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# The T.R.U.S.T. Model: A Human-Centered Framework for Safety Technology Implementation

National Safety Council

## Executive Summary

Advances in emerging technologies like artificial intelligence, robotics and wearable sensors are rapidly transforming approaches to workplace safety. When thoughtfully implemented, these innovations have the potential to proactively identify hazards, improve situational awareness, automate high-risk tasks and streamline time-consuming environmental, health and safety processes. However, in practice, organizations often invest significant time and resources into new technologies only to encounter delayed or inconsistent use, workarounds or outright rejection by those they were intended to support.

Existing technology acceptance and change management models provide a solid foundation for understanding the various human and organizational factors that can make or break implementation efforts. However, no known framework exists to address the unique challenges associated with safety technologies, which often have a more personal impact on individuals than traditional workplace solutions. Workers may interact with these solutions directly or experience their effects through changes in how their work is monitored, supported or performed. Therefore, successful long-term implementation often requires greater emphasis on trust, communication and engagement than other system or process changes.

To address this gap, this report introduces the **T.R.U.S.T. Framework**, a practical, human-centered model designed to help organizations evaluate and strengthen the conditions that support successful safety technology implementation. The framework is built around five domains:

- **Transparency:** Do workers know what the technology is, how it works, why it's being implemented and how it will be used?
- **Relevance:** Can workers clearly connect the technology back to their work, safety or experience?
- **Usability:** Can workers use the technology easily and effectively under actual working conditions?
- **Support:** Do workers know what to do when they need help, encounter a problem or the technology fails?
- **Transformation:** Has the technology become part of how work is done? Is it creating meaningful value for workers?

The report also introduces five Technology Response Patterns, recognizing that workers may respond differently to the same technology based on their willingness, ability, trust and available capacity. To earn buy-in and maintain sustained technology use, organizations must tailor their response strategies to meet these varied needs. These patterns are not intended to label workers themselves, but rather to identify responses that may emerge during implementation and provide tailored strategies to meet workers' needs accordingly.

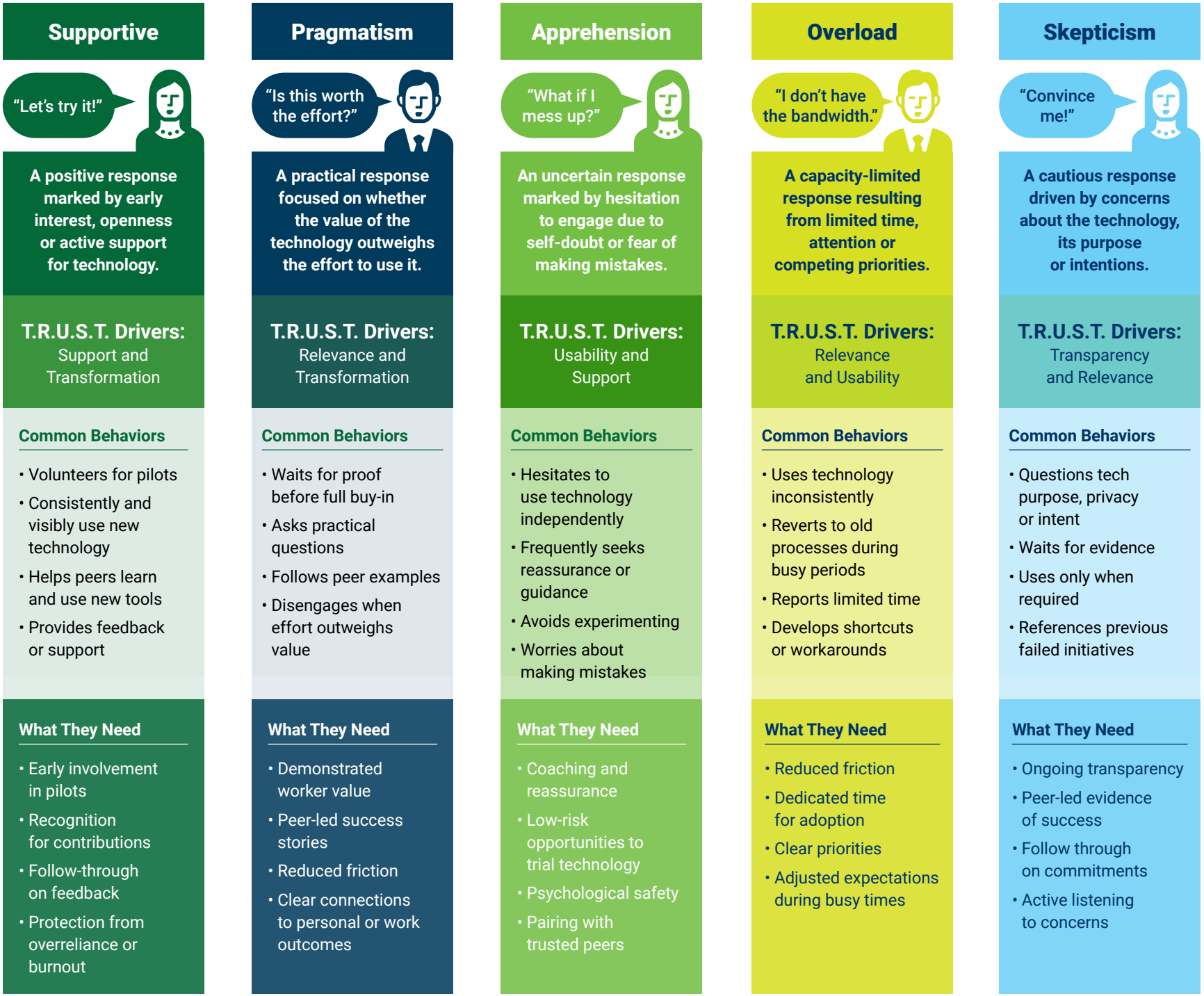
- **Supportive:** A response pattern marked by early interest, openness or active support for the technology. This response often presents as a willingness to try new tools, share feedback and help others learn and use them.
- **Pragmatism:** A practical, results-oriented response pattern in which individuals evaluate whether a technology's value outweighs the effort required to learn and use it.
- **Apprehension:** A willing but uncertain response to new technology, marked by hesitation to engage because of self-doubt, uncertainty or fear of making mistakes.
- **Overload:** A capacity-limited response in which individuals may struggle to use technology consistently when workload, competing priorities or other demands exceed their available time or resources.
- **Skepticism:** A cautious response pattern that relies on evidence, transparency and demonstrated trustworthiness before adoption. This response often presents as questioning the technology itself, its purpose or the organization's intentions behind implementation.

