

Resilience Engineering, Gaps and Prescription of Safe Work Method Statements Part 1: The View of Organisational Outsiders

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Abstract The construction industry is frequently cited for its poor safety performance. In spite of this, many countries continue to rely on contemporary, prescriptive approaches to improve performance in the sector. In Australia, one such approach, Safe Work Method Statements (SWIMS), have been mandated in construction work. However, there is limited empirical research on SWIMS, so their ability to improve health and safety is largely unknown. This is a significant gap in our knowledge. Recent research suggests that Resilience Engineering (RE), which is an innovation in organisational health and safety management, offers a promising approach, by understanding the gap between work as imagined and work as performed. SWIMS provide a practical tool by which such a gap can be investigated in construction settings. Recent research also suggests that organisations are part of a broader socio-technical system. As such, gaining a view of the different elements of the system is an important first step towards developing an understanding of the role SWIMS play in health and safety risk management. This paper first describes the socio-technical system that constitute construction work; followed by an exploration of the meaning SWIMS as ascribed by the external agencies as the first ‘outsider’ of this system. It is based on an analysis of data collected as part of a larger PhD study of the prescription and practice of SWMS in the Australian construction industry.

Keywords Construction health and safety · Resilience engineering · Safe work method statements · Work-as-imagined

1 Introduction

The industry has always been considered to have one of the highest injury and fatality rates [1], with the same type of accidents continuing to occur over time [2]. There are a number of things that occur in construction work that set it apart from

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other traditional industries such as manufacturing. Construction work can be dispersed physically over several, sometimes distant, locations, with each construction site deemed to be a new workplace, effectively creating a series of ‘mobile factories’ which are disassembled and relocated once the project is completed [3]. However, the conditions at the new site might be completely different from earlier sites. Construction working environments can also be very dynamic, with frequent rotations of work teams, changing weather conditions, and a high proportion of unskilled, temporary and transient workers [4]. In addition, construction work is risky because of outdoor operations, work-at heights and use of sophisticated plant and machinery [5]; on some of the more larger construction projects tendering processes associated with sub-contracting may give little attention to safety, leading to cost and corner cutting [6]. On-site subcontracting also increases the risks of injuries [7]; with the nature of the work, poor attitudes and behaviours, ignorance, pressure from budget cuts and time restraints compounding the risks [5]. Moreover, some of the “unique work practices within the construction industry make it vulnerable to poor OHS outcomes” [8]. The industry is also highly fragmented, and the temporary nature of works that are involved means that lessons from previous works are not adequate to predict new sources of hazards [9]. In essence, this means that the construction industry is a complex one [10, 11]. A possible consequence of this is that improving health and safety in construction work can be more difficult than in a manufacturing facility [4], necessitating more innovative approaches. However, many organisations continue to rely on contemporary approaches, including standards, regulations, procedures and behaviour modification programs in the industry; in some cases due to regulations. In Australia one of such requirements includes safe work method statements (SWIMS), which have been regulated for high risk construction activities. However, apart from some guidance provided by state safety regulators, there is limited empirical research on SWIMS [12]. It is therefore questionable whether SWIMS are of any benefit in addressing construction health and safety risks, or merely an attempt by regulators to create an illusion of safety through paperwork.

1.1 SWIMS, Gap Between Work-as-Imagined Versus Work-as-Performed and Resilience Engineering

In essence, SWIMS are similar to safety rules [12, 13], and a key assumption behind their use is that workers will follow them. However, people do not always do so, and violations of safety rules are common in industry [14]. Moreover, sometimes some violations are necessary for achieving safety [15, 16]. In the field of organizational learning it has been identified that workers were quick to realize that no matter how clearly the rules were specified, the world was (to some degree) unpredictable, and they had to be prepared to use their innovative skills [17]. Such learning, according to the author, led them to adapt; subsequently, these adaptations

become part of norm. Moreover, because procedures and rules ‘always require an interpretation to bridge the gap between assumed and actual conditions, work as actually done is always different from work as imagined’ [18]. Hence there will be always be gaps between work-as-imagined (as assumed by rule makers) and work-as-performed (by those for who these designed for). What is important about this gap (between work as imagined by management and work as actually performed by workers) is that it is also an important factor in resilience engineering (RE) [19–21], which is the most recent innovation in health and safety management. Hence SWIMS offers us a way of exploring the gap between work-as-imagined and-work-as performed. A central research question which can be asked is do SWIMS enhance or impede RE as a health and safety management strategy in the Australian construction industry? Answering this question through empirical research is an important first step in understanding the role SWIMS play in construction safety.

1.2 Conceptual and Theoretical Framework

Advancing research on RE and SWIMS requires the use an appropriate conceptual and theoretical framework to set a boundary and provide a focus for research. This research is broadly aimed at developing an understanding of whether SWMS enhance or impede RE as a health and safety strategy in construction. According to the new thinking about safety and accident prevention, safety is a dynamic property [21–23] that emerges out of the interactions between different elements and sub-units of a socio-technical system [24, 25]. An understanding of the socio-technical framework that constitutes construction and SWIMS is thus important in answering the research question. One such framework is presented in the next section.

2 The Socio-technical System of Construction Work

The socio-technical system (STS) was first proposed as a way of understanding how different stakeholders could influence the way risks are managed in dynamic work environments [26]. The STS presented by the author included several levels including government, regulators and associations, company, management, staff and work. In the state of Victoria, Australia, where this research was conducted, the socio-technical structure can be decomposed into at least six levels, illustrated in Fig. 1.

The first level involves the government, and three key agencies that are involved include the Australian Building and Construction Commission (ABCC), Federal Safety Commissioner (FSC) and Safe Work Australia (SWA). The ABCC was an independent statutory body established following a Royal Commission of Inquiry into the Building and Construction Industry [27]. Until its abolishment in 2011 the

Fig. 1 The socio-technical system of construction safety in Victoria, Australia



ABCC had the primary responsibility of ensuring that ‘building work is carried out fairly, efficiently and productively for the benefit of all building industry participants and for the benefit of the Australian economy as a whole’ [28]. Whilst its main focus was the enforcement of industrial relations, the Act also enabled the establishment of the Office of the Federal Safety Commissioner (OFSC) for (i) promoting sustainable occupational health and safety cultural change in the building and construction industry, (ii) developing and administering the Australian Government Building and Construction OHS Accreditation Scheme, and (iii) identifying and progressing initiatives to improve OHS performance [29]. The activities of these agencies were directed at organisations involved in building and construction works for the Federal Government. This is different to the third agency, Safe Work Australia (SWA), which is a tripartite body composed of state governments, unions and industry representatives, and which is charged with the responsibility of ‘improving health and safety and workers’ compensation arrangements across Australia [30]. SWA is jointly funded by the Federal, State and Territory governments through an intergovernmental agreement (IGA) signed in July 2008. Its main mission is to reduce death, injury and disease in the workplace. Unlike the ABCC and the OFSC, which are predominantly involved with building and construction Safe Work Australia is involved in all industry sectors. Most recently, SWA developed and released the Model Work Health and Safety Act 2010, Model Work Health and Safety Regulations 2011, and a series of Codes of Practice, to fulfil the agenda of ‘harmonisation’ of health and safety laws.

The second level is the regulator who translates the government’s aspirations into safety law and enforces this in industry. The agency responsible for this is WorkSafe Victoria, through the Occupational Health and Safety Act 2004 and Occupational Health and Safety Regulations 2007. They also adopt the Model

COPs issued by the SWA. It is at this level that the legal prescription of SWIMS is established.

The third level includes a myriad of Associations of employers and unions, such as the Housing Industry Association (HIA), Master Builders Association (MBA), Civil Contractors Federations (CCF), Master Plumbers Association (MPA). In addition, a number of different segments and interest groups specific to building and construction may also be represented here; such as Australia's Largest Residential Builders (ALRB), Volume Home Builders (VHB). The main union involved is the CFMEU (Construction Division). Both types of associations provide advocacy, consultancy, and advisory services to assist their members make sense of state safety policy. It is at this level that the legal prescriptions are translated into advisory documents that are then made available for use, including 'generic SWIMS' which can be accessed and used by members.

The fourth level includes the company which undertakes the construction work, oversee development and construction, set broad policies and frameworks for works, operations, and safety. It is at this level that senior managers translate the legal requirements into organisational policies, standards and/or rules. In doing so they may seek advice and assistance of the Association to which they belong. At this level the legal prescriptions of SWIMS are translated into organisation controls.

The fifth level is represented by line managers, and these can be a varied group, from project and/site managers, depending on how the company is structured. In domestic construction their job involves managing a portfolio of construction jobs; in doing so they may work with a range of trade supervisors. These line managers are responsible for establishing and meeting targets for production and safety, selecting and inducting sub-contractors. They may work with OHS personnel to implement broad-level organisational controls handed down by senior management.

The sixth level is represented by the workers, comprised of a myriad of building and construction supervisors, subcontractors, tradesmen, apprentices and employees. At this level the supervisors play two distinct roles. One of these is as a manager for either one specific contract or a number of construction projects and it is here that they implement organisational policies, procedures and controls, including SWIMS. The other is as an employee, where they themselves are expected to follow policies, procedures that have been laid down by their organisation. So supervisors may play a role both in the prescription and in the practice of SWIMS.

The above discussion reveals that there are at least five different levels of involved in prescribing SWIMS in residential construction industry. Three of these are based outside of the construction organisation; these have been labelled as organisational outsiders. Two are based inside; these have been labelled as organisational insiders. The sixth level, which is also part of organisational insiders, is where the practice of SWIMS can be most evident. Gaining an understanding of SWIMS therefore requires an exploration of what this means to different stakeholders in this STS.

One method that has been suggested to be useful entails multi-level analysis which is a useful way of understanding organisational systems and enables

researchers to develop a deep insight into the realities of the complex nature of work in organisations [31]. Such an approach has been previously used earlier to investigate learning from errors in healthcare and patient safety [32, 33]. This framework can therefore be applied to investigate the prescription and practice of SWIMS.

3 The Prescription of SWIMS According to Organisational Outsiders

In order to test the STS framework, data was collected at a number of levels. The remainder of this paper discusses the prescription of SWIMS as according to organisational outsiders. For ease of discussion, results will be presented under two subtopics; government/regulator and association.

3.1 *Government/Regulators' Prescription of SWIMS*

The views of government/regulator are based on an analysis of two main sets of data. The first included a series of documents (comprised of standards, regulations, codes of practice, discussion papers, reports, submissions, codes of practice and 'generic SWIMS' for a range of activities). The second included interviews with six-key informants from the regulator. The informants worked as Health and Safety Inspectors, were all male, aged between 32 and 60 and had been in their current role from one to twenty-one years. Five key themes emerged at this level.

Safe System of Work. The first theme that emerged from the various understandings of SWIMS is that it is a safe system of work, one that 'sets out the method that will be used to undertake a particular task and the way that any hazards and risks associated with that task will be controlled' [34]. An example of this was illustrated in "... *it looks at the tasks that need to be undertaken, what are the hazards and risks associated with those tasks that need to be undertaken and what are the risk control measures that you're going to put into mitigate those risks*"... PAR048. The 'system of work' includes the method, or way the proposed work is expected to be done; and the 'way hazards and risk of the work are to be controlled' suggests it is about safety. They were very similar to 'job safety analysis' or JSAs, which is a method of identifying hazards with a focus on the relationships between the worker, tasks, tools and the working environment [4].

Live Strategy for Risk Control. The second theme was that SWMS are a live strategy for controlling risks. They are live because (i) they are required to be developed before the work actually commences, and (ii) maintained up-to-date during the course of the work. The expectations that SWMS are developed before the work actually commences is expressed in the following example: "... SWMS

should be treated as a live document in that they might go through detail in the SWMS of how they're going to do the works etc. but in any given time things may come up where they're going to alter how they're going to conduct a particular task. So it's no use going back to a SWIMS where it's no longer relevant so it's a live document so if anything changes then a SWIMS should then be changed to reflect any of the changes ..." PAR049. For this informant keeping SWIMS alive was about ensuring the written document was relevant to the work at hand, with any changes in task reflected in the written document.

Relevant for Some Work. The third theme suggested SWIMS were required for some, not all construction work. Both the government and regulator stipulate SWIMS come into play when doing 'high-risk construction work', including a prescribed list of nineteen specific activities. Thus activities such as bricklaying, framing, and concreting did not necessarily require SWIMS. In addition, the laying of concrete foundation for single storey buildings, plumbing and drainage works only necessitated one when this is being done by an excavator. In a similar manner the construction of pre-fabricated homes and pre-fabrication of precast concrete panels or roof trusses at a workshop were not deemed to warrant not a SWIMS [35]. The distinction that is used by regulators is to use the term designated high risk work (DHRW): "*We just look to see if they have got a (SWMS) when they are doing designated high risk work ..."* PAR044.

Regulators took more interest in those SWMS that are for designated high risk construction work: "I only look at the ones for high risk work, I don't look at the other ones ..., I am not interested in them ..." PAR044.

A Cognitive Artefact. The fourth theme that emerged at this level was that SWIMS represented a form of cognitive artefact [36, 37]. Such artefacts significantly amplify the basic purpose of physical things one uses in daily life. The following excerpt illustrates this: "*Preparing a SWMS is part of the planning of the work*" [38, 39].

"Well, a SWMS is just to demonstrate that you have thought through the process of how you are going to do the job"... PAR044.

According to the above, SWIMS can be used for planning and organising the work at hand, by thinking about the process of work, including the sequence in which it is going to be executed. This planning is expected to start well before the work starts, and usually revolves around hazards, risks and means of controlling them: *To make people involved in carrying out the activity stop and think about how they're going to do it ..., rather than getting half-way through a job and thinking, 'oh, gee, how am I going to get up there now? How am I going to finish this bit?' ...* PAR047.

Johns and Nemeth [36] have suggested that cognitive artefacts are useful in instances where it is impossible to perform the tasks. It is proposed they are also useful identifying both unanticipated and unexampled threats, particularly when the work environment and contexts can change from day to day, and new hazards can be introduced if multiple works are going on (for example, digging up a trench next to an area where roof tiling is going on, as opposed to digging a trench only or

doing roof tiling only). Having SWIMS meant forcing people to think about hazards and risks of the additional tasks they may not have been previously exposed to on the site.

A Tool for Social Interactions. The fifth theme that emerged here is that they are a tool for interacting with people. One form of this interaction involves consulting with people involved in the work: “*Employees, HSRs, as well as contractors and their employees, must be consulted in the preparation of the SWMS so far as is reasonably practicable*” [38, 39]. The regulator saw this consultation to include a range of actors, including workers, health and safety representatives, contractors and their workers. A second form of interaction involved informing people about the work at hand, an example of which was expressed in the following: “*It is to inform the employees how to do the job, that’s what it should be for ... This is how we we’re going to do the job and this is the system of work that we’re going to use*” ... PAR046. Informing involves communication, one of the fundamental requirements for achieving high levels of safety performance [40]. A third form of interaction involved ensuring those who are responsible for carrying out the work are actually involved in developing the SWMS. The importance of such interaction was expressed in the following example: “*... it’s no point in having someone sitting in an office who may have done the work previously, writing out one and then saying, “here, this is for you to do”. It has to be done by the people, they’re organised by the people who are doing the job because they’re the people who do the job, they’re the best ones qualified to write it and they’re the best ones of course to later on carry it out. And, if it needs reviewing, they’re the best people to review it as well*” ... PAR045. For this informant reviewing a SWMS meant engaging with people who were expected to be involved in doing the work. Completing a SWMS in the office and handing it out for someone to follow was not good enough because it was devoid of context.

3.2 *The Association’s Prescription of SWIMS*

This section includes findings from one employer association who chose to participate in the study, based on an analysis of discussions held with 1 informant, an OHS expert, and a review of documents. Two themes emerged from this level.

A Form of Control. The association who was involved in this study had not defined what a SWIMS was. If there was one, it had not been publicly expressed in the documents they supply and maintain on their websites. However, they ‘*see SWMS as a very critical component of safety management, especially in construction*’ (Association informant). According to this view SWIMS is an element of safety management. This term has a number of definitions, but a most recent one by Hollnagel is “a kind of control ... of organisational functions and practices that together produce safety” [41]. In this regard SWIMS represents a form of control for bringing about safety. However, whether this control is exerted as a ‘process’ or as an ‘action’ according to the Hale and Swuste [42] criteria was not really clear.

Required for All Construction Work. The association had view that SWIMS should be limited to construction work activities. However, they believe that there is no need to suggest the term ‘high risk work’;

(The Association) considers that the regulations should not use the term ‘high risk construction work’... [43].

They used an example to demonstrate the following point:

“...if a painter is painting a wall and there is energised electrical installation behind the wall, the painter would be required to complete a safe work method statement...even though there is no risk arising from the energised electrical installation. As the safe work method statement must include the hazards and risks “associated with” the high risk work (rather than the hazards and risks of that work) the safe work method statement would not need to cover the hazards and risks of the energised electrical installation (there are none) but associated hazards and risks (such as manual handling)...” [43]. The submission went on to argue that SWIMS should not be an automatic requirement but come in only *if there is a risk to health and safety* [emphasis added].

In terms of the types of construction work to which SWIMS were relevant to, the association believed all construction work had to be the subject of SWIMS. This was evidenced by an observation of at least 41 different SWIMS available on its website at the time the data was collected. The list was in fact twice that suggested by the government and regulator, and included different trades, work activities and equipment. What was different, however, was that it is possible that a work activity could be expected to have more than one SWIMS. For example, roof tiling on a domestic housing construction could be the subject at least thirteen different ones.

4 Conclusion

A STS framework was used to investigate SWIMS and RE in the Victorian residential construction sector. The findings of the two levels of organisational outsiders revealed a wide diversity in the prescription of SWIMS. While the government/regulator saw these as a safe system of work, a live strategy for controlling risks, relevant to (designated) high risk work activities, a cognitive artefact for planning work, and as tool for social interactions; the association saw these as form of control, and relevant for all works and trades. The latter also believed SWIMS should not be automatic requirement, but kick in if there is a risk to health and safety. In this light this view appears to be closer to the regulator than the government.

Findings at these two levels also suggested that there are at least three ways in which SWIMS contribute to safety. The first is by acting as a cognitive artefact, the second as a tool for socially interacting with workers, and third as a form of control. What appears to be clear from these two main groups is that the association investigated here appear not to have been influenced by the government/regulator.

An interesting question that arises here is the extent to which of these outsiders influence the prescription of SWMS in their member organisations. This may become clearer from an understanding of the views from the organisational insiders.

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