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What do we really know about HROs?

Contents

Introduction

As many in the mining industry are aware, the Queensland Government Commissioned *Review of All Fatal Accidents in Queensland Mines and Quarries*, recommended that 'the industry should adopt the principles of High Reliability Organisational (HRO) theory in order to reduce the rate of serious accidents and fatalities'.

A recommendation of this type raises understandable questions. What, for example, are these principles based on? What evidence is there that high reliability organisational theory has been successfully implemented, with resulting safety improvements? How is an organisation meant to transition from lesser to higher reliability according to the research? Can progress be measured? What role should leaders play? How does implementation of higher reliability principles sit against existing organisational improvement activities? And so on.

Researchers have been publishing studies on various aspects of high reliability organisational theory and practice for nearly thirty-five years. Over this extended period, what the term 'HRO' encompasses has undergone multiple revisions. Literature searches will typically uncover several thousand papers with some form of HRO focus. Many of those papers do offer useful insights into how those seeking to improve the reliability of their approaches to, for example, safety and health, could proceed. Nevertheless, as recent research has noted, there is still much that is yet to be resolved.

This paper provides a short summary of HRO research as it stands; highlighting both key points for companies to consider, and areas where further work is required.

Early HRO Research

The designation 'High Reliability Organisation' (HRO) had its origins in research done in the 1980s in an endeavour to understand why some 'high-risk' organisations had, in the researchers' view in any case, 'operated nearly "error free" over long periods of time'. For our purposes, as we look to distil and understand High Reliability Organisational theory, it is important to appreciate the scope, and the limitations of this early work.

The University of California-Berkeley studies, led by Karlene Roberts, focussed on three US organisations deemed to be 'high risk' in that they faced a perennial, but unrealised, prospect of catastrophic failure: the United States Federal Aviation Administration's air traffic control system, a US electricity company, and US Navy nuclear aircraft carriers. These case study organisations were observed 'at a single slice in time'. There was, as researchers since have noted, no attempt to define how these organisations had come to be, in the researchers' definition, 'Highly Reliable Organisations'. All three of the entities examined also had the common characteristic of 'operating in closely regulated environments with limited direct exposure to market pressures'.

This initial research made no pretensions to offer a prescription for 'high reliability' that could apply to all organisations everywhere. Instead, the research focussed on identifying the characteristics that separated these deemed HROs from other types of organisation. Some of those characteristics were directly related to the pressures those organisations faced. For example, HROs were seen as entities where there were 'compressed time factors', 'extreme hierarchical differentiation', 'hypercomplexity' of systems and components, and where 'more than one critical outcome must happen simultaneously'. On the basis that not all of these elements were present, Roberts and Denise Rousseau explicitly excluded other entities, for eg. hospital emergency rooms', from designation as HROs.

Having said this, Roberts did go on to suggest what has since been termed 'Six Actions' for managers seeking to improve the reliability of high risk organisations. In brief, Roberts proposed that managers should:

- 'Consider the cost of safeguards against accidents versus their costs (in money, lives and public outcry)';

- 'Think of strategies (communication, temporary structures, etc) to ameliorate against the negative effects of tight coupling';

- 'Look carefully at interdependence and develop mechanisms (special units, etc.) for managing it';

- 'Recognise that the cost of redundancy and training are lower than the cost of accident aftermath';

- 'Develop decision making strategies appropriate to operating complex technologies in time-dependent settings';

- 'Analyse the components of high reliability cultures (such as task security, safety, accountability and responsibility) and how to build them into an organization'.

Roberts made clear that these general suggestions were 'tentative' only, given the very limited research that had been conducted at that stage.

Interestingly, this initial work on specifically designated HROs was followed by a study by Karl Weick, in collaboration with Roberts, which conceptualized the concept of 'collective mind' in the context of observations of how participants on aircraft carrier flight decks interrelated with each other.