The T.R.U.S.T. Framework and accompanying response patterns are intended to be used as practical tools for creating ongoing worker trust and engagement. Together, they provide organizations with a structured approach for strengthening implementation efforts, improving safety outcomes and ensuring new solutions are a good fit for workers and the organization.

**Table 1.** The T.R.U.S.T. Framework

| | T | R | U | S | T |
|---|---|---|---|---|---|
| **Domain** | **Transparency** | **Relevance** | **Usability** | **Support** | **Transformation** |
| **Core Questions** | **Do workers know what the technology is, how it works, why it is being implemented and how it will be used?** | **Can workers clearly connect the technology to their work, safety or experience?** | **Can workers use the technology easily and effectively under actual working conditions?** | **Do workers know what to do when they need help, encounter a problem or the technology fails?** | **Is the technology part of how work is done, and is it creating meaningful value for workers?** |
| **Key Considerations** | • Clearly explain the purpose, benefits and limitations of the technology<br>• Communicate early, often and through multiple channels<br>• Involve workers in planning, testing and implementation decisions<br>• Empower digital champions<br>• Avoid punitive use; prioritize coaching and learning | • Focus on worker value, not just organizational outcomes<br>• Connect the technology to real tasks, hazards and challenges<br>• Tailor messaging to different departments and roles<br>• Demonstrate value through real-world examples<br>• Reassess relevance as work conditions and needs change | • Evaluate the technology under real working conditions<br>• Minimize friction and unnecessary complexity<br>• Integrate the technology into existing workflows<br>• Identify and address barriers to adoption | • Establish clear support pathways and points of contact<br>• Reinforce and celebrate adoption through supervisors and peers<br>• Create feedback loops, respond to concerns and communicate outcomes<br>• Plan for technology failures, outages and other contingencies | • Measure outcomes and adoption over time, not just at implementation<br>• Demonstrate the technology's value to workers and the organization<br>• Reinforce successes and desired behaviors<br>• Continue, adapt or discontinue use of the technology based on results |

**Figure 1.** Technology Response Patterns: Common Responses to New Solutions



# Introduction and Background

## Safety in the Age of Industry 5.0

The increasing implementation of emerging safety technologies reflects a larger pattern of transformations that have reshaped how work is performed, how workers interact with machinery and how organizations identify and manage risk. Over five industrial revolutions, advances in innovation have steadily expanded the role of technology in the workplace, creating opportunities to improve safety and operational performance (see Figure 2). However, it was Industry 4.0 that fundamentally changed how organizations collect, share and use information, laying the foundation for many of today's workplace safety technologies.

