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Moving Beyond a Zero Tolerance Mindset: Embracing Action Errors in Construction

Peter E.D. Love [a,*], Jane Matthews [b], Weili Fang [c]

[a] School of Civil and Mechanical Engineering, Curtin University, Perth, WA 6845, Australia
[b] School of Architecture and Built Environment, Deakin University Geelong Waterfront Campus, Geelong, VIC 3220, Australia
[c] School of Civil Engineering and Mechanics, Huazhong University of Science and Technology, Wuhan 430074, China

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ABSTRACT

Action errors—unintentional deviations from goals, rules, or standards—are an inevitable part of work in construction. Understanding how individuals and organizations can embrace and "learn through errors" (i.e., how to handle them effectively) is crucial for contributing to project success. However, within construction, a prevailing belief persists that errors can and should be eliminated, fostering a zero-tolerance mindset. Organizations that adopt this mindset risk stifling their capacity to learn, innovate, and improve profitability. While errors can indeed have negative consequences, they also play a vital role in enabling learning and innovation. Given the limited empirical research on action errors in construction, this paper aims to stimulate inquiry into this promising area of study. It briefly outlines different forms of error orientation and proposes directions for future research relevant to construction organizations. The contributions of this paper are twofold, as it: ① advocates for construction organizations to broaden their understanding of errors to enhance their learning capability and ② identifies ways in which organizations can improve their capacity to learn and innovate through error management.

1. Introduction

Errors, in their various guises, are a routine and unavoidable feature of work in construction. While often associated with individual wrongdoing, most errors occur unintentionally. This paper focuses specifically on unintentional *action errors*, defined as "unintended deviations from plans, goals, or adequate feedback processing as well as an incorrect action that results from lack of knowledge" [1: p.1229]. In doing so, it deliberately excludes errors related to judgment and decision-making, as well as violations, referred to as intentional deviations from procedures or rules, which are examined in detail elsewhere in Busby and Iszatt-White's work [2]. Alexander Pope's aphorism, "To err is human [*errare humanum est*]," reminds us that error is an inherent feature of human behavior [3]. However, in construction, this reality is rarely acknowledged. Errors are often treated as entirely preventable and unacceptable, fostering a culture of zero tolerance [4].

A prominent example is the Get It Right Initiative (GIRI), a UK-based non-profit organization that convenes a broad spectrum of stakeholders, including clients, consultants, contractors, and regulators. Its mandate is to foster cultural and behavioral change across the construction sector by promoting collective responsibility for error reduction. GIRI estimates that avoidable errors impose an annual cost of between 10 billion and 25 billion GBP on the industry[†]. Such projected savings, however, remain open to question as they are not underpinned by rigorous empirical evidence. Furthermore, GIRI employs an expansive definition of error, grouping it with changes and omissions that result in rework. While this approach may facilitate practical reporting, it risks obscuring analytically important distinctions between error types (e.g., action errors, violations, and judgment or decision-making errors). Each category stems from different underlying causes and, as such, necessitates tailored strategies for both prevention and organizational learning.

* Corresponding author.
E-mail address: p.love@curtin.edu.au (P.E.D. Love).

[†] See (https://getitright.uk.com).

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Despite widespread recognition that action errors can significantly impact individual (e.g., stress and motivation), project and organizational performance, productivity, and profitability, there is surprisingly little empirical research in the construction sector that systematically investigates the nature, frequency, causes, and consequences of errors [4–7]. As a result, the actual costs of error, both direct and indirect, remain poorly understood [8]. Quantifying these costs is currently infeasible, as no systems or processes exist to capture such data. Furthermore, few organizations are willing to invest in the additional layers of data collection and system modification required to do so [9].

A more nuanced understanding of error is needed. Not all errors are detrimental. While this notion may seem contradictory, errors, particularly unintentional action errors, can serve as essential drivers of learning and innovation. Indeed, in sectors outside construction, leading organizations such as 3M, Apple, BMW, IDEO, Google, and Southwest Airlines actively embrace errors as opportunities for reflection and improvement [1,10–12]. In contrast, construction organizations' unwavering emphasis on error prevention often blinds them to the valuable learning opportunities that errors present, limiting their capacity to adapt, innovate, and evolve toward more resilient and high-performing practices. Embracing action errors in construction has the potential to unlock opportunities for learning, innovation, and improved organizational performance.

The paper begins by outlining the key developments in the fields of error prevention and error management (Section 2). In light of the limited research on action errors within construction, it then proposes directions for future inquiry (Section 3), followed by reflections on the implications of adopting a more constructive orientation to error (Section 4).

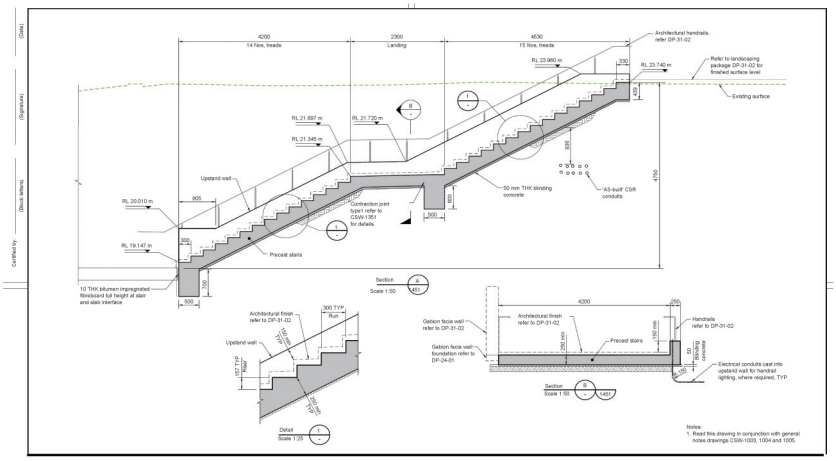
2. Error orientation

While individual action errors originate at the personal level, their effects can cascade upward, influencing team- and organizational-level errors that emerge from collective behaviors, managerial decisions, and the unintended consequences of broader systemic conditions [11: p. 452]. Table 1 outlines the key differences between individual, team, and organizational errors.

At the individual level, action errors typically manifest as slips, lapses, or mistakes. This may include misinterpreting a drawing or forgetting a procedural step. On their own, such errors may be minor or easily correctable. Examples of action errors manifesting as non-conformances requiring rework, derived from a real-life project, are provided in Figs. 1 and 2. However, when left undetected or unaddressed, they can propagate across a project, mainly when supported by weak team or organizational processes. Teams also play a pivotal role in either amplifying or buffering the effects of individual errors. Effective coordination, communication, and mutual monitoring can help to identify and correct errors early. Conversely, when teams suffer from poor role clarity, fragmented communication, or the absence of psychological safety, individual errors can go unnoticed or unreported, contributing to larger

Table 1
Individual, team, and organizational errors.

Level	Error definition	Examples	Contributing factors	Typical consequence	Error management implications
Individual	*Action errors* are unintentional mistakes made by a person during the execution of a task. These errors typically result from slips (attention failures), lapses (memory failures), or mistakes (errors in planning or decision-making), occurring at the individual level and reflecting momentary failures in perception, cognition, or skill, rather than deliberate violations	Misreading a measurement, forgetting a task step, or using the wrong material	Fatigue, inattention, lack of experience, and cognitive overload	Localized rework, safety risks, and reduced productivity	Improve task design, provide training, encourage near-miss reporting, and support a just culture
Team	*Team errors* occur when collective actions or interactions among members lead to unintended failures or mistakes. These errors often stem from communication breakdowns, coordination problems, role ambiguity, or conflicting priorities within the team. Unlike individual action errors, team errors stem from *the way members collaborate* and share information, ultimately impacting group performance and outcomes	Misaligned task sequencing, incomplete handovers, and inconsistent updates between work crews	Role ambiguity, lack of shared understanding, poor communication, and schedule pressure	Rework at interfaces, delays, and strained team relationships	Foster team reflexivity, clarify responsibilities, and support collaborative planning practices
Organizational	*Organizational errors* refer to failures rooted in the broader structures, processes, policies, and culture of an organization. These errors emerge from managerial decisions, systemic weaknesses, resource constraints, or latent conditions embedded in the organizational environment. Organizational errors create conditions that increase the risk of failures at both individual and team levels, and may include issues such as unrealistic targets, inadequate training, or poor safety management. Thus, system-level actions or inactions inadvertently lead to deviations from intended outcomes	Ambiguous procedures, inadequate inductions, flawed procurement strategies, and misaligned performance metrics	Weak governance, siloed departments, poor learning systems, and a lack of accountability structures	Widespread inefficiencies, recurring errors, cost growth, and reduced organizational learning	Establish learning loops, align incentives with goals, and embed error management into systems and culture



Non-conformance: Following the stripping of the stair risers, it was found that the formwork had shifted during the pour, resulting in the toe of the riser being out of alignment, which occurred due to the bracing methodology being inadequate to support the loads imposed.

Root cause: Limited access to a restrictive area, and the formwork did not have enough bracing provided.

Remedial action: ① Grind back the toe of the risers as required; ② liaise with the paving subcontractor to adjust the grout level.

The cost of rework: 1000 USD.

Correction action: The following corrective actions were taken to prevent recurrence: ① The subcontractor revised their methodology of staircase/formwork construction; ② the access location was adjusted to reduce the traffic requirement through the work area.

Fig. 1. Action error: non-conforming riser alignment.

Non-conformance: After the construction of a headstock (i.e., the topmost component of a bridge pier, as can be seen in the photographs to the left), it was found that the six locating dowels for the precast stairs were not cast-in. The designers were made aware of this problem as soon as it was identified, and a request for information was raised seeking how it could be addressed.

Root cause: Steel fixtures used the correct reinforcement drawings, but as dowel bars were marked on the concrete drawings, they were missed:

- It was identified during a pre-pour inspection by a project engineer that all five headstocks were missing the dowel bars, even though subcontractors had been instructed to install them.
- A subsequent pre-pour inspection was carried out on several of the headstocks to check for the missing bars; however, not all of them were checked.
- Engineers *assumed* that all the dowel bars were installed as assured by the subcontractors. The subcontractor did not have time to install due to production pressure.

The cost of rework: 4000 USD.

Remedial action: N20 bars were epoxied into the headstock with 250 mm embedment as per the approval provided by the designer.

Corrective action: Conduct a thorough check during the concrete pre-pour inspection to ensure that *all* cast-in items are installed at the correct locations by the project engineer, rather than relying on the subcontractor. Discussions to be held during the 2 pm daily construction meetings to reinforce this process.

Fig. 2. Action error: non-conforming headstock (missing dowel bars).

failures. For example, a slight miscalculation made by one team member may lead to cumulative downstream errors if it is not challenged, questioned, or caught during task handovers.

At the organizational level, systemic conditions, such as ambiguous procedures, inadequate training and induction, misaligned performance incentives, and a punitive error prevention

culture, can increase the likelihood of both individual and team-level errors [10]. More importantly, organizational responses to error heavily influence whether such deviations are contained or allowed to escalate, though how they are handled will depend on an organization's error orientation.

To this end, the dynamics between individuals, teams, and the organization can be understood in terms of two broad pathways. In one instance, a minor individual action error, left unchallenged by the team and unsupported by organizational systems, escalates into a costly rework incident or a safety risk. In the other, the same error is identified, reported, and resolved collaboratively, leading to improved awareness and adaptive learning. In this way, while action errors originate at the individual level, the way teams and organizations interact with them determines both their likelihood and their eventual consequences. These pathways highlight the critical role of team and organizational factors in either amplifying or mitigating the impact of individual action errors. Although such errors often manifest as lapses in attention or skill at the individual level, focusing solely on these immediate causes risks overlooking the broader systemic conditions that enable or constrain the occurrence and response to errors. To illustrate how errors spread across levels in practice, Box 1 presents a vignette that traces the escalation of an individual action error from team-level issues to systemic organizational failures.

Box 1 Escalation of Errors.

During the construction of a new rail viaduct, a draftsperson omitted reinforcement details in a revised drawing set, an *individual lapse*. The omission went unnoticed because the drafter was working under intense time pressure and relied on memory rather than systematically verifying the revised drawings against standards. At the *team level*, the structural design group failed to catch the omission during coordination meetings—relying on informal communication instead of formal checks. Project engineers assumed that the design had been verified and proceeded with fabrication without raising questions. At the *organizational level*, weaknesses in governance and management processes worsened the problem. The project's internal procedures prioritized schedule performance, with limited resources allocated to design verification and quality assurance reviews. Commercial pressures to approve design changes rapidly fostered a culture where verification steps were routinely bypassed. The incorrect fabrication of several large precast beams ultimately required demolition and remanufacture, causing a six-week delay, over 5 million AUD in additional costs, and damage to the reputation of both the contractor and client. This case demonstrates how an *individual lapse* can escalate into *team failures* and then into *systemic organizational issues*.

The causes of action errors in the workplace have been extensively studied and are commonly attributed to attentional lapses, memory failures, or deficits in individual skills and knowledge [10]. However, it is more accurate to view action errors not as root causes but as symptoms of deeper systemic issues embedded within organizational structures and cultures. Such errors do not arise solely from human fallibility but are shaped by latent conditions created through strategic decisions and socio-organizational processes, particularly in construction contexts [7]. For example, managerial choices that impose unrealistic targets, overload teams, or cultivate high-pressure environments often lay the groundwork for errors to occur [5–7]. However, such systemic contributors are rarely acknowledged by management during construction [13]. Instead, responsibility is frequently displaced onto frontline workers, the "sharp end" of project execution, who are then blamed for errors and subjected to adverse emotional consequences such as diminished confidence, low self-esteem, and fear. The attribution of fault to individuals not only obscures the underlying causes of error but also obstructs opportunities for organizational learning, as it diverts attention from the more critical questions of why and how the error occurred [11]. By localizing error at the individual level, construction organizations reinforce a narrow view of causality that fails to interrogate the broader systemic conditions at play [13,14].

2.1. Error prevention (zero-tolerance)

The concept of error prevention, underpinned by a zero-tolerance stance, implies punitive responses to mistakes and is rooted in the belief that errors can be avoided through careful control of goal-directed behaviors and communication processes [10]. Prevention strategies typically involve system design, standardized procedures, prescriptive tools, and targeted training programs, all aimed at cultivating a "zero vision" mindset [10]. While goals such as "zero defects" or "zero accidents" are intended to inspire high performance and continuous improvement, they can also foster unrealistic expectations [8].

In practice, zero vision often downplays or denies human fallibility, suggesting that all errors are preventable and that perfection is attainable [7]. This view contradicts the well-established understandings of human error, which recognizes that mistakes are an inherent feature of complex, high-pressure environments, such as construction [10]. As Dekker [15] warns, such ideals may contribute to a culture of fear and underreporting, in which individuals conceal mistakes to maintain alignment with the zero ideal. Thus, opportunities for learning and systemic improvement may be lost.

Despite these concerns and given the significant consequences that errors can have on both organizational performance and project outcomes, it is understandable that construction organizations place a strong emphasis on prevention. However, when errors are viewed solely as indicators of failure, managerial responses often focus on assigning blame, whether to individuals or teams, rather than investigating the systemic conditions that contributed to the error. Such blame-oriented approaches risk suppressing open communication and undermining organizational learning, thereby limiting the potential for lasting improvement.

An example of this dynamic was provided by Love et al. [13], who described how communicative action was deliberately suppressed within a project team. In this case, a project manager instructed a contract administrator to break down a non-conformance exceeding 100 000 AUD, caused by a subcontractor's mistake, into smaller amounts (e.g., under 10 000 AUD) to conceal it from senior management. The rationale was to avoid triggering disciplinary action, as acknowledging the full extent of the rework would damage the perceptions of project performance. Treating errors in this way, as signs of failure, discouraged transparency and ultimately undermined opportunities for organizational learning.

When an individual commits an error of consequence, they are often, as indicated above, prone to heightened stress, cognitive overload, and fatigue, all of which increase the likelihood of further errors. As Frese and Keith [10] describe, people experiencing error-induced stress frequently engage in triple-tasking; they must (p. 669): ① focus on the primary task, ② address the error itself, and ③ manage their emotional response. The internal strain associated with juggling these demands can significantly impair performance and increase the likelihood of additional mistakes. Such error cascades are especially common in environments where a negative mindset toward errors prevails [13]. For instance, an initial action error, whereby a subcontractor misinterprets a construction drawing and incorrectly installs reinforcement, may go

unreported due to fear of blame. As a result, the error remains undetected until later in the project, at which point rework is required under significant time pressure. During the correction process, a worker operating in a confined space is injured while cutting and repositioning reinforcement, resulting in a reportable safety incident. This scenario illustrates how a seemingly minor individual error, when situated within an unsupportive organizational climate, can escalate into a serious event with broader safety consequences.

Encouragingly, evidence suggests that fostering a positive mindset toward errors, through a supportive organizational culture, can mitigate these risks [1]. Construction organizations that foster a culture of openness and learning are better equipped to identify, manage, and learn from errors, thereby reducing their recurrence and adverse impacts [11–13].

2.2. Error management (errors happen)

An error management orientation fosters a constructive and proactive mindset toward errors [1,10]. It acknowledges that, despite the best efforts to prevent or eliminate them, errors are an inevitable part of organizational life. Importantly, this orientation distinguishes errors from their consequences, recognizing that they can lead to both negative and positive outcomes [10]. The objective of error management is not only to reduce the occurrence of future errors and minimize their adverse impacts, but also to detect and respond to them quickly. Openness about errors is essential, as it facilitates early detection, which is critical, as the longer an error remains unnoticed, the more severe its consequences are likely to be.

Error detection should not rest solely on individuals. Instead, everyone within a construction organization and its project teams shares responsibility for identifying and addressing potential issues, which requires a collective preoccupation with failure, a mindset of anticipating "what might go wrong" and being constantly alert to emerging risks [14]. Psychological safety, the ability to speak up and admit mistakes without fear of blame, is pivotal in this context. It must be actively nurtured within the organization–project dyad [16]. When such a climate is established, individuals and teams are more likely to share knowledge about errors, describe how they managed them, and generate learning that benefits future practice. In this way, error management becomes a platform for continual improvement and adaptive learning. According to van Dyck et al. [1], error management encompasses a suite of interrelated practices (p. 1230):

(1) Communicating about errors
(2) Sharing error knowledge
(3) Providing help in error situations
(4) Detecting errors quickly and controlling damage
(5) Analyzing errors
(6) Coordinating error handling
(7) Handling errors effectively.

Despite the theoretical importance of these practices, construction organizations often implement them in a piecemeal manner, which limits their capacity to learn and innovate effectively. A notable exception is the Level Crossing Removal Project (LXRP) in Melbourne, Australia, a multi-billion-dollar initiative to eliminate 110 level crossings between 2015 and 2030 [17], where error management practices have been implemented in a more systematic and integrated manner.

From the outset, the LXRP adopted a strategy and legacy vision that was implicitly aligned with an error management orientation. Central to this was the establishment of an integrated program alliance delivery model designed to promote best practice and drive productivity improvement, not only in Australian construction but also globally. The LXRP committed to cultivating a no-blame culture, supported by a Project Alliance Agreement (PAA), to collaboratively address defects, disputes, errors, and performance issues. All project participants were expected to accept joint responsibility and work together to resolve the problems in a way that prioritized "Best for Project" outcomes.

To support "Best for Project" outcomes, the LXRP adopted Micro Focus IDOL (Intelligent Data Operating Layer) technology to connect and capture knowledge across all alliance organizations. The digital platform enabled the real-time sharing of information related to errors, non-conformances, rework, and safety incidents through the project's intranet, Engineering Hub, and TeamBinder system. These tools fostered a strong learning environment by making relevant information widely accessible. By normalizing error communication and integrating it into everyday project practices, the LXRP has helped its alliances develop a more nuanced understanding of how rework arises in their projects [17]. However, an important question remains: *Do alliance projects focused on error management result in less rework*? Although no empirical evidence currently confirms this, a survey of the alliance's participating organizations (i.e., a construction organization, two engineering firms, and an owner participant) [18] and subcontractors [19] involved with the LXRP suggested that rework levels were lower than those of projects delivered via traditional procurement approaches. The strength of this perception alone highlights the need for further research into the causal link between error management practices and reduced rework.

3. Considerations for future research

While an error management orientation has been shown to stimulate learning, foster innovation, enhance profitability, and support both rational and creative problem solving, it remains challenging to implement in practice. Establishing such an orientation requires a supportive organizational culture, one that often stands in stark contrast to the prevailing error prevention mindset [10,12]. How such a culture can be purposefully induced in organizations, particularly when existing norms emphasize avoidance and blame, remains an open question [12]. This question is particularly pertinent in the context of construction, where a zero-tolerance approach to error remains the dominant standard.

Understanding *how* to develop an error management culture is a key area of study. If, as previous research indicates, such a culture is linked to better performance outcomes, such as innovation, productivity, and profitability [1,12], then it is important for research to identify practical ways to change organizational culture. A valuable instrument for assessing attitudes toward errors is the Error Orientation Questionnaire (EOQ), a psychometric scale developed and validated by van Dyck et al. [1] to measure how individuals and organizations perceive, interpret, and respond to errors. The EOQ can therefore be used to evaluate an organization's orientation toward errors and to explore how this orientation influences learning, adaptability, and overall performance. Real-world examples can offer some guidance. In the LXRP, an error management culture was intentionally and systematically built from the start. The PAA served as a means to establish shared norms and values that fostered open discussion and "learning through errors," particularly in managing mistakes effectively.

By contrast, many construction organizations address errors in an *ad hoc* manner, driven by the belief that errors are inherently negative. Such an approach highlights the difficulty of shifting from a prevention-based orientation to one focused on management and control. Rather than treating error prevention and error management as mutually exclusive, future research should explore how these orientations might be integrated and balanced across the organization–project dyad. Doing so could allow organizations

to mitigate harmful consequences while still leveraging the learning opportunities that errors provide.

Leadership plays a central role in cultivating an error management culture [20]. Leader behavior influences the psychological climate within project teams and shapes how errors are perceived and addressed [13]. Thus, several key questions emerge:

- What leadership styles are most effective in generating positive error-related outcomes?
- How can leaders actively promote learning and resilience in response to errors?
- How can leaders foster a high-error-management culture on projects where there are no formal contractual mandates to do so?

Given the limited research on error culture in construction organizations, addressing these questions is essential. Advancing our understanding in this area could significantly enhance the sector's capacity for organizational learning, innovation, and sustained improvement in performance.

4. Conclusions

As the late Steve Jobs, founder and former CEO of Apple, aptly remarked, "Sometimes when you innovate, you make mistakes. It is best to admit them quickly, [learn], and get on with improving other innovations." Organizations that adopt a constructive attitude toward error do not view mistakes as failures, but as opportunities for learning and innovation. Nevertheless, the construction and engineering management literature has largely remained silent on the positive contributions of error. The argument presented in this paper is that embracing error management can enhance the performance of construction organizations. Nonetheless, further empirical research is required to substantiate this claim. In response, this study outlines key areas for future investigation that could support the development of more adaptive, innovative, and resilient construction practices.

CRediT authorship contribution statement

Peter E.D. Love: Writing – review & editing, Writing – original draft, Conceptualization. **Jane Matthews:** Writing – review & editing, Writing – original draft, Conceptualization. **Weili Fang:** Writing – review & editing, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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