Weick and Roberts concluded that high reliability performance, (seemingly regardless of the industry in question), required 'a well-developed collective mind in the form of a complex, attentive system' of human interrelationships 'tied together by trust'. The more participants were encouraged to see their own activities as a component of a whole, the more information across a system was shared, and the more interactions were 'heedful' and based on care, Weick and Roberts theorised, 'the greater the capability to comprehend unexpected events' and to identify and respond to small errors.

Weick and Roberts also appeared to suggest that high reliability required a particular kind of leadership. They gave the example of the 'person responsible for deck operations (the bos'n)' on an aircraft carrier who 'gets up an hour early each day just to think about the kind of environment he will create on the deck that day, given the schedule of operations'. It is important to note here that the bos'n was not thinking through the day's tasks as such; he was reviewing 'the capabilities and weaknesses of imagined crewmembers' responses' and considering how those crew members were likely to interact as he planned the day ahead.

Weick and Roberts also drew a distinction between productivity and reliability. Without organisational mindfulness they argued, it would be possible to be productive, at least for a time, but not be reliable.

The next major milestone in studies of organisational reliability was the release in 2001 of Karl Weick and Kathleen Sutcliffe's *Managing the Unexpected, Resilient Performance in an Age of Uncertainty*. This book focussed on the lessons that could be learnt, in the authors' view, from 'high risk organisations', (though this category was more broadly defined than it had initially been by Roberts and her collaborators). For Weick and Sutcliffe, HROs were entities which 'operate under very trying conditions all the time and yet manage to have fewer than their fair share of accidents'. Rather than focussing on organisational structures, or work processes, Weick and Sutcliffe suggested that what delineated HROs from other organisations was the reality that 'these organisations also think and act differently'.

Weick and Sutcliffe argued that the essence of resilient, or reliable performance can be achieved where an organisation 'creates a mindful infrastructure that continually does all of the following:

- Tracks small failures;

- Resist oversimplification;

- Remains sensitive to operations;

- Maintains capabilities for resilience; and

- Takes advantage of shifting locations of expertise'.

Weick and Sutcliffe's 'five principles', or 'five behaviours', or 'five characteristics', have been rephrased (including by the original authors) and repeated for twenty years. What has less commonly been acknowledged is that, for Weick and Sutcliffe, **all** of these features needed to be developed within an organisation for it to become, and be seen, as highly reliable.

As with many often referenced works, *Managing the Unexpected* has been subject to much misinterpretation over the years. Weick and Sutcliffe's first point, that organisations should track small failures, and indeed, as they subsequently describe it, should be 'preoccupied with failure'; has often been interpreted narrowly as meaning that organisations should have in place effective systems for reporting hazards and near misses. While Weick and Sutcliffe certainly encourage this, they go further, to say that HROs, in their view 'make a continuing effort to articulate mistakes they don't want to make and assess the likelihood that strategies increase the risk of triggering these mistakes'. In addition, those looking to emulate HROs should, according to Weick and Sutcliffe 'restate your goals in the form of mistakes that must not occur'.

The exhortation to resist oversimplification comes accompanied by the caveat that simplification is acceptable so long as 'people are more deliberate in their choices of what to simplify'.

'Sensitivity to operations' is elaborated on to mean that organisations should understand interdependencies, reduce silos, and ensure that communication across levels and locations is sound.

Often overlooked in subsequent research, Weick and Sutcliffe also proposed 'nine audits' (which take the form of employee surveys), that could be used to assess the degree of 'mindfulness' or 'mindlessness' in an organisation. They suggest that, for managers, questioning comfortable certainties should be the order of the day.

Managing the Unexpected has been the base platform for much of the subsequent work on HROs. Given its seminal status it is important to be clear about what Weick and Sutcliffe did not do. Though the authors did review, in some detail, the response to the 2000 Cerro Grande wildfire in New Mexico, *Managing the Unexpected* is not, and is not meant to be, an evaluation of how any single HRO works, nor is it an account of how an organisation became an HRO. The HRO principles articulated by Weick and Sutcliffe provided a measure of guidance, but at the time *Managing the Unexpected* was written, those principles had yet to be implemented, evaluated, or refined in any measured way.

From 2001 to 2021

After twenty years it might be reasonable to assume that industry practitioners would be able to draw on a reservoir of studies further developing the theory surrounding HRO principles; and describing the implementation of either Roberts' 'Six Actions', or Weick and Sutcliffe's 'Five Principles'. We might even expect research linking that implementation to demonstrable outcomes in terms of reliability and safety.

The reality is somewhat different.

A recent search through nearly fifteen hundred research papers found that while 'much was written about HRO theory, little has been written about HRO implementation and even less has been written about HRO success over time'. It is worth noting that the vast majority of all research papers referencing HRO deal with the potential, and sometimes the actual, application of perceived HRO concepts to health care.

The past two decades have also seen ongoing questioning of what, exactly, a HRO is, and whether, given definitional challenges, the term ought to be replaced altogether with, say, Reliability Seeking Organisation or (RSO). Andrew Hopkins' view that HROs are 'very elusive creatures that inhabit the realm of theory more than the real world' has been echoed by others. Overall, researchers remain very interested in the general

question of how organisational reliability may be improved, but less convinced that there is any 'ideal type' to follow.

In the main, researchers interested in HRO theory have endeavoured to put more flesh on the bones of Weick and Sutcliffe's 'Five Principles'; further explore the concept of 'mindfulness'; and distinguish the aspects of organisational culture that are most likely to be conducive to higher reliability. To the extent that one can be discerned, the overarching trend in theoretical research over the past two decades is to move away from the notion that particular structures, or utilisation of specific tools, characterise high reliability entities; towards a broad view that higher reliability is predicated on how the people within an organisation relate to each other.

A 2019 paper by Kenneth Pettersen and Paul Schulman, for example, argues that 'high reliability is associated with management of fluctuations in such things as mindfulness, trust, shared sensemaking, communication and cooperation'.   When those fluctuations are in negative territory, the authors argue, organisations need to sit up and take notice. Other authors have also posited that the key to achieving high(er) reliability is the establishment of trust, across different work units, and different levels, within organisations.

In much of the recent theoretical research there is a strong sense that those seeking to achieve higher reliability need to understand, as a starting point, how their organisation currently works. An objective assessment of organisational communication flows; leadership behaviours; actual, as opposed to stated, priorities; and the 'mental models' utilised by leaders and workers alike; is seen as a necessary precursor to design of any improvement pathway.

The role of leaders in fostering higher reliability has received only scant research attention. Beyond the general point that leaders should strive for a 'just culture' in which workers can bring issues to management attention with the knowledge that the response will be neither punitive nor disinterested; managers seeking guidance on how to effect change have few sources to consider. One of the few researchers who has explored the nature of leadership for high reliability is Mario Martinez-Corcoles. Martinez-Corcoles draws from Weick and Sutcliffe's 'Five Principles' to 'propose a holistic conceptual framework for leadership' consisting of 'six key facets of high reliability organizing'. In summary, Martinez-Corcoles suggests that leaders seeking higher organisational reliability should: be deeply familiar with what their organisation's safety plan doesn't cover, as well as what it does; actively promote collaborative learning and communication, and challenge assumptions; not only encourage reporting, but 'openly admit their own mistakes as well'; actively decide when delegation is a better course of action than control; and allow 'diversion from procedures', and support operators in this, in extreme circumstances where those same operators have been 'made aware of operational alternatives beyond the procedures'. Martinez-Corcoles is at pains to point out that his conceptual framework 'should be taken as a guide, rather than a prescription' given that his 'suggestions have not been empirically tested'

The question of how a drive for reliability might sit in organisations seeking to adapt and innovate is also underexplored. Pettersen and Schulman argue that in HROs, innovations are only initiated if they result in the overall organisation becoming more reliable. Other studies seem to provide support for the notion that new ideas, and methods, while important to the maintenance of reliability are only introduced in HROs under very carefully controlled circumstances. It is worth noting, however, that researchers who comment on innovation at all, typically do so in the context of their understanding of how change is made in very controlled environments such as power plants.

Similarly, few research papers reference what role a regulator might play in fostering higher reliability. Those that do, are at odds as to how important regulators might be in this space. Hopkins has argued that 'a factor conducive to the emergence of HROs is the presence of "aggressive, knowledgeable watchers"'. By contrast, Mark Chassin and Jerod Loeb have stated that 'regulation had only a modest and supportive role ' in improvements to reliability and safety in high risk industries; and suggested that regulators' primary role in any drive to reliability should be limited to removing any unnecessary 'requirements that obstruct progress

towards high reliability'; and 'publicly reporting reliable and valid measures of quality'. There is clearly more work to do here.

Perhaps even more fundamentally, there is a dearth of research dealing with the transition from lesser to higher levels of reliability; or, indeed, from higher reliability back down to poorer outcomes.   A recent study which sought to identify every paper which, in some way, dealt with 'published tools, techniques, processes, procedures, or implementing frameworks that facilitate the implementation, sustainment and measurement of high reliability organising' found only 'six which involved the change process from reliability to high reliability'. Notably 'no application of the Weick and Sutcliffe Mindfulness Audit by any High Reliability-Seeking Organisation (HRSO) was found'.

One of the papers identified in the aforementioned study, did draw from interviews in eight organisations across three industries (using a modified version of Weick and Sutcliffe's original 'audits'), to propose to 'a measurable framework for organisational reliability maturity or FORM'. According to the authors, this framework could not only be used to assess an organisation's current state, but also to 'predict the future of the organisation' by means of a 'simple probability' calculation. The paper is mentioned given its rarity as an attempt to map the core elements of a reliability transition, rather than due to its intrinsic persuasiveness.

Usefully, a 2019 Review by the United States Department of Veterans Affairs did analyse twenty articles dealing with attempts to implement, in varying forms, high reliability organisational principles in hospitals. This Review identified eight implementation frameworks, and 'six tools for measuring progress toward becoming an HRO', that had been used in the US healthcare sector. Common elements across the implementation frameworks included a focus on 'developing leadership'; and an emphasis on establishing a culture of 'trust'; although actual approaches in these areas varied. The reviewers were impressed by one of the measurement tools developed by the Joint Commission on Accreditation of Health Care Organisations, the OroTM tool, which was designed in collaboration with 'high reliability experts', 'tested iteratively with hospital leaders', and has 'since been validated in peer-reviewed research studies'. Unfortunately, the OroTM tool, which is specifically aimed at hospitals, 'is only available to Joint-Commission accredited organisations'. The Veterans Affairs reviewers observed that the organisations who implemented initiatives under one or the other of the HRO frameworks did 'experience significant reductions in serious safety events'. However the reviewers nevertheless described the 'strength of the evidence' for a connection between the higher reliability initiatives undertaken, and the outcomes achieved, as 'low', given other changes that had occurred over the implementation timeframe.   The reviewers also noted that substantive 'gaps in knowledge on HRO implementation' remain.

In addition, there have been several studies of how schools, or school networks, have implemented 'HRO characteristics'. One such study, examined the transition at a Welsh high school, over an almost eleven year period, from extremely poor student achievement levels, to nationally recognised excellence. The school implemented what the researchers have identified as the 'twelve key characteristics of HROs', which were themselves grounded in the view that 'high reliability is a social construction'. These characteristics are an expansion, and modification, of those nominated by Weick and Sutcliffe. In addition to versions of the Weick and Sutcliffe five principles, the paper also emphasises the need for collective belief 'that failure of the organisation to achieve its key goals would be disastrous'; agreement on a limited number of shared improvement priorities; 'encouragement to all concerned to identify flaws in standard operating procedures, and honouring the flaw finders'; and a recognition that 'in HROs, short-term efficiency takes a back seat to very high reliability'. The paper also stresses that higher reliability will not be achieved if an organisation adopts some, but not all, of the 'key characteristics'.

