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A model for the implementation of industry-wide knowledge sharing to improve risk management practice

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ABSTRACT

This article examines the process of industry-wide OHS/safety information management in the Australian coal industry. It uses as a case study the novel RISKGATE interactive database that has been created as part of collaborative efforts between multiple coal mining industry stakeholders over the last five years. The RISKGATE database operates within both the information systems and organisational learning models of knowledge management, capturing inter-organisational expert knowledge and facilitating dissemination to field practitioners through the medium of a digital web-based tool. This discussion will utilise variations of the Data–Information–Knowledge–Wisdom (DIKW) hierarchy as a means of interrogating, firstly, the process of how the various industry stakeholders codify their tacit knowledge on safety issues in the coal mining industry; and secondly, how that data is then made available through the RISKGATE database to practitioners (and others) working in the field. While Frické (2009, 131) thinks the DIKW hierarchy out-dated by reason of its 'philosophical backdrops of operationalism and inductivism' amongst other problems, we believe it still has relevance if considered a dynamic entity and not a fixed hierarchy.

1. Introduction

The juxtaposition of the two concepts: 'risk society' and 'information society', is a critical one (Hansson, 2002). Both labels are largely post World War II developments, ones that have accompanied a range of other 'post' re-configurations of the social, political, cultural, economic and technological landscape: 'post-industrial', 'post-modern', 'post-fordism', amongst them. As a concept, the 'information society' has been traced back to Fritz Machlup's 1962 book, *The Production and Distribution of Knowledge in the United States* (Crawford, 1983). From a technological trajectory, 'the invention of the transistor' is the 'crystal fire' precipitating 'the birth of the information age' (Riordan and Hoddeson, 1997). The 'risk society' concept is usually attributed to Ulrich Beck's landmark work from 1992: *Risk Society: Towards a New Modernity*. These works (and many more besides) assume and persuasively argue for a surfeit of each: we now have colossal levels of risk and monumental amounts of information, or rather, data. Furthermore, there has been much discussion, debate, and controversy over both terms. Inevitably, there are many causes (and outcomes) of this titanic excess of both risk and information in the post World War II period: intensifying globalisation, technological transformations, conflicting ideologies, the rise of mass media, political upheavals, environmental concerns, and wealth imbalances amongst them. We can, however, be certain of one thing: both a mutually compatible and a dualistically antagonistic relationship exists between risk and information.

Greater levels of information might suggest that both a decrease and an increase in the level of risk is possible, while a greater and a lesser cognisance of risk can arise from both more and less information. If this point is confusing it's meant to be, largely because confusion arises easily when human cognition is overloaded by too much risk and/or too much information (Miller, 1956). This intertwining of risk and information is especially pertinent in hyper-industrialised contexts like coal mining where an acute awareness and an enactment of both concepts underpin their safe and ongoing operation.

The communication of existing, *relevant* information related to risk/OHS management is one of the primary purposes of safety management systems (SMSs), with the objective of dispersing expert knowledge and making available tacit knowledge in an explicitly codified form (Wold and Laumann, 2015). SMSs are also designed to provide a standardised technology for regulating safety

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management procedures throughout an organisation, an assumption of linear knowledge diffusion that will be challenged within this discussion.

This article examines the process of industry-wide OHS/safety information management in the Australian coal industry. It uses as a case study the novel RISKGATE interactive database that has been created as part of collaborative efforts between multiple coal mining industry stakeholders (mining companies, suppliers, contractors, consultants, regulators, and researchers) over the last five years. While certain industries, such as the nuclear industry (Wahlström, 2011; Nesheim and Gressgård, 2014) and the geophysical industry (Threadgold, 2014), have been developing safety management systems at an inter-organisational level for some time, there is not yet any overarching industry-wide framework for the capture, retention and dissemination of safety-related information in the Australian coal mining industry.

The RISKGATE database operates within both the information systems and organisational learning models of knowledge management, capturing inter-organisational expert knowledge and facilitating dissemination to field practitioners through the medium of a digital web-based tool. This discussion will utilise the Data–Information–Knowledge–Wisdom (DIKW) hierarchy as a means of interrogating, firstly, the process of how the various industry stakeholders (referred to above) codify their tacit knowledge on safety issues in the coal mining industry; and secondly, how that data is then made available through the RISKGATE database to practitioners (and others) working in the field.

The DIKW hierarchy is used extensively, either explicitly or implicitly, in a wide variety of contexts, from libraries, museums, knowledge management, epistemology, and media communication, amongst other disciplines (Rowley, 2007). Furthermore, the DIKW hierarchy is traditionally configured diagrammatically as a vertical pyramid (see Fig. 1), with 'data' at the bottom, progressing through 'information' and 'knowledge', with 'wisdom' at the top (see Rowley, 2007; Awad and Ghaziri, 2004; Chaffey and Wood, 2005). A different variation simply inverts the hierarchy: data at the top and wisdom (or knowledge) at the bottom, as in Fig. 2 (Tuomi, 1999). Critically, as Nissen (2006, 22–24) acknowledges, information technology (or equally, digital or electronic technology), is closely interrelated to the evolution of the DIKW hierarchy, with both having emerged almost simultaneously over the last thirty years. However, given the omnidirectional and multitudinous nature of data as it is mediated via electronic technology, the term 'hierarchy' itself should be brought into question. Subsequently, and in response to the inverted model advocated by Tuomi (1999, Fig. 2), Nissen (2006, 21), proposes a DIKW model he calls 'knowledge flow directionality', where the various DIKW categories are duplicated on an horizontal axis with the 'producer/source view' of the categories on the left and the 'consumer/receiver view' on the right of the diagram (Fig. 3).

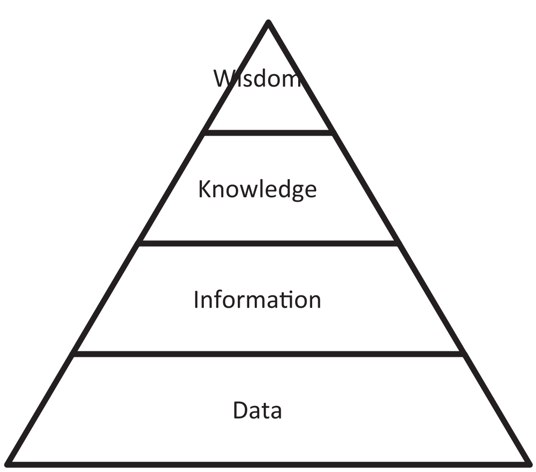

Fig. 1. Standard DIKW hierarchy.

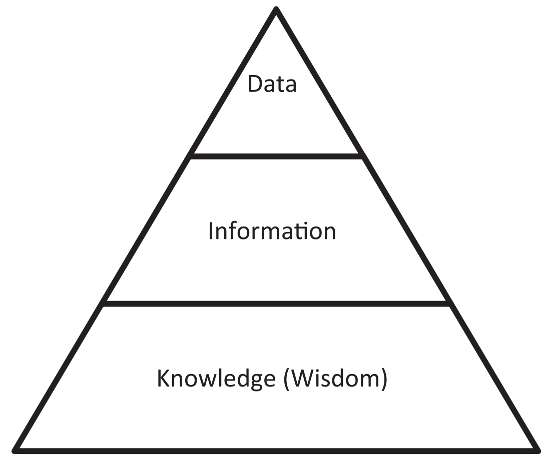

Fig. 2. Tuomi's inverted hierarchy.

As will hopefully become even clearer during the course of this discussion, Nissen's 'knowledge flow directionality' inflected DIKW model seems more appropriate to understanding the flow of safety information through the RISKGATE database. While Frické (2009, 131) thinks the DIKW hierarchy out-dated by reason of its 'philosophical backdrops of operationalism and inductivism' amongst other problems, we believe it still has relevance if considered a dynamic entity and not a fixed hierarchy. We will have more to say on how data in the DIKW model flows through the RISKGATE database in due course.

2. The background

2.1. Australian coal mining OHS

The Australian coal mining industry has been recognised as highly progressive in its approach to Occupational Health and Safety (OHS) (Cliff, 2012a,b). This quality is best exemplified in the change, throughout the late 1990s and early 2000s, from a compliance-based safety system to a risk-based management system (Kirsch et al., 2014e; Cliff, 2012a). This altered method was first proposed in the Robens Report in the UK in 1972, but did not have a major influence on Australian mining OHS regulations until it was formally introduced following a series of three major underground mining explosions in Moura, Queensland, the first occurring in 1975 and subsequently in 1986 and 1994 (Yang, 2011; Kirsch et al., 2014e). These explosions resulted in the death of 36 workers, and prompted the Queensland government's introduction of the 1999 *Coal Mining Act*, which was followed by a similar solution in New South Wales, the 2002 *Coal Mine Health and Safety Act* (Kirsch et al., 2014e). Each of the Australian states has implemented their own legislation for mining safety, although not all have moved away completely from compliance requirements, and there is no overarching federal legislative framework in place as yet (Cliff, 2012a). Joy (2004) describes the initial years of implementation of risk management approaches in Australian mining, which was accompanied by the introduction of duty of care and workforce representation and involvement, collectively driving the significant changes to safety management.

Risk-based OHS legislation is now the primary safety system in Australian black coal mining, with a predominance of operating