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Reforming the road freight transportation system using systems thinking: An investigation of Coronial inquests in Australia

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ABSTRACT

Road freight transport is considered to be one of the most dangerous industries in Australia, accounting for over 30% of all work fatalities. Whilst system reform (i.e., change to policy and practice) is needed, it is not clear what this reform should be, or what approaches should be used to drive it. This article argues that road freight transportation reform should be underpinned by a systems thinking approach. Efforts to understand crash causation should be focused beyond the driver and identify contributing factors at other levels with the road freight system. Accordingly, we present the findings from a study that examined whether Australian Coronial investigations into road freight crashes reflect support appropriate system reform. Content analysis was used to identify the contributing factors and interrelations implicated in the road freight crashes described in publicly available Australian Coroner's inquest reports from the last 10 years (2004–2014; n = 21). The results found evidence to suggest that the Coronial inquests provide some understanding of the complex system of factors influencing road freight transportation crashes in Australia. However, there was a lack of evidence to suggest an understanding of system-based reform based on the identification of reductionist-focused recommendations. It is concluded that researchers and practitioners (ie., government and industry) need to work together to develop prevention efforts focused on system reforms. Systems thinking based data collection and analysis frameworks are urgently required to help develop this understanding in road freight transportation.

1. Introduction

Over the past few years a series of significant truck crashes have raised questions about the state of the road transport industry in Australia. From 2003 to 2012, 787 Australian workers were killed in truck-related incidents and 1119 people were involved in a fatal road crash involving a heavy vehicle (SafeWork Australia, 2014). Without appropriate intervention, these figures are likely to increase given a steadily increasing demand for both freight services and the requisite truck drivers (Australian Bureau of Statistics, 2014). These sobering figures highlight that road freight transport not only poses a significant threat within the workplace but also to public safety.

One approach to identifying interventions designed to reduce crashes involves the in-depth analysis of Coronial inquests. These inquests are designed to gather information about the cause and circumstances of a death, and make recommendations related to public health and safety; thus, the reports are critical in prevention efforts. Despite the industry's reliance on the Coroner, there has been little analysis of whether the analyses undertaken and recommendations produced are in fact appropriate given the complex nature of road freight crashes. This question is raised in light of recent research conducted in the U.S that identified that their peak body in crash investigation – the National Transport Safety Bureau (NTSB) – had a reductionist focus (see Newnam and Goode, 2015). That is, the data collected the NTSB crash investigation process does not fully consider aspects of system performance, beyond driver and vehicle level factors. It is unknown if this limitation exists in the Australian context. This question is important to answer as system reform in road freight transportation is required at a global level and researchers and practitioners need to work together to understand the strengths of system-reform and share their knowledge on lessons learnt. This article presents the findings from a study which examined whether the current Australian Coronial inquest process is optimal for understanding, and preventing future, road freight transport crashes. The paper addresses the question ". . .do

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the findings and recommendations from Coronial inquests support the appropriate reform of the road freight transport system?".

A driver-focused reductionist perspective has been identified as one of the key barriers preventing significant reductions in road crashes in the general driving population (Salmon et al., 2012; Salmon and Lenné, 2015) and in road freight transport (Newnam and Goode, 2015). This approach considers driver error as the primary cause of a crash, while contributory factors residing at other levels of the transport system (ie., regulatory policies & procedures) are largely ignored. It has been argued that a shift from the reductionist, driver focused approach to a complex, systems thinking approach is required for further reductions in fatalities and injuries to be achieved (Salmon et al., 2012; Salmon and Lenné, 2015). Newnam and Goode (2015) conducted a study examining the utility of a systems thinking approach in road freight crash analysis; yet to date, no research has examined if there is evidence to suggest an understanding of system-based reform in prevention efforts.

In Australia, the industry's understanding of the factors that contribute to road freight transport crashes is largely informed by the National Transport Insurance (NTI) Commission. The NTI produces bi-annual reports that are based on insurance claim data that describe the crash incident, the incident/site, the equipment involved and the immediate recollection of the drivers. There are various problems with this data and further it is evident from the reports that the insurer adopts a reductionist approach to investigations, primarily focusing on identifying unsafe driver behaviours. For example, the latest report highlights both inappropriate speed and fatigue as primary causes of road freight transport crashes (Driscoll, 2013). Whilst identification of such factors is appropriate, the systems thinking approach requires that a thorough investigation of the system wide factors that may have contributed to these factors and the relationships amongst these factors within and across system levels (Salmon et al., 2014). In the case of fatigue, for example, there may be contributory factors related to work rostering, industry guidelines around shift-work and safe driving hours, required delivery timelines, and organisational pressures. Factors, such as these, and the relationships between them are not identified within the NTI investigation process. Reports such as these suggest that the NTI does not adopt a systems-based approach to crash investigation.

The only other publically available source of information about road freight transportation crashes in Australia is through coronial inquests. These inquests typically involve detailed investigations into the causes and contributing factors of fatal injuries, as well as recommendations for reducing the likelihood of similar deaths. The recommendations are used to inform the decisions of government and regulators to improve public safety. These inquests, therefore, play a critical role in understanding road freight crash fatalities, and reforming the road freight transport system in Australia. As yet, no research has examined whether the Coronial inquest process adequately supports these goals.

The objective of the study therefore, is to explore the findings and recommendations identified in the coroners' reports using a system-based framework. To do this, we adopt Rasmussen's (1997) risk management framework and the Accimap technique (Rasmussen, 1997; Svedung and Rasmussen, 2002). The following sections provide a brief overview of both, along with details of their application to the road freight system and the current study.

1.1. Rasmussen's risk management framework and AcciMap

Rasmussen's (1997) risk management framework is underpinned by the idea that accidents are caused by: the decisions and actions of all actors within the system (e.g. government departments, regulators, CEOs, managers, supervisors), not just front line workers (e.g. freight drivers) alone; and multiple contributing factors, not just one bad decision or action. Safety is maintained through a process referred to as 'vertical integration', where decisions at higher levels of the system (i.e., government, regulators, company) are reflected in practices occurring at lower levels of the system, while information at lower levels (i.e., work, staff) informs decisions and actions at the higher levels of the hierarchy (Cassano-Piche et al., 2009; Svedung and Rasmussen, 2002).

To support the use of the framework for incident analysis, Rasmussen developed the Accimap technique (Rasmussen, 1997; Svedung and Rasmussen, 2002). The Accimap technique graphically represents how the conditions, and decisions and actions of various actors within the system interact with one another to create the incident under analysis. The technique describes the system in question as comprising of six levels (government policy and budgeting; regulatory bodies and associations; local area government planning & budgeting; technical and operational management; physical processes and actor activities; and equipment and surroundings). These can be adapted to reflect the domain of interest. For example, Newnam and Goode (2015) adapted Rasmussen's (1997) framework and Accimap technique to describe the road freight transport system in the U.S.A. The six system-levels as represented on Newnam & Goode's framework are described in Table 1.

Rasmussen's framework also makes a series of predictions, shown in Table 10, regarding accidents and safety in complex sociotechnical systems. These predictions have been used to evaluate the applicability of Rasmussen's framework and the AcciMap

Table 1
System levels of the road freight transportation industry.

Level	Description
Government policy and budgeting	Decisions, actions and legislation relating to road transportation
Regulatory bodies	Activities, decisions, actions etc made by personnel working for road transportation regulatory bodies, as well as policies and guidelines
Other organisations and clients	Activities, decisions, actions etc made by commerical organisations that impact on road freight transportation activities, such as clients and other organisations that operate within the road environment
Road freight transportation company	Activities, decisions, actions, etc made by supervisory and management personnel at the road freight transportation company, as well as company policies, planning and budgeting. Factors at this level typically occur prior to the crash itself but can also include decisions and actions made during, or in response to, the crash. Contributory factors related to policy, planning and budgeting typically occur well before the crash itself, and may even exist years before the crash occurred
Drivers and other actors at the scene of the crash	Actions and decisions undertaken 'at the sharp end' prior to, and during, the crash. This level therefore, describes factors related to actors directly involved in the heavy vehicle operation (e.g. driver of the heavy vehicle, co-drivers, passengers and the vehicle convoy) as well as other actors at the scene of the crash (e.g. other drivers, enforcement, road and rail work crews)
Equipment, environment and meteorological conditions	This level describes contributory factors associated with the vehicle and equipment (eg., in-vehicle telemetry), the physical road environment (eg., road surface conditions), and the ambient and meteorological conditions prior to or during the crash