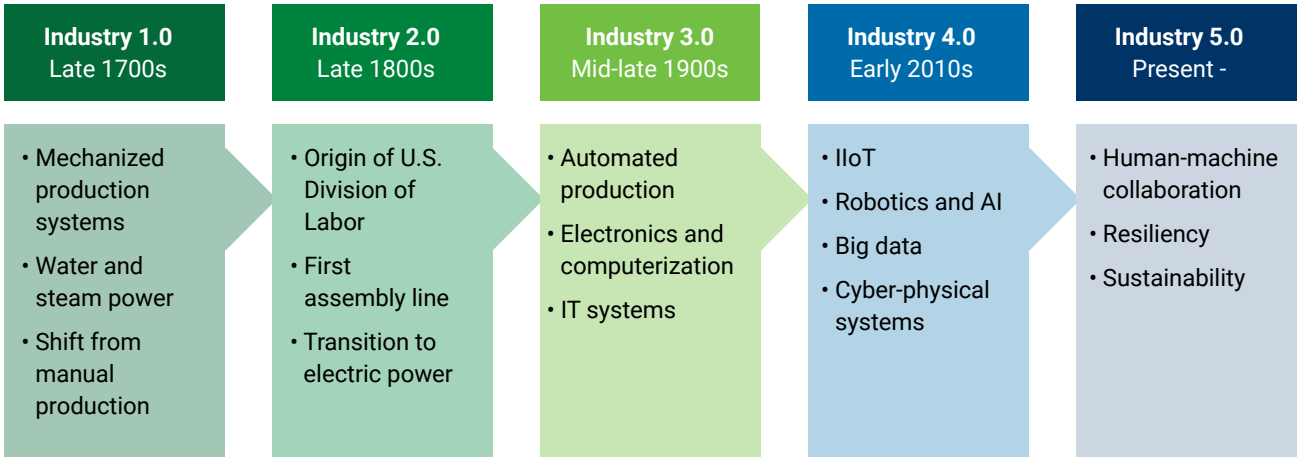
Industry 4.0 is characterized by the integration of digital technologies into connected work systems, enabling continuous communication, automation and the exchange of data across people, equipment and operations (Varshney et al., 2024). Technologies such as the Industrial Internet of Things, collaborative robotics (cobots), advanced analytics and artificial intelligence make this connectivity possible, allowing organizations to monitor work in real time. This shift moves organizations away from manual observations, paper-based processes and lagging indicators, providing greater visibility into work as it occurs and enabling more proactive approaches to hazard identification and risk management.

Building on the technological advances of Industry 4.0, the European Commission (2024) introduced the concept of Industry 5.0, which asks how technology can better support workers and organizations while contributing to long-term societal goals. Industry 5.0 is built around three core principles:

- **Human-centricity:** Rather than replacing workers, technology should enhance human capabilities, improve safety and wellbeing, and enable people to focus on tasks that require judgment, creativity and expertise
- **Resilience:** Organizations use technology to anticipate, adapt and respond to disruptions by creating flexible systems that can continue operating safely under changing conditions
- **Sustainability:** Technology supports environmentally, socially and economically sustainable industrial systems by reducing waste, improving resource efficiency and creating long-term value

For workplace safety, Industry 5.0 marks a shift from viewing technology primarily as a tool for efficiency to recognizing its role in supporting worker safety, health and wellbeing. It emphasizes that successful implementation depends not only on what technology can do, but also on how workers experience and interact with it. To realize its full benefits, employers must support the people expected to use these solutions by building trust, addressing barriers to adoption and ensuring technologies fit naturally within daily work processes. By taking this human-centered approach, organizations can create safer, more resilient and sustainable workplaces aligned with the vision of Industry 5.0.