Those looking for guidance on a transition to higher reliability can also turn to accounts from practitioners who have taken the original Weick and Sutcliffe 'Five Principles' and endeavoured, in their own ways, to apply them. W. Earl Carne's 'Applying Reliability Principles: Lessons Learned', a book chapter based on discussions with thirty-one senior practitioners from organisations that the author identifies as RSOs, contains some interesting observations worthy of further exploration. Carne's sample group made clear that for an organisation to become an RSO, there needed to be 'a sense of camaraderie where all are committed

to a shared vision through a sense of personal identity and shared collective contribution'. RSOs understand that 'the problem does not lie with errors of individuals but with collectives of people…' For this group, Weick and Sutcliffe's 'mindfulness' has to be built on a foundation of deep collaboration. Carne's group also suggest that organisations seeking greater reliability have to make that outcome a genuine business goal. This will drive different behaviours at all levels. They also argue that managers need to see their job differently. 'Designing an organisation that enables our people to excel' should be the primary aim of senior executives; with managers continuously enhancing their understanding of how organisations, not just their own, work. Carne sees this as so important that he recommends that RSOs 'create a separate executive intelligence system to assess changes needed to design for excellence, recruit respected high calibre-people to staff the organization, train and educate them in organizational science and practice, [and] make membership a badge of honour'.

What Can We Conclude From 34 Years of Research?

Perhaps the most obvious conclusion we can draw after more than thirty-four years of research is, as Rangaraj Ramanujam has noted, that there is a lot of uncertainty sitting behind one, not always carefully used, 'three letter acronym'.

We do not have the luxury of being able to rely on any well-researched pathways from lower to higher reliability. Methodologies companies might use to make that transition are mostly very generalised, or, where effort has been made to provide specific guidance, are untested. Core areas such as leading for high reliability, regulation, measurement, and innovation are underexplored. There would, it seems, be considerable value in taking on further research in these areas.

Nevertheless, we can say, that over the past three decades researchers have coalesced towards a broad view that attaining higher reliability in safety, or, for that matter, other areas such as environmental and social performance, requires a deep organisational mindshift. If real, sustainable, change is to be achieved then, however messy our current understanding of 'high reliability' is, this is where our research, and our practical efforts should be directed.

References

Agwu, Agwu Emele, Labib, Ashraf, and Hadleigh-Dunn, Sara, 'Disaster prevention through a harmonized framework for high reliability organisations', *Safety Science*, vol. 111, 2019, pp. 298-312.

Brady, S., *Review of All Fatal Accidents in Queensland Mines and Quarries from 2000 to 2019*, Queensland Department of Natural Resources Mines and Energy, 2019.

Cantu, Jaime, Gharehyakheh, Amin, Fritts, Steve, and Tolk, Janice, 'Assessing the HRO: Tools and techniques to determine the high reliability state of an organisation', *Safety Science*, vol. 134, 2021, pp. 1-11.

Carnes, W. Earl, 'Applying reliability principles: lessons learned', in *Organizing for Reliability: A Guide to Research and Practice*, Ranga Ramanujam and Karlene H. Roberts (eds.), Stanford University Press, Stanford, 2018, pp. 274-300.

Carroll, J.S., & Rudolph, J.W., 'Design of high reliability organizations in health care', *Qual Safe Health Care*, 2006, pp. i4-i9.

Chassin, Mark, and Loeb, Jerod, 'High-reliability Health Care: Getting There From Here', *The Millbank Quarterly*, vol. 91, no. 3, 2013, pp. 459-490.

Cox, Sue, Jones, Bethan and Collinson, David, 'Trust Relations in High-Reliability Organizations', *Risk Analysis*, vol. 26, no. 5, 2006, pp. 1123-1138.

Haavik, Torgeir, Antonsen, Stian, Rosness, Ragnar, and Hale, Andrew, 'HRO and RE: A pragmatic perspective', in Robert L. Wears and Karlene Roberts (eds), *Special Issue, Safety Science, High Reliability Organisations and Resilience Engineering*, vol. 117, 2019, p. 479-489.

Hopkins, Andrew, *Learning from HROs*, North Ryde, CCH Australia, 2009.

Le Coze, Jean Christophe, 'Vive la diversite! High Reliability Organisation (HRO) and Resilience Engineering', *Safety Science*, vol, 117, 2019, pp. 469-478.

Martinez-Corcoles, Mario, 'High reliability leadership: A conceptual framework', *Contingencies and Crisis Management*, vol. 26, 2018, pp. 237-239.

Martinez-Corcoles, Mario, Gracia Lerin, Francisco Javier, Silla, Jose Maria, 'Human safety performance in high reliability organisations: the case of the nuclear industry', *Psychologist Papers*, vol., 39, no. 3, 2018, pp. 183-190.

Milosevic, Ivana, Bass, A. Erin, Combs, Gwendolyn, 'The Paradox of Knowledge Creation in a High-Reliability Organization: A Case Study', *Journal of Management*, vol. 44, no. 3, 2018, pp. 1174-1201.

Petterson, Kenneth, and Schulman, Paul, 'Drift, adaptation, resilience and reliability: Toward an empirical classification', in Robert L. Wears, and Karlene Roberts (eds), *Special Issue, Safety Science, High Reliability Organisations and Resilience Engineering*, vol. 117, 2019, pp. 460-468.

Ramanujam, Rangaraj, 'The Multiple Meanings and Models of Reliability in Organizational Research', in *Organizing for Reliability: A Guide for Research and Practice*, Rangaraj Ramanujam and Karlene H. Roberts (eds.), Stanford University Press, 2018, pp. 17-34.

Roberts, Karlene H., 'New challenges in organizational research: high reliability organizations', *Industrial Crisis Quarterly*, vol. 3, 1989, pp. 111-125.

Roberts, Karlene H., and Rousseau, Denise M., 'Research in Nearly Failure-Free, High Reliability Organizations', *Transactions of Engineering Management*, vol. 36, no. 2, 1989, pp. 132-139.

Schaffer, Eugene, Reynolds, David and Stringfield, Sam, 'Sustaining turnaround at the school and district levels: The high reliability schools project at Sandfields Secondary School', *Journal of Education for Students Placed at Risk*, vol. 17, no. 1, 2012, pp. 108-127.

Stringfield, Sam, Reynolds, David, and Schaffer, Eugene, 'Creating and sustaining secondary schools' success: Sandfields, cwmtawe, and the Neath-port Talbot local authority's high reliability schools reform, Teachers College Records, vol 118, no. 13.

Tolk, Janice, Cantu, Jaime, & Beruvides, Mario, 'High Reliability Organization Research: A Literature Review for Health Care', *Engineering Management Journal*, vol, 27, no. 4, 2015, pp. 218-237.

Veazie, Stephanie, Peterson, Kim, and Bourne, Donald, 'Evidence brief: Implementation of high reliability organization principles', *Department of Veterans Affairs*, Washington, DC, 2019, pp. 1-33.

Weick, Karl and Roberts, Karlene H., 'Collective Mind in Organizations: Heedful Interrelating on Flight Decks', *Administrative Science Quarterly*, vol. 38, no. 3, 1993, pp. 357-381.

Karl Weick and Kathleen Sutcliffe, *Managing the Unexpected, Resilient Performance in an Age of Uncertainty*, 2nd edn, San Francisco, John Wiley & Sons, 2011.