Towards an Alternative Approach to Safety in Construction

Eleanor HARVEY[1], Patrick WATERSON[1] and Andrew DAINTY[2]

Human Factors and Complex Systems Research Group[1] and Loughborough School of Civil and Building Engineering[2], Loughborough University, Leicestershire, UK

Abstract. Many safety-critical industries are moving away from compliance-based safety measures and looking for solutions incorporating adaptability and resilience. However, there are significant challenges when considering applying such measures to construction. The unique design of projects prevents the development of transferable experience, and the use of subcontracting limits opportunities for long-term investment in workers. This paper contrasts the traits of resilient organisations with the characteristics of the construction industry. It is proposed that construction could become more resilient by incorporating employee-level – as opposed organisation-level – aspects of the 'Adaptive' age of safety. Further research is needed to understand how the psychological factors believed to underpin a resilient response to risk can be developed.

Keywords. Construction, Chronic Unease, Health and Safety, Resilience.

1. Introduction

In 2014/15 thirty-five occupational fatalities occurred in construction making construction workers nearly four times more likely to be killed in an accident at work compared to the average across all sectors (HSE, 2015). There is a pressing need to change attitudes within this sector that safety management is a "*bureaucratic burden*" that detracts from production and that risk is an inherent part of their work (Swuste, et al., 2012, p.1333). The emerging "*Adaptive*" age (Borys, et al. 2009) offers new approaches to safety management with the potential to challenge this; however, safety management research has become increasingly focussed on ultra-safe high-risk sectors which are vulnerable to rare but catastrophic accidents (such as plane crashes and explosions) and neglected hazardous work like construction. Hence, when translating these novel measures into an industry like construction – which sees frequent, individual casualties – significant clashes arise.

This growing disconnect between traditional occupational health and safety (OSH) and the emerging fields of resilience engineering and safety-II mean the latest developments in risk management are unsuitable for contexts where the need for innovation is greatest. Safety-critical sectors are seeing important changes in the way safety is managed, moving towards a less calculative approach that no longer depends upon identifying and eliminating a 'root cause'. The past 10 years have seen a growing emphasis on resilience and how this can be developed within organisations: People are no longer seen as a threat to reliability that needs to be controlled, but as the source of flexibility which is needed to overcome unexpected and adverse circumstances (Hollnagel, 2008). The enlightened approach of these organisations recognises that rigid procedures can prime inappropriate responses; unrealistic targets such as "*zero accidents*" breed scepticism and prevent incident reporting; and risk aversion stifles creativity and learning.

Construction is a particularly unique industry characterised by its heterogeneous

network of subcontractors: Employment is fragmented, projects unique, plans dynamic, and finances constrained (Lingard and Rawlinson, 2005), and as such it is difficult to develop and invest in a long-term risk management strategy like permanent organisations are able to. This paper contrasts the traits of resilient organisations with the characteristics of the construction industry with a view to defining the barriers and identifying a way forward so construction can benefit from adaptive safety.

2. Method

A literature review was conducted exploring conventional risk management and injury prevention in the built environment disciplines, and comparing this with constructs from the adaptive age including high reliability organising (HRO), resilience engineering, safety-II, and a generative safety culture.

3. Findings

The findings will be discussed with reference to five characteristics of organisations which are managing safety in accordance with the adaptive age – continuously learning, well-resourced, flexible, chronically uneasy, and humanising – each of which poses specific problems for the construction industry.

3.1 Continuously Learning

Learning from experience and feedback allows a resilient organisation to anticipate and prepare for unexpected events; however, construction is an industry particularly vulnerable to economic pressure: Employment fluctuates with recession and growth, hence the sector operates as a dynamic network of projects subcontracted to multiple organisations, allowing firms to employ specialists on a flexible per-task basis and cope with changing market demands. As a result, construction projects become fragmented into units with a silo mentality – conflicting interests, ambiguous authority, inadequate communication, and reduced teamwork (Manu et al., 2013). This is a very different picture to the empowered, multi-disciplinary, and constantly interacting teams which enable high reliability organisations to build up a complete risk picture (Weick and Sutcliffe, 2007).

This transient structure impacts both workers' loyalty to the client and management's commitment to workers' professional development. While resilient organisations see the value of investing in training and drills to develop a wide range of employee experience and shared knowledge within the system, this long-term outlook is not prioritised for temporary employees of construction projects. Furthermore, the unique design of projects prevents knowledge transfer between projects and the specialised nature of the construction trades prevents multi-skilling, therefore limiting workers' awareness of risks outside their own role.

3.2 Well-resourced

Another feature of safety-critical organisations which contributes to their resilience is that safety is prioritised and therefore invested in. The ability to respond to unexpected events without sacrificing performance relies on building up resources, both in terms of knowledge and physical assets. These can take the form of preparations, procedures, and competence to manage known threats, or a contingency of uncommitted resources (*"pockets of resilience"* Weick and Sutcliffe, 2007, p.80) to tackle unknown threats.

Unfortunately, the structure and economic constraints of the construction sector make it difficult to prioritise safety by investing in resources in this way. Although the notion of uncommitted resources is attractive, in a temporary and financially pressured

environment it is unlikely. It is known that for safety management to be most effective it needs to be incorporated into the project at the design phase; however, projects are often awarded to the lowest bidder and clients focus on the end service or infrastructure without considering the implications of how this will be achieved. Production is prioritised over safety; efficient decisions (as opposed to mindful) are encouraged, and in order to cope in this dynamic industry workers are forced to take shortcuts and workaround issues to meet production targets.

3.3 Flexible

Ironically, construction workers and projects are adaptable, but their inability to cope with change without it resulting in incidents means they cannot be described as "resilient". OSH is far more difficult to implement in organic organisations – those which respond rapidly to changing market conditions (Burns and Stalker, 1961) – than mechanistic because autonomy, independence, and the use of initiative to overcome problems are encouraged (Lingard and Rowlinson, 2005). Instead, it is the inflexible timescales and regulations which put pressure on workers to take risks.

Proceduralisation and compliance-based risk management are widespread in construction. Tasks are seen as routine and therefore they can be proceduralised, however each project is unique and so procedures, particularly if they are rigidly adhered to, can have a negative impact on workers' awareness and flexibility: Procedures can create a form of 'tunnel vision' known as inattentional or perceptual blindness and can prime the wrong responses, reducing sensitivity to cues outside their expectations.

The difficulties of managing a dynamic project also means site-wide regulations, such as "*no hard hat no work*", are implemented in situations where hard hats and other Personal Protective Equipment (PPE) are unneccesary or even a hinderance. Rather than empowering workers to deal with risk, this inflexible approach to work practices shows a lack of sensitivity to operations and breeds cynicism among the workforce. Although this risk averse strategy protects against litigation, conventional approaches to OSH, including highly prescriptive procedures and legislation, limit innovation and professional judgment, hindering people's ability to assess and manage risk appropriately and the development of "*entrepreneurialism…resilience and self-reliance*" (Gill, 2007, p.18) – the types of thinking needed to adapt in response to unexpected events.

3.4 Chronically Uneasy

Fruhen et al. (2013) categorised the sensitivity and suspicion within managers of high reliability organisations as comprising of "*pessimism, propensity to worry, vigilance, requisite imagination and flexible thinking*" (p.969). Developing a culture of chronic concern about safety issues is a fundamental part of resilience: Maintaining the potential for failure at the forefront of their mind-set fights the complacency and automatic processing which allow errors surface. In contrast, construction is known for its 'macho culture': Physically demanding tasks undertaken in all weather conditions attract a workforce stereotypically seen as young, agile, males with low academic attainment, who therefore lack the vulnerability that motivates a vigilant and proactive attitude to risk. Their inability to resolve "*distancing through differencing*" (Cook and Woods, 2006) – also described as the 'it would never happen to us' attitude – makes it particularly difficult for these workers to learn from the mistakes of colleagues and other organisations.

Imagination is another trait which seems incongruous with construction work. Requisite imagination (Adamski and Westrum, 2003) or the "*the fine art of anticipating what might go wrong"* (p.193) has been identified as a component of chronic unease:

Imagination can support an adaptive approach to safety by enabling those involved to anticipate more potential scenarios and capture the failures that fall outside the expected. It also encourages a questioning attitude and helps to prevent distancing through differencing by allowing workers to imagine themselves in an accident scenario and digest its consequences (Kreiner, 2009).

3.5 Humanising

Managing risk in a humanising (as opposed to 'dehumanising') way can be subdivded into two aspects: Firstly, an approach to risk management which engages with workers and empowers them, and secondly an approach to investigating accidents which appreciates their complex causes and avoids hasty judgements of workers' incompetence or negligence.

As discussed in Section 3.1 organisational resilience relies on feedback, enabling the workforce to collectively learn from experience; this requires a just culture to support reporting of accidents. On the other hand, in construction there is a strong tendency towards explaining accidents with a root cause model. Pragmatic '*Zero Accident*' style behavioural safety programmes have becoming increasingly popular in spite of their superficial understanding of psychology which promotes a simple reward-punishment paradigm as a means to control unsafe behaviour. Rather than promoting a culture of trust and motivating learning, the unachievable goal of zero accidents breeds scepticism of OSH and reduces reporting for fear of punishment. Innovation and flexibility have also been shown to decrease, and rewarding successes (such as the number of hours since the last accident) worryingly promotes complacency (Long, 2012). Similar rigid and centrally-determined targets – which are often skewed towards those which are easier to measure such as behaviour instead of culture, accidents instead of resilience – lack the sensitivity to operations needed to allow workers' the autonomy and responsibility to manage their own risks.

Zero accident programmes also demonstrate a superficial understanding of accident aetiology which causes blame to be placed on worker behaviour rather than systemic issues. In contrast, a view of accidents has been proposed from the adaptive age which opposes a causal-pathways altogether and instead sees accidents as an unfortunate and unpredictable combination of sacrificing decisions, the consequences of which resonate throughout the system in a way that far exceeds the sum of the errors (Hollnagel, 2009). Instead of seeing humans as inherently dangerous, and therefore firing those 'responsible' for accidents, this view challenges this approach and opens up opportunities to discuss and learn from accidents by avoiding blaming individuals. A humanising approach, which sees people as part of the solution, is critical to managing safety adaptively.

4. A Way Forward

The adaptive age of safety offers a move away from bureaucracy and a means to manage safety without sacrificing performance – both of which are needed to change the cynical attitude towards safety management within construction – yet opportunities to incorporate adaptive safety in this sector have been neglected. By viewing the components of adaptive safety in light of the characteristics of the construction industry the incompatible organisational characteristics which have prevented progress are highlighted; however, adaptive safety relies on the principle that people are resilient and innovative, so focussing on the employee aspects of adaptive safety offers the potential to circumvent the challenges posed by its complex structure.

Many of the challenges discussed have their roots in the fragmented and financially-constrained nature of this project-based sector, rather than its employees. In reality, construction workers *are* adaptable, demonstrated by their ability to work around

problems, but at present the pressures on this sector channel this capacity towards productivity rather than safety. An employee-centred, bottom-up approach to cultivating resilience by developing requisite imagination and chronic unease could help to increase vigilance and promote proactivity in the face of risk. Further work to understand these mechanisms – which have been proposed as antecedents to a resilient response to risk – presents a valuable opportunity to improve safety in construction and enable hazardous industries, as well as high risk, to employ aspects of an adaptive approach to safety.

5. Conclusion

The disparities between construction OSH and the and adaptive safety have been explored: The project-based nature and transient workforce prevent continuous learning; temporary employment limits investment in diversifying workers' skills and experience; financial constraints do not allow for contingencies; rigid procedures hinder initiative and flexibility; the macho culture fights feelings of vulnerability; and a pragmatic approach to finding the root cause of accidents has created a culture of blame and intolerance. Applying principles advocated by the adaptive age such as management commitment, sensitivity to the frontline, prioritisation of safety, empowerment of employees, and a just culture presents a significant challenge. Instead, it is proposed that construction could become more resilient by incorporating employee-level – as opposed organisation-level – aspects of the adaptive age of safety. For this, further research is needed to understand how the psychological factors believed to underpin a resilient response to risk (chronic unease and imagination) can be developed.

References

Adamski, A.J., & Westrum, R.J. (2003). Requisite Imagination: The Fine Art of Anticipating What Might Go Wrong. In: E. Hollnagel, (Ed.) Handbook of Cognitive Task Design. Mahwah, NJ: Lawrence Erlbaum Associates.

Borys, D., Else, D., & Leggett, S. (2009). The fifth age of safety: The adaptive age? Journal of Health and Safety Research and Practice, 1(1), 19–27.

Burns, T., & Stalker, G. M. (1961). The management of innovation. London, UK: Tavistock.

Cook, R. I., & Woods, D. D. (2006). Distancing Through Differencing: An Obstacle to Organisational Learning Following Accidents, in E. Hollangel, D. D. Woods, & N. Levenson, N. (Eds.) Resilience Engineering: Concepts and Precepts. Aldershot, UK: Ashgate Publishing Limited, 329–338.

Fruhen, L.S., Flin, R., & McLeod, R. (2013). Chronic unease for safety in managers: a conceptualisation. Journal of Risk Research, 17(8), 969–979.

Gill, T. (2007). No Fear: Growing Up in a Risk Averse Society. London, UK: Calouste Gulbenkian Foundation.

Hollnagel, E. (2008). Resilience Engineering in a Nutshell. In: E. Hollnagel, C. P. Nemeth, & S. W. A. Dekker (Eds.) Relilience Engineering Perspectives, Volume 1: Remaining Sensitive to the Possibility of Failure. Aldershot, UK: Ashgate Publishing Limited.

Hollnagel, E. (2009). The ETTO Principle: Efficiency-Thoroughness Trade-Off. Aldershot, UK: Ashgate Publishing Limited.

HSE (2015). Health and Safety in the Construction Sector in Great Britain 2014/15. Retrieved November 23, 2015 from http://www.hse.gov.uk/statistics/industry/construction/construction.pdf

Kreiner, K. (2009). Learning and imagination in construction, in Proceedings of the 25th Annual ARCOM Conference, 7-9 September 2009, Nottingham, UK, 135–144.

Lingard, H. and Rowlinson, S. (2005). Occupational Health and Safety in Construction Project Management. Oxon, UK: Spon Press.

Long, R. (2012). For the Love of Zero: Human Fallibility and Risk. Kambah, ACT: Scotoma Press.

Manu, P., Ankrah, N., Proverbs, D., & Suresh, S. (2013). Mitigating the health and safety influence of subcontracting in construction: The approach of main contractors. International Journal of Project Management. Elsevier Ltd and APM IPMA, 31(7), 1017–1026.

Swuste, P., Frijters, A., & Guldenmund, F. (2012). Is it possible to influence safety in the building sector? Safety Science, 50(5), 1333–1343.

Weick, K. E. and Sutcliffe, K. M. (2007) Managing the Unexpected: Resilient Performance in an Age of Uncertainty. 2nd edn. Jossey-Bass.