projects

The Construction Industry's safety management arrangements in the UK are governed by the Construction Design and Management (CDM) Regulations 2015. These regulations outline interfaces between organisations for project delivery and safety management. By definition a project is '*a temporary endeavour with a defined beginning and end undertaken to meet unique goals and objectives'* (Oxford Brookes 2011). A common project organisation structure is developed, referred to as a 'Project Delivery Organisation' for the remainder of this paper, as illustrated in Figure 1. A Project Delivery Organisation is established with a number of companies, co-ordinated via contractual obligations, for a determined period of time (Rowlinson 2004); key duty holders being the Client, Principal Contractors and Supply Chain.
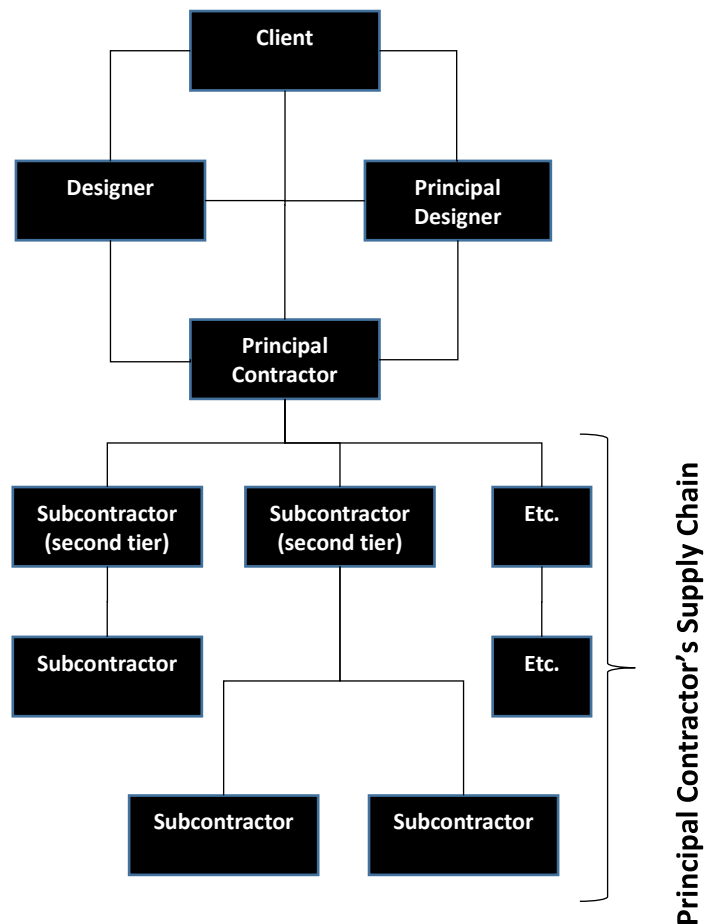
Figure 1: Typical structure of a Project Delivery Organisation

The Client is *'the person or company, with the controlling interest in the project'* (Health and Safety Authority 2009); usually the funder of the project and specifies the project remit. The Client's influence is substantial, and has a direct impact on project safety performance (Winkler and Irwin 2003). Following the introduction of CDM Regulations 2015 there is an increased focus on the role of Clients, as it is recognised that *'Clients can significantly influence standards on a project / site from its inception;… where clients show leadership and promote collaborative working then health, safety and other benefits ensue'* (HSE 2016b). However, there have been limited studies undertaken regarding the role of Client and their impact on safety performance.

The Principal Contractor, by definition, provides the project lead for safety. The site management team set the project safety agenda and any desire for improving safety performance. Akintoye et al (2000) found that outsourcing often leads to a lack of leadership commitment to safety due to a perceived dilution of accountability and unclear responsibilities, negatively affecting the safety culture on the project. Subsequently, outsourcing can become a potential barrier to successful safety performance. Arditi and Chotibhongs (2005) found that the more complex the organisational structure

of the project, including many layers of sub-sub-contracting, the greater the lack of clarity regarding safety responsibilities. Assumptions, duplication and gaps were commonplace due to poor communication and lack of proactive management. Studies from other sectors by Winkler and Irwin (2003) and James et al (2007) also support these findings.

Ninety eight percent of the industry's Supply Chain is made up of SME organisations with less than 60 employees (DTI 2011). Research has shown that SMEs typically have less adequate control and arrangements for safety, which is exacerbated in the Construction Industry due to the complex socio-technical systems common across the industry (Walters and James 2009, Winkler and Irwin 2003). The typical characteristics of a SME include a lack of health and safety personnel appointed by the company resulting in a reduced awareness of safety requirements and a lack of ownership and leadership to improve safety (Walters and James 2009). Farrington-Darby et al (2005) identified that use of subcontractors greatly affected trust, negatively impacting on safety culture within a rail Delivery Unit.

2.2 Safety Improvement and Leadership

What is clear from research is that there are defined approaches for establishing a safety improvement programme (Fleming and Lardner 2001, Vredenburgh 2002), although none of these take specific account of the challenges within a Project Delivery Organisation. A Safety Improvement Programme (an example of change management) is a wide term for any activity focused on changing workplace behaviours that cause (or are believed to cause) accidents. Whilst there are a number of different Safety Improvement Programmes, many of them have similar principles, focusing on improving behaviours and safety culture for the elements listed below.

- Visible safety leadership where senior management show their commitment to safety;
- Two-way communication throughout the organisation, and a means for obtaining feedback from the workforce;
- Engagement, involvement and inclusion of everyone in safety decision making;
- Peer observation of working practices to identify safe and unsafe behaviours during specific tasks;
- Use of coaches to promote good safety behaviours in the workplace;
- Assessment of safety culture or climate through use of attitude and perception surveys;
- Awareness training of psychological principles that describe how and why people behave in particular ways;

- Accident investigation techniques involving human factors, undertaken in a manner which avoids a desire to attribute blame.

Several papers have reviewed and compared such programmes across a range of industries. Generally, it is accepted that there is no single way of achieving behavioural change. Behavioural safety techniques are thought to help improve safety performance (Fleming and Lardner 2001), although studies have not yet quantified their impact (Sulzer-Azaroff and Austin 2000) and few studies provide information about the most effective approaches to take (Wirth and Sigurdur 2008). However, common lessons are reported from these studies and leadership is identified as a critical factor. Programmes are thought to be more successful when leaders are perceived to be committed to safety (Hopkins 2006, Fleming and Lardner 2001) and focus should be placed on management behaviours and not just the workforce (Hopkins 2006). Allocation of budgets, direct and indirect decisions that impact on safety, priorities, working practices and behaviours of leaders are known to affect a host of organisational outcomes, including safety. It is considered that without the right leadership in place any change programmes are likely to fail (Krause 1997, Petersen 1999).

There has been much research into organisational leadership since the 1950s, with a number of different definitions deriving from these studies, varying from:

- the influence of an individual (the leader) over followers (Hollander 1978)
- the process of influencing the activities of an individual or a group in efforts toward goal achievement in a given situation (Hersey and Blanchard 1988)
- leadership is that process in which one person sets the purpose or direction for one or more other persons and gets them to move along together with him or her and with each other in that direction with competence and full commitment (Jaques and Clement 1994).

These concepts were developed further in the 1990s where a number of studies considered the relationship between management behaviours (leadership) and safety outcomes. Such studies found that organisations in which leaders take an active role in promoting occupational safety show lower accident rates and therefore better safety performance (Shannon et al 1997, Zohar 1980). Wu (2005) defines safety leadership as *'the process of interaction between leaders and followers, through which leaders could exert their influence on followers to achieve organizational safety goals under the circumstances of organizational and individual factors'*.

Improving Safety Culture requires determination and stamina. Long-term focus, commitment, and reinforcing talk with action are more influential than campaigns and posters. Effective safety performance comes from the top where leaders should examine their own behaviours to become more effective leaders in safety. It is recognised that leadership drives culture, which in turn drives behaviour (Lekka and Healey 2012, Zohar 2002, Zohar and Luria 2003, Flin and Yule 2004). The Construction Industry recognises the lack of leadership across the industry (CIOB 2008). In 2008, the Chartered Institute of Building (CIOB) surveyed 655 construction professionals, and found that there was a need to *'reassess the leadership qualities and skills required by the Construction Industry'*.

As well as leadership being an important concept, there are a number of evidenced examples of what constitutes good safety leadership. These can be summarised within nine categories, presented within Table 1.

Categories of Safety Leadership	Source
Safety as a top priority	Gadd and Collins (2002); Clarke and Flitcroft (2013)
Demonstrable commitment to safety	Zohar (2002a); Flin and Yule (2004); Lekka and Healey (2012); Farrington-Darby et al (2005)
Increasing visibility around safety	Gadd and Collins (2002); Conchie and Moon (2010); Simard and Marchand (1995); O'Dea and Flin (2001); Zohar (2002a)
Enable safety reporting	Clarke and Flitcroft (2013); O'Dea and Flin (2001); Gadd and Collins (2002); Vredenburgh (2000)
Workforce involvement	Conchie and Moon (2010); Vredenburgh (2000); Zohar (2002b); Farrington-Darby et al (2005)
Create an open and learning culture	Gadd and Collins (2002); Vredenburgh (2000)
Provide recognition for good safety performance	Zohar (2002); Conchie and Moon (2010); Vredenburgh (2000); O'Dea and Flin (2001)
Ensure effective communications	Floyd and Wooldridge (1997); O'Dea and Flin (2001); Lekka and Healey (2012); Farrington-Darby et al (2005)

Effective safety management arrangements	Lekka and Healey (2012)

Table 1: Examples of good safety leadership taken from literature

Research also identifies the importance of safety leadership at two levels; Senior Management and front-line supervisors. The day to day opportunities for each of these groups to demonstrate their commitment to safety is different, based on their roles and day to day responsibilities (Thompson et al 1998, Marsh et al 1998). For example, a Senior Manager would demonstrate commitment through setting safety performance goals, and providing the resources to deliver these (for example people, funds and time for training etc.) (Isla Díaz and Díaz Cabrera 1997). By comparison a supervisor would demonstrate commitment by ensuring the workforce are involved in safety decision making, and prioritising safety above production (Andriessen 1978, Farrington-Darby et al 2005). This study focuses on the safety leadership of Senior Management. However, while good safety leadership can enable good safety performance, this can be undermined by pressure imposed by the leader to deliver work and 'get the job done' (Clarke and Flitcroft 2013, Zohar 2002b, Vredenburgh 2002).

It can be concluded that leaders' commitment to safety and their subsequent actions, does have an impact on safety culture and performance. Poor safety leadership can also have a significant impact on the organisation's safety culture and performance in a negative way, just as positive safety leadership is powerful. Therefore, if an organisation is seeking to improve safety it would be beneficial to understand what good safety leadership looks like to ensure that any necessary improvements are made in this critical area.

2.3   Research questions

Whilst key aspects of safety leadership are clearly identified within literature, there is limited research into the effective application of safety leadership within a complex Project Delivery Organisation. Existing models are focused on safety leadership within a single organisation and do not consider the challenges that are characteristic of this sector. This includes complex multi-organisational interfaces with unclear roles and responsibilities, lack of health and safety resources within the Supply Chain, unknown perceptions of safety leadership within SMEs, and lack of clarity in safety leadership within the temporary nature of a project environment.

Therefore, this study seeks to evaluate attitudes of senior management towards safety leadership across a sample of Project Delivery Organisations within Rail Construction for Client, Principal

Contractors and the Supply Chain representatives. These are interpreted for the rail construction sector using conclusions from the study by Lekka and Healey (2012) into effective leadership behaviours for safety and findings from safety leadership research in other sectors (e.g. manufacturing, Zohar 2002a; mining, Donovan et al 2016) on perceptions of leadership and examples of interventions.

The study focuses on the following three questions:

1. How well understood is the concept of safety leadership within Project Delivery Organisation in rail construction?
2. What safety leadership interventions are currently being undertaken in rail construction Project Delivery Organisations?
3. What factors are identified as influencing the effectiveness/success of safety leadership interventions?

3   Method

Interviews were undertaken with rail industry staff to explore the research questions. The structure and content of the questions allowed some variation in the questioning, enabling collection of additional explanatory details and examples to explore the understanding of the interviewees where this was appropriate.

3.1   Participants

To evaluate levels of understanding of the concept of safety leadership, 21 telephone interviews were undertaken with a purposive sample of Senior Management representatives from the Client, Principal Contractor and Supply Chain (seven from each group). This is purposive (Devers and Frankel 2000) in that participants were selected because they were already known by the interviewer to cover the relevant levels of Project Delivery Organisations, and were representative particularly for Principal Contractors and the Supply Chain, of the kind of organisations represented in the rail construction sector. This kind of approach has been used before in understanding safety culture (Parker et al 2006, Idris et al 2012). Each participant was chosen based on availability and willingness to participate from the first author's contacts within the industry. Due to the opportunities that were available all seven interviews for the Client group were with Senior Management representatives from an Infrastructure Manager acting as Client for rail construction projects. The Senior Management from Principal

Contractors and from Supply Chain Contractors were from different organisations covering a multitude of services within the Rail Construction sector. It is considered that the participants from the Principal Contractor and Supply Chain were representative of those undertaking the role within the Rail Construction Industry.

3.2   Materials

A set of interview questions was developed to structure the interviews. The interview involved two stages.

For the first stage, a definition of safety leadership was provided as detailed below:

> "Safety leadership is associated with visible and active commitment from the management team. Safety responsibilities are taken seriously and leading by example to establish and reinforce expectations for peers and colleagues through effective downward communication systems, and integration of safety in company-wide decision making (Gadd and Collins 2002, Zohar 2002a)."

Participants were asked whether they understood the statement, and either agreed or disagreed with this. This allowed a general appreciation of level of understanding of the concept of safety leadership, and for any misunderstandings of the concept to be clarified before progressing to the next stage.

For the second stage, participants were asked to share any good practice examples of safety leadership from their experience, using the following questions in relation to each safety leadership example:

- Can you briefly explain how this example works and what is involved?
- Who does this involve?
- How often is this carried out?
- From your experience, what are the good points?
- From your experience, what are the lessons learned?
- Would you repeat or recommend this to others?

3.3   Procedure

Each participant was provided a copy of the interview questions in advance of the interview. A telephone interview was carried out at an agreed time, and this was recorded with consent from the participant. Confidentiality and anonymity of information provided was maintained during this process. No findings from previous interviews were discussed with other participants.

The explanation of safety leadership that was provided to the interviewee in advance of the interview was used to frame the concept of safety leadership for the purposes of the interview. The interviewer read the safety leadership definition and asked if the interviewee understood the definition and secondly whether they agreed or disagreed with the statement.

Following this the interviewee was requested to share any examples of good practice regarding safety leadership with the researcher, using the prompts listed in Section 2. This procedure was repeated for all interviews for the Client, Principal Contractor and Supply Chain participants.

3.4   Analysis

A thematic analysis approach was taken to analyse the content from the interviews. The analysis followed the 15-point checklist of good thematic analysis identified by Braun and Clarke (2008), which informed the analysis steps undertaken. A similar approach to analysis was repeated for data for each of the research questions.   A summary of the steps in the analysis for each research question are listed in Table 2.

Research Questions	Step 1 – Transcription and Data Familiarisation	Step 2 – Initial Coding	Step 3 – Establishing Themes	Step 4 – Reviewing Themes against Literature	Step 5 – Analysis Conclusions	Step 6 – Reviewing Themes and Sub Themes	Step 7 – Theme Relevance and Conclusions
1 Understanding of safety leadership	X	X	X				
2 Examples of interventions	X	X	X	X	X		
3 Factors influencing effectiveness	X	X	X			X	X

Table 2 - A summary of the steps taken during the analysis for each research question

3.4.1   Analysis of understanding of leadership and examples of interventions

This part of the analysis relates to data on the participants' understanding of safety leadership, and secondly their examples of interventions. For the analysis of data on understanding safety leadership only steps 1 to 3 were followed as the interview responses contained were simple and concise and it was easy to allocate responses to one of three groups; no understanding, some understanding or good understanding. For the analysis of data for examples of interventions steps 1 to 5 were applied, with the additional steps included for a review of themes against literature findings in order to form conclusions. Further explanation of the five steps in the analysis are provided below.

Step 1 – Transcription and Data Familiarisation - The interviews were transcribed from recordings. Following the transcription, two reviews of each interview record were undertaken. These were reviewed in batches (Client, Principal Contractor and Supply Chain). The first review was for familiarisation with the data set. On the second review descriptions of leadership/examples of specific leadership interventions were highlighted within each interview record.

Step 2 – Initial Coding – Once each record had been reviewed, the participants' responses (for understanding of safety leadership and also examples of interventions) were coded in an inductive manner, with codes being driven by the data set and not predetermined by a coding framework. The codes that were generated from across all records were listed to form a full suite of codes. The full suite of codes were placed on individual cards and used as reference criteria for reviewing the interview records again (third review), to confirm the original coding or allocate a revised code to the text. Where different or additional codes were allocated these changes were noted on the individual interview record. These were reviewed in batches for Client (Cl), Principal Contractor (PC) and Supply Chain (SC) to simplify the process of administration. Once codes were identified these were recorded in a table for each batch with comments against each.

Step 3 – Establishing Themes - Themes were identified by grouping similar codes, using both the cards and notes on the codes to aid this part of the process of analysis. This allowed a definition to be developed for each theme. For example, examples of safety leadership interventions are provided in Table 3.

Batch	Comments	Code	Theme

CI	Briefings by management team, repeated on the project. Site stood down for a whole morning to attend the briefings.	Leadership Briefings	Engagement
PC	Tours are required to ensure key senior leaders of a business are visible to the workforce.	Safety Tours	Leader Visibility
SC	Consult with the workforce to create safety goals, and the importance of their roles when it comes to safety. Ask for workers opinions on what can be done better.	Workforce Engagement	Engagement

Table 3: Safety leadership interventions - examples of codes and commentary

Step 4 – Reviewing Themes against Literature – Themes from the analysis in this study were compared with literature on safety leadership interventions. A second set of cards was developed using the nine categories taken from a literature review (section 2.2), which represent good safety leadership. The cards listing the themes of intervention examples from step 3 above were then matched to the second set of cards based on literature findings of the planned intention for each type of leadership intervention. Themes were then collated into a table; themes which were identified from both the literature and study findings, those identified within the literature but not this study, and vice versa.

Step 5 – Analysis Conclusions – Conclusions from the analysis were recorded.

3.4.2 Analysis of factors influencing the effectiveness/success of safety leadership interventions?

A similar thematic analysis was conducted for this data relating to this third research question. This included repetition of steps 1, 2 and 3, to become familiar with the data, carry out coding and identify themes within the data, specifically for factors affecting the success of safety leadership. Due to the complexity of the data, sub-themes within each main theme were identified as detailed below.

Step 6 – Reviewing Themes and Sub Themes – For each of the main themes, the cards and table records (generated from step 3 above) were reviewed, in order to identify associated sub-themes. These were collated into a table for each main theme.

Step 7 – Theme Relevance and Conclusions – A written record of the analysis was prepared to identify factors that could influence the effectiveness or success of safety leadership interventions; either

positively or negatively. Emphasis was placed on the keyness or relevance of a theme to the context identified above (i.e. the relevance of a theme for the identification of factors that affect successful safety leadership interventions). Prevalence (increased occurrence within the data) was considered as part of the analysis, though recognising that a greater prevalence does not necessarily mean increased significance or importance to the findings.

4   Results

4.1   Understanding of leadership

The interviews were analysed for the level of understanding of leadership established by the respondents' ability to provide a description of safety leadership supported by 'real world' examples. Participants were asked whether they understood the statement, and either agreed or disagreed with this. This allowed a general gauge of level of understanding of the concept of safety leadership Categories of response ranged from demonstrating a lack of understanding of safety leadership through to a good level of understanding, based on participant responses. Example quotations are included.

I.   'Interviewee didn't really understand' (n = 4) - Individuals who were unable to explain what safety leadership was and couldn't provide any details or describe leadership at all, with wrong examples given that were not representative of safety leadership, but general safety management arrangements.

- *'Company A has good workforce engagement.'*
- *'I can't think of any examples that I have seen to be honest, it's not something we would be involved in.'*

II.   'Interviewee showed some understanding' (n = 6) – Individuals who stated that leadership was important for safety and described the role for safety leadership in terms of setting an example in the workplace, giving one or two examples, but without further explanation or reasoning.

- *'The Company always strives for best practice in safety leadership. We have adopted a Leadership Evaluation Tool which identifies and measures leadership behaviours.'*

III.   'Interviewee showed a good level of understanding' (n = 11) - Individuals provided a thorough explanation of why safety leadership is important, giving several different examples of leadership interventions and provided views on those which are most successful.

- *'Leaders must be passionate about their values and demonstrate them through behaviours consistently. They should want to do it rather than have to do it.'*
- *'As a senior team, we have regular and visible safety tours, where we have safety discussions with operatives. Our focus in on listening to operative feedback, actioning as we need to. We will share site safety tours with senior team from other contractors, showing our willingness to learn and be open with everyone.'*

Overall, almost all participants (n = 17) showed some understanding of safety leadership with 11 demonstrating a good level of understanding of safety leadership. This was indicated by being able to spontaneously generate many examples of safety leadership activity. Principal Contractors showed the greatest level of understanding and provided more examples of safety leadership than either the Client or Supply Chain groups.

4.2   Examples of leadership interventions

71 references to leadership interventions were recorded from across the interviews. In total, 26 different intervention types were identified from the interviews. Table 4 presents the list of interventions provided for each interviewee group: Client, Principal Contractor and Supply Chain.

The three most common interventions identified from interviews were:

- Workforce engagement sessions (identified by 9 participants)
- Site safety tours (identified by 8 participants)
- Mindful leadership (identified by 7 participants)

Following a further review of the 26 intervention types, they were grouped within seven themes on the basis of the planned intention for each intervention. The seven themes and definitions are listed in Table 5, along with the total number of references to interventions in that theme from across all batches (Client, Principal Contractor and Supply Chain).

Theme	Example Intervention	Description	Number of Participants that gave this example			
			CI	PC	SC	TOTAL
Strategic Direction	SHELT (Safety and Health Executive Leadership Team)	Meeting/forum where Senior Management discuss safety matters. Usually held by the Principal Contractor, sometime with Directors of supply chain invited to attend.	1	2	0	3
	Site leaders call	Weekly call where all Project Management dial in for a discussion and briefing with the most senior leader within the organisation. Focuses on communication of significant performance issues, and sets clear expectations for the forthcoming week.	0	2	0	2
	Safety objectives within performance appraisals	Safety performance is discussed within personal appraisals and objectives set that are specific to safety.	0	1	0	1

Theme	Example Intervention	Description	Number of Participants that gave this example			
			Cl	PC	SC	TOTAL
	Policy statements	A legal requirement for organisations who employ more than 5 people. The policy defines the organisation's commitment to safety and is signed by the most senior member of the organisation.	0	1	0	1
Leader Visibility	Site Safety Tours	Leaders (management from on or off the project) will visit and walk around the site of work activities to review and discuss safety performance with the supervisors/workforce on that site. A report is produced on completion of the tour.	1	7	0	8
	Back to the floor	Dedicated time where Senior Management work alongside the workforce and share their experiences in day to day activities, building relationships between management and the workforce.	0	1	0	1
	Prompt interventions	When a leader observes at risk or unsafe behaviour they immediately take action to stop an individual, make safe and correct their behaviour. The leader does not walk by the occurrence.	0	1	1	2
	Mindful leadership	Leaders demonstrate consistent role model behaviour towards safety; individuals have a high level of self-awareness and the impact of their behaviour on others.	2	3	2	7

Theme	Example Intervention	Description	Number of Participants that gave this example			
			Cl	PC	SC	TOTAL
	Follow up on investigations	Management actions in response to an incident; including the immediate response at the scene, preservation of evidence, escalation and reporting, further investigation and subsequent action. Management are present at event review meetings, provide investigation resources, participate in the investigation and ensure actions are undertaken in a timely manner.	0	1	0	1
Engagement	Step Ups	Time when everyone working on the project stops work to focus on safety. Usually led by Project Management and/or supported by Off Site Senior Management. Facilitation is commonly by the Safety Department.	1	3	1	5
	Contractors Safety Forum	Dedicated forum for the Supply Chain to attend, led by the Principal Contractor/Client to discuss safety matters.	1	1	0	2
	Supervisor forums	A forum for supervisors to discuss safety matters. Chaired by Principal Contractor/Client representative providing a direct route for feedback and communication with Senior Management.	0	2	0	2

Theme	Example Intervention	Description	Number of Participants that gave this example			
			Cl	PC	SC	TOTAL
	Workforce engagement sessions	A forum with the workforce to discuss safety matters. Chaired by Principal Contractor/Client representative providing a direct route for feedback and communication with Senior Management.	2	2	5	9
Training and Awareness	BBS Programmes	Behavioural Based Safety Programme where individuals attend briefings and training sessions to raise awareness of personal behaviours.	1	2	2	5
Training and Awareness	General safety training	Delivery of safety training; some of this is a statutory requirement, others a requirement of the industry, client or company to undertake specific works, including the use of plant/equipment/tools, or the placement of people in nominated roles.	0	1	3	4
Training and Awareness	Safety briefings	Briefings of safety related information which may include risk assessments, method statements, safe systems of work, tool box talks.	0	1	0	1
Reward	Reward Schemes	Defined scheme for recognition of desirable safety behaviours and performance. Rewards can vary from prize draws, donations to charity, trophies, vouchers.	1	1	1	3

Theme	Example Intervention	Description	Cl	PC	SC	TOTAL
			Number of Participants that gave this example			
Information Sharing	Leadership briefings	Leaders allocate time to deliver important safety messages via briefings. These are usually face to face.	1	1	2	5
	Safe Start Event	Akin to an open day dedicated to safety where leaders are present to discuss safety matters. Everyone is invited to attend from across a project or wider company/organisation. There is often a sharing of good practices and presentation of awards for good safety performance at these events.	0	1	0	1
	Safety moments	Safety messages are communicated; these can be via posters, emails or text messages. These are discussed at every meeting and briefing undertaken during the week of issue. Intention is to promote proactive safety communications and sharing of information.	0	1	0	1
	Observation cards	Post cards are distributed across the site so that individuals can record and report any safety concerns that they have. Project Management collate these and ensure prompt action is taken to resolve any safety concern.	0	1	0	1

| Theme | Example Intervention | Description | Number of Participants that gave this example | | | |
			CI	PC	SC	TOTAL
	Sharing of good practices	Process for the identification, assessment and sharing of good safety practices and innovations across the project, organisation and wider industry.	0	2	0	2
	Smart safety communications	Timely and effective safety communications for raising awareness of key safety risks as well as communicating significant events and messages to everyone.	0	2	3	5
Compliance Monitoring	Site safety audits	Scheduled audit/inspection of site practices. Documented record is produced and issued to site management for action. Can be undertaken by on or off site Senior Management, safety department or client representatives.	0	1	1	2
	Use of Just Culture Tools	Structured process for responding to errors and violations in a consistent manner. Also provides guidance on the application of consequences/sanctions for these behaviours.	0	1	0	1
	Worksafe procedure	Process where individuals have the right to stop work on the grounds of safety. The intention is that the individual feels confident to stop and report their concerns, and is not fearful of retribution.	0	0	1	1

Table 4: Details of Safety Leadership Interventions including counts from each interview group

Theme	Count	Description
Strategic Direction	7	Provide policy, governance and strategy for safety management arrangements
Leader Visibility	19	The physical presence of leaders in context of safety
Engagement	18	Time allocated for two-way discussion on safety matters with different members of the project's organisation
Information Sharing	15	The provision of safety related information using a variety of media
Training and Awareness	10	The provision of training and awareness increasing knowledge and skills to perform safety related activities
Compliance Monitoring	4	Undertake inspection, audit and assessment of compliance with minimum safety standards
Reward	3	The provision of award to recognise and reward contribution to safety

Table 5: Themes identifying planned intentions of safety leadership interventions

4.3 Factors influencing the effectiveness/success of safety leadership interventions

The analysis identified several themes that could influence the effectiveness or success of safety leadership interventions; both positively and negatively. A total of five main themes, with between two and four sub-themes were identified for each theme, presented in Table 6.

Main Theme	Description	Sub-Themes
Context	The environment and context in which the safety leadership interventions are being applied, including organisational and industry factors	• Leadership role as part of wider objectives is important • Organisation needs to be ready for this approach to be effective • There is a lack of consistency across the industry which undermines progress

Preparation	The focus on planning the safety leadership interventions; what needs to be considered before implementing the intervention(s)	• This is a significant commitment to do right and needs adequate resourcing • Interventions need continual refreshing • Measures of leadership behaviours are difficult; often measure the wrong thing which affects behaviours
Communication	The importance of communications to support the implementation of safety leadership interventions	• Targeted communications are important: relevance • Balance between positive and negative messages is important
Leadership Style and Behaviour	Reliance on the individual leaders who will be undertaking the safety leadership interventions	• Leaders must engage, be visible and credible • Leaders are not consistent at walking the talk • Management often overlook why individuals behave in a certain way; they do not tackle the real problem • Very reliant on individuals, their skills and desire to change
Action	Continual delivery of commitments and promises by leaders	• Follow up on actions and commitments is essential • Leaders need to understand that this is not a quick fix!

Table 6: Themes and Sub-Themes outlining factors for the successful application of safety leadership interventions

Each of the themes for success can be expanded upon as follows.

The theme 'context' takes account of the environmental factors in which the leadership interventions are being applied. The analysis has identified three different aspects for consideration. Cognisance of the integration of safety within wider organisational objectives is important, as well as the trigger or driver for any improvement activity; both of which are internal factors to an organisation and therefore more valuable to a Senior Manager who seeks to initiate an improvement programme

implementing safety leadership interventions. However, the third sub theme identified is in relation to the wider industry and the lack of consistency therein, which an organisation may need to be aware of but is unlikely to have significant influence over.

'Preparation' was also indicated as a critical factor. Interventions should include the allocation of sufficient resource (time, money, people) to deliver leadership interventions effectively. For example, there needs to be enough of the right people with the capacity to do a Safety Leadership Tour monthly. Individuals need training prior to conducting the Safety Tour, and there is a need for sufficient budget to pay for this training.

Targeted, regular and high impact formal organisational 'communication' is essential. This can be delivered through a variety of different media that balances the sharing of good news stories as well as lessons learned from accidents/incidents and other such significant events.

'Leadership style and behaviour' is heavily reliant on individual desire and ability to perform well. Success is dependent on how the workforce perceive the commitment to safety and whether it is believable from leader to leader (i.e. do they walk the talk, challenging at risk behaviours in a prompt and positive manner, each and every time such behaviour is observed).

Being seen to engage in 'action' was the final factor relevant to effective leadership. When leaders deliver on their commitments and promises, providing feedback to the wider teams to help manage their expectations, this helps to support credibility and develop trust. There is recognition that leadership is not a quick fix and will take some time to have a positive impact.

5 Discussion

This study has evaluated the attitudes to safety leadership of different stakeholder groups working within the Rail Construction Industry; for Clients, Principal Contractors and Supply Chain Senior Management representatives.

The depth of understanding of safety leadership as a topic was evaluated by considering how well the study participants could explain the concept and whether they could provide any examples of real world application. Providing a good level of understanding of what good safety leadership looks like becomes an enabler for recognising, and potentially implementing, leadership interventions as part of a safety improvement programme. It can be considered necessary to raise awareness of what good

safety leadership looks within the rail construction sector for organisations that are considering implementing a safety improvement programme (Farrington-Darby et al, 2005).

Whilst there was some level of understanding across the group, the Senior Management of Principal Contractors demonstrated a greater depth of understanding than both the Client and Supply Chain groups. This may be expected as it is the statutory duty of the Principal Contractors to manage safety on a construction project. Furthermore, the Supply Chain (typically SMEs) characteristically have limited health and safety resource (Walter and James 2009, Akintoye et al 2002). A role for dedicated health and safety resources is often to increase awareness of 'what good safety looks like' within an organisation, including safety leadership. Furthermore this study identified safety resource as one of the main themes for effective leadership interventions. The findings highlights the importance of understanding safety leadership at all levels within a Project Delivery Organisation, supporting research by Donovan et al (2016) that emphasised the importance of vertical integration, understanding safety leadership across multiple levels of an organisation. This is of particular importance within rail sector Project Delivery Organisations that have complex organisational interfaces.

The Principal Contractor group provided more examples of interventions than the Clients and Supply Chain representatives, giving an indication that as a group they are more aware and have more experience of implementing safety leadership interventions than the other groups. Although the Chartered Institute of Building (CIOB) in 2008 found that there was a need to *'reassess the leadership qualities and skills required by the Construction Industry',* it can be concluded that there is still some work to be done to improve safety leadership particularly amongst Client and Supply Chain organisations within the rail construction sector.

This is particularly relevant for a Project Delivery Organisation intending to implement safety leadership interventions, as projects are led by Principal Contractor representatives where the level of understanding and experience of real world application could be anticipated to be higher. Vredenburgh (2000) and Gadd and Collins (2002) identify the importance of leaders creating an open and learning culture; if Principal Contractors could develop such a culture within a Project Delivery Organisation there would be an environment that enabled the sharing of lessons between all parties through open two-way communication channels for both good and bad safety related news e.g. shared leadership training, workshops and safety inspections. For any future studies, further exploration of different levels of understanding and application between the different stakeholder groups (Clients, Principal Contractors and Supply Chain), as this may have an impact on the successful

implementation of safety leadership interventions for Project Delivery Organisations (i.e. some groups may need more training than another).

A total of 26 different examples of safety leadership interventions were identified from this study. These mostly aligned to the nine good safety leadership areas identified within the literature, summarised in Table 1 (Simard and Marchand 1995, Floyd and Wooldridge 1997, O'Dea and Flin 2001, Gadd and Collins 2002, Vredenburgh 2002, Zohar 2002a, Farrington-Darby et al 2005, Lekka and Healey 2012, Clarke and Flitcroft 2013); increasing visibility around safety, enhancing workforce involvement, providing recognition for good safety performance and ensuring effective communications. Half of the intervention examples provided were focused on communications; whether these were focused on opportunities for leader engagement or the sharing of information. Donovan et al (2016) has reported on the importance of communication for effective safety leadership. Several previous studies have identified critical leadership orientated success factors (Zohar, 2002a, Donovan et al, 2016, Lekka and Healey, 2012), including communication at both an organisational and individual level for successful leadership outcomes.

The leadership intervention themes identified in this study were compared against the nine areas from the literature, as shown in Table 7. The common areas identified between both this study and literature review are leadership visibility around safety and ensuring effective communications, workforce involvement within safety decision making and communications, and the provision of recognition for good safety performance. Each of the themes identified within this study show common areas with conclusions from Zohar (2002a); who's study from within the manufacturing industry found Senior Management expressing concern for worker well-being engendered stronger relationships between both parties with greater workforce involvement. The findings from this study also found effective safety leadership interventions targeted worker involvement with Senior Management. This aspect of leadership is common across both the manufacturing and construction industries and may be a key component of effective safety leadership in other sectors too.

Findings	Areas of Safety Leadership
Themes identified from study <u>not</u> included within literature review	• Strategic direction for safety • Provision of training and awareness • Compliance with safety standards and requirements
Themes identified within both study <u>and</u> literature review	• Increasing visibility around safety • Workforce involvement • Provide recognition for good safety performance

	• Ensure effective communications
Themes identified within literature review <u>only</u>	• Safety as a top priority
	• Demonstrable commitment to safety
	• Enable safety reporting
	• Create an open and learning culture
	• Effective safety management system

Table 7: Mapping of key aspects of leadership intervention outputs from study against the literature review

There were themes identified from safety leadership literature that were not evident in this study. Overall, there was less focus on leaders creating an open and learning culture to improve safety performance. The examples of safety leadership interventions were more transactional (e.g. award schemes, dedicated safety forums). Some of the examples of interventions were more aligned to leadership at supervisory level rather than Senior Management; similar to findings in earlier studies by Thompson et al (1998), Marsh et al (1998), and Wu et al (2008). This may be an indication that there is a greater awareness and prevalence of safety leadership interventions that can be applied at a supervisory level, more so than at a Senior Management level. Zohar (2002a) previously identified the importance of supervisory leadership in developing positive relationships with the workforce that, when supported by Senior Management commitment, was an enabler for improvements in safety climate within the manufacturing sector.

The current study has found that some factors influencing effective deployment of safety leadership interventions are around context (impact of internal and external influencing factors), preparation and planning prior to deployment, and the continual delivery of commitments made by leaders. Therefore, it can be concluded that the value of some interventions is recognised, although these are not specifically identified as leadership interventions.

The study found some examples of leadership interventions that included provision of strategic direction for safety management arrangements, provision of training and awareness, and compliance monitoring. These areas were not identified within safety leadership previous research, but are more commonly cited as good general safety management (Hale et al 1997). Further studies may be required to evaluate the relevance of these aspects as constituents of good safety leadership, whether these examples are more relevant to Senior Management than Supervisory safety leadership, and to determine whether these aspects are transferable beyond the rail construction sector of the industry.

The study identified five main themes for effective safety leadership interventions; which were; context, preparation, communication, leadership behaviour and style, and action. Each of these themes have been identified within literature as potentially having an impact on leadership interventions and subsequent safety performance. Donovan et al (2016) also found that leadership style was important in the context of safety. Also recognising that there was a lack of research to understand safety interventions and outcomes in complex socio-technical systems; a Project Delivery Organisation is such an example.

An individual's self-awareness and motivation will often affect their behaviour (Charles 2003), which in turn affects how other people perceive them. Consistency of behaviours is important for building credibility that there is a genuine commitment to safety, fundamental for good safety leadership (Lekka and Healey 2012). Another aspect that supports credibility and the development of trust, is when leaders deliver on their commitments and promises, providing feedback to the wider teams to help manage their expectations (Lekka and Healey 2012). This was also identified as a main theme. Similarly Farrington-Darby et al (2005) found that Senior Management had 'considerable influence' on safety on the track, through their role model behaviours, actions taken and dealings with Client demands.

Understanding the context in which the leadership intervention was to be implemented was considered as important. Schein (2010) commented on how it is important for an organisation to understand their position in the wider industry. Due consideration should be given to both industry and organisational factors as follows;

- other priorities and initiatives that are being implemented at the same time and the role of leaders in delivering these (safety or non-safety related), including time and resource limitations
- the trigger for implementing any improvement programme - is there a strong recognised desire and intent to improve leadership interventions? Is the organisation really ready?
- the transient nature of the industry and associated inconsistent externally-led influencing factors leads to an unstable motivation and conflicting demands, more challenging for any organisation/individual to balance the desire to change with day to day operations and project delivery

Overall this study provides support to existing safety theory by Zohar (2002a), Donovan et al (2016), and Lekka and Healey (2012) as already identified, and applies this to the rail construction industry. Undertaking effective safety-related communication practices has been identified as being important for the sector, addressing some of the specific characteristics of delivering work through Project Delivery Organisations made up of Client, Principal Contractors and the Supply Chain representatives,

and the associated challenges. Effective safety leadership at all levels of the Project Delivery Organisation is essential for positive safety outcomes.

The data set included the outputs from a purposive sample of 21 participant interviews. Therefore, the validity of the study findings are reliant on a relatively small sample of views from within the industry. Each data point for a Client represents a different individual for the Client organisation. Each data point for a Principal Contractor or Supply Chain represents the views of one person from different organisations. Therefore, this means that the results for the Principal Contractor and Supply Chain are based on one individual's perception and may not be truly representative of all organisations working at these levels within rail industry Project Delivery Organisations. However, this method was chosen as it is representative of the organisational and structure of a Project Delivery Organisation. All of the Client interviews were undertaken with Senior Management from one organisation, wholly employed to work within the rail industry, which may have led to some bias. Organisations that participated in the Principal Contractor and Supply Chain interviews may have some projects in sectors outside of rail. A broader experience may have influenced the feedback obtained during the interviews, but this is typical of organisations working within the rail industry. Extending the sample size further amongst the Principal Contractors and Supply Chain groups would go some way to address this.

6   Conclusions

Rail construction and engineering is an area where safety improvement is desirable. Rail construction projects are typically delivered by Project Delivery Organisations comprising of Client, Principal Contractor and a Supply Chain predominated by SMEs. In response to the three questions addressed in this study, the following conclusion are made.

This study has found differences in perceptions and levels of engagement with the concept of safety leadership within the Project Delivery Organisation, with Principal Contractors demonstrating greater depth of understanding and real-world application when working in a rail construction environment.

This study has identified that there are numerous safety leadership interventions being deployed within the rail construction sector. The most common interventions identified were examples of different types of engagement activities between leaders and the workforce, where visibility of leaders in the context of safety was highlighted. The effectiveness of interventions was found to be reliant on a number of factors, associated with the context, preparation, communication, leadership behaviour and style, and action.

For the Rail Construction Industry, the findings may help those introducing safety leadership interventions by highlighting the different types of leadership interventions that already take place, the bias towards communication-based activities, as well as providing a better appreciation of those factors that influence successful outcomes.

These results highlight the importance of understanding the application of leadership within a Project Delivery Organisation. The work presented in this paper has fed into a programme of action research which aims to identify and evaluate factors that influence the effectiveness of safety leadership interventions being implemented within Project Delivery Organisations of the rail construction sector with results due in the next 12-24 months.

The current study has focused on the attitudes to safety leadership. It would be beneficial for future studies to develop the work by Zohar (2002a), Donovan et al (2016), and Lekka and Healey (2012), to evaluate whether there are lower accident rates and therefore better safety performance within Project Delivery Organisations where leaders take an active role in promoting occupational safety. A focus on evaluating complex socio-technical aspects of the Project Delivery Organisation would be necessary to achieve this. Particular focus should be placed on understanding the objective and motivations of each Project Delivery Organisation member (Client, Principal Contractor and Supply Chain), resources, roles and responsibilities, and contractual relationships, all in the context of safety. It would also be beneficial to seek a greater understanding of what determines effective safety leadership interventions amongst supervisory as well and Senior Management levels working within a Project Delivery Organisation; in particular to evaluate if there a difference in interventions applied by both groups, how does this contribute to the effectiveness of the intervention as well as overall safety performance, and to explore the reasons for this.

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