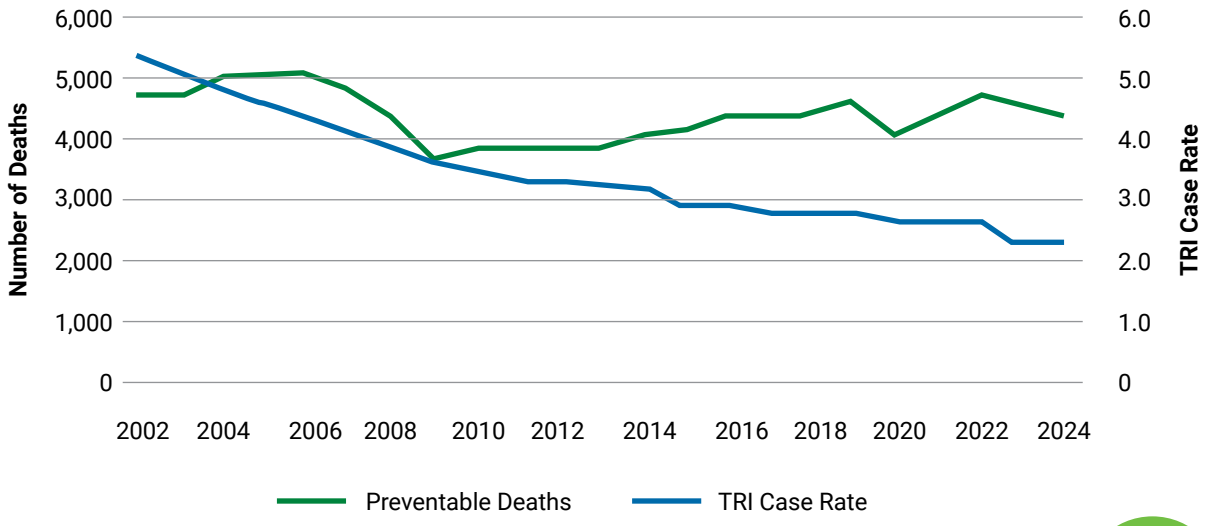
**Figure 2.** Industrial Revolutions and Key Technological Advancements



### Why Invest in Safety Technology?

Over the past two decades, the United States has made significant progress in workplace safety. Total Recordable Incident Rates have declined from approximately 5.3 injuries for every 100 workers in 2002 to 2.3 injuries per 100 workers in 2024, representing a 57% reduction overall. By contrast, the preventable workplace fatality rate declined only 15% in the same period, with 4,337 preventable fatalities in 2024 alone (Injury Facts, 2026). This slower decline in fatalities has prompted many safety professionals to reconsider traditional approaches to workplace safety, recognizing that efforts to reduce overall injury rates do not necessarily reduce the risk of serious injuries and fatalities (Bayona, Hallowell, & Bhandari, 2024; Ivensky, 2016; Martin & Black, 2015).

**Figure 3.** Trends in Preventable Workplace Deaths and TRI Rates (2002-2024)




In response, organizations are increasingly shifting their focus away from total recordable injuries toward SIF prevention, including the adoption of more progressive safety philosophies (e.g., Human and Organizational Performance, Safety I/II) and the use of leading indicators to better understand and manage risks before incidents occur (Evemy, 2025; Inouye, 2020). This shift has also accelerated investments in safety technologies that can help streamline manual safety processes, improve visibility into workplace conditions, identify emerging hazards and support proactive actions.

However, realizing the benefits of safety technology is not always guaranteed. Despite growing interest and investment (Crawford, 2024), many technology initiatives fail to move beyond temporary pilots to sustained adoption. These challenges often emerge when the technology introduces new burdens or trade offs for workers. For example, a technology that improves hazard detection may also increase workload, reduce worker autonomy, raise privacy concerns or contribute to alert fatigue. The goal of human-centered implementation is to understand and manage these competing trade offs in ways that maintain worker trust and maximize overall benefit.

While technology may enhance, support or strengthen existing controls, organizations should first define the problem they are attempting to solve and determine how the technology will be integrated into their overall safety strategy. Technologies that are poorly aligned with workplace risks, work processes or worker needs are unlikely to achieve their intended benefits regardless of their technical capabilities.

## Challenges to Implementation

While technology offers significant potential to improve safety, implementing new solutions in the workplace is rarely straightforward. According to the 2018 McKinsey Global Expert Survey, over 70% of Industry 4.0 pilots fail to move beyond the pilot stage, with companies trying an average of eight different solutions simultaneously (Narayanan & Coxon, 2018). This rapid pace and sheer volume of innovation can place significant demands on organizations, making sustained implementation difficult. The resulting challenges generally fall into three categories: organizational, technical and human considerations.

**Organizational Challenges.** Technology implementation often requires substantial investments in time, money and organizational resources. According to a 2023 survey of 500 employers across safety-sensitive industries, purchase costs remain the top barrier to safety technology implementation, with nearly half (44%) reporting that management would be unlikely to approve the purchase of new solutions. Other challenges include lack of time to test or investigate new solutions (35%) and limited resources to implement accompanying training or policies (22%) (Crawford, 2024).

Organizational culture also plays a significant role. Conditions like resistance to change, bureaucratic rigidity, risk aversion and highly siloed or fragmented teams can all influence how new tools are perceived and ultimately adopted by workers (Gamