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Conditions affecting safety on the Swedish railway – Train drivers' experiences and perceptions

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ABSTRACT

Major changes have been implemented in recent years within the rail bound sector. There is, therefore, a need to consider if and how these large alterations affect rail safety. The aim of the study was to explore train drivers' experiences and perceptions of conditions affecting safety of the Swedish railway system. Narrative semi-structured interviews were performed with ten train drivers. Qualitative content analysis was used to analyze the interviews. The results were captured in two main categories: (1) *Facing structural changes* includes results unclarity in responsibility assignment, deteriorated tracks and insufficient safety culture and (2) *facing technology development*, covered safety systems such as ATC and ERTMS which were seen as high-quality safeguards with both benefits and challenges due to new technical devices. The new challenges that have entered the arena should be offset by increased coordination and by a party responsible for safety within the industry. Finally, restrictions and regulations regarding the use of the tablets and smart phones are desirable.

1. Introduction

Sweden has had relatively few severe train crashes over the last few decades but the capacity situation for rail traffic is today very strained, by for example, substandard maintenance of infrastructure (Swedish Transport Administration, 2011a). Also, there have been startling numbers of severe mishaps during the last years (Forsberg, 2012) and serious incidents continue to occur (Transport Analysis, 2013). This is alarming given the predicted growing demand for passenger and freight transport in the near future (Swedish Transport Administration, 2011b).

Factors that decrease safety are often caused by a complex interaction of (i) human, (ii) vehicle/equipment, (iii) physical environment, and the (iv) socioeconomic environment during the pre-incident, incident and post-incident phases (Haddon, 1980; Haddon and Baker, 1981). The human factor is frequently used to denote the human tendency to misunderstand, miscalculate, and make mistakes (Edkins and Pollock, 1997; Chang and Ju, 2008; Dorrian et al., 2011; Kecklund et al., 2001). However, Lawton and Ward (2005) warn against putting too much blame on human error at the risk of omitting other important factors. The human factor must therefore be viewed in its context, for example as a part of the socioeconomic environment, and be understood as a result of a systematic failure (Lawton and Ward, 2005), symptoms of latent defects within responsibility assignment (Edkins and Pollock, 1997; Midya and Thottappillil, 2008) or unfavorable company policies (Kecklund et al., 2001; Chang and Ju, 2008). Consequently, resource management and organizational climate are critical parts of overall safety (Baysari et al., 2008; Santos-Reyes and Beard, 2006).

During the years 1998–2001 a comprehensive TRAIN-project (Kecklund et al., 2001) was conducted in Sweden investigating safety-related risks using a multi-disciplinary approach. The project focused on factors influencing the train drivers. During the course of the project, major structural changes within the sector were in progress. Thus, the authors concluded that there was a great need to conduct more scientific studies concerning safety issues and investigate how safety related risks had changed as a result of the development.

Since then, a liberalization of the public sector has taken place and critical societal functions, for example rail transport, are today controlled by an increasing number of mainly private, actors. The structural changes have involved new market solutions including deregulation privatization and incorporations which have created new conditions for safety (Alexandersson and Hultén, 2008; Finger, 2014).

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Today, the rail sector is fragmented in Sweden as well as within the Nordic countries and the EU. This signifies a lack of clarity regarding liability issues (Finger, 2014). There is a long history of state-owned railway in Sweden with the main actor being the Swedish State Railway. In 1988 a deregulation process started and the monopoly was dissolved. The Swedish State Railway was divided into several specialized companies, some state-owned and some private. A new authority responsible for the railway infrastructure, the Swedish Rail Administration, was formed (Alexandersson and Hultén, 2008). Responsibility for passenger- and freight transport, the technical maintenance of rail carriages, engineering and technical services, IT business, properties and cleaning, and switching are today divided onto different actors/-companies. The competition for track usage has increased and public procurement by competitive tendering now dominates the passenger rail market (Alexandersson and Hultén, 2008).

The new societal organization indicates that intersectional issues and decisions have increased between the various actors (Dekker, 2011; Dekker et al., 2011; Ingelstam, 2002), particularly since mishaps or accidents often are caused by circumstances or weak links between them (Akselsson, 2011; Dekker et al., 2011). Deficiencies or changes within one part of one sector can lead to unexpected phenomena in another sector. Time lag between an event and its implications can be difficult to identify when no clear linear relationship between them exists. However, today's methods, designed to measure linear and direct effects, are still used on complex phenomena whose effects occur over a longer time span. In doing so, there is a great risk of misunderestimating factors of significance for safety and drawing incorrect conclusions (Klinke and Renn, 2012; Bruijne and Eeten, 2007; Dekker, 2011).

This indicates that the railroad is in need of an examination where the rail sector is analyzed in the context of current conditions. Those who work daily on the tracks can provide one piece of the puzzle needed to give us a picture of conditions affecting safety within the rail bound sector today. Thus, the aim of this study is to explore train drivers' experiences and perceptions of conditions affecting safety within the Swedish railway.

2. Method

2.1. Participants

Swedish train drivers working for various railway operators were provided with information about the study and invited to participate either via an email from their employers or through written information at their workplace. The ten drivers who showed an interest in participating were issued an informational letter stating that participation was voluntary and that they were guaranteed confidentiality. All ten were included in the study after they gave their verbal informed consent. The drivers operated trains in various regions throughout Sweden. All participants, aged 25–64 had passenger traffic experience; four also had freight running experience. Work experience varied from 14 months – 37 years with an average of 11 years.

2.2. Data collection

The data was collected between November 2013 and May 2014 by the author using semi-structured interviews (Kvale and Brinkmann, 2009). An interview guide was constructed and included a few related questions. The interviews were conducted in narrative form (Riessman, 2008) starting with, "Please, tell me how you perceive and experience safety within the rail bound sector?" Follow-up questions such as, "What are possible factors which either reduce or increase safety?" The questions were asked to obtain as detailed descriptions as possible. To clarify the content of the interviews, (Mishler, 1986) the narratives were sometimes augmented by questions such as, "What do you mean?" and "What did you experience then?". The interviews were performed face to face ($n = 6$) and by telephone ($n = 4$) lasting between 30 and 90 min with average 55 min. All interviews were audio recorded and transcribed verbatim.

2.3. Data analysis

The transcripts were processed using qualitative inductive content analysis (Graneheim and Lundman, 2004). The analysis focused on the manifest content in the transcribed text meaning that the visible, obvious components are described (Kondracki et al., 2002). Thus, the text itself generated ideas for concepts and categories. The text was initially read to provide a first impression of drivers' experiences and perceptions of safety. In the next step, the text was re-read and words, sentences or paragraphs where related to each other through their content. As a result, meaning units were created. Thereafter, the meaning units were condensed while preserving the core content. The condensed text was then abstracted to emphasis description and interpretation on a higher logical level. The abstraction phase involved the creation of codes and categories (Graneheim and Lundman, 2004). This was done by the author and when uncertainty arose discussions was preformed with colleagues to ensure that the coding was in line with the meaning units and with the text as a whole. The meaning units were accordingly labeled with codes which were compared based on differences and similarities. Next, the codes where sorted into preliminary subcategories where the content shared a commonality (Krippendorff, 1980). After content comparison within and across the codes, they were combined into five separate sub-categories. The procedure was repeated to refine and validate the chosen structure. This arrangement enabled identifying and describing the characteristics of the main categories. Two main categories were formulated based on the text as a whole and the original interpretation of the text and where identified as a thread through the codes and sub-categories (Graneheim and Lundman, 2004). The internal logic and consistency was verified with research colleagues in seminar and by quotations from the text (Polit and Beck, 2011). Examples of the qualitative content analysis are seen in Table 1.

2.4. Methodological considerations

Using interviews as a data collection method is satisfactory when the desire is to explore people's experiences and perceptions (Graneheim and Lundman, 2004). However, the interface between the interviewer and the interviewee leaves an opportunity for co-creation. Nevertheless, this is not necessarily negative as it is possible to curb preconceptions and instead obtain a more detailed story. However, it is important to be aware of one's own preconceptions during the interview and in the analysis process (Kvale and Brinkmann, 2009; Mishler, 1986). To increase the credibility and transferability of the findings (c.f. Polit and Beck, 2011), the internal logic and consistency are verified by quotations from the text (Polit and Hungler, 2004). I assume that the findings are transferable to other settings were the contexts are similar, but especially relevant for rail bound sectors with comparable conditions as in Sweden.

Present study provides an indication that a more comprehensive study (e.g. survey) is needed concerning the topic in order to grasp a wider perspective. However, this study provides new knowledge and guidance on what should be examined in upcoming studies in order to obtain a high safety in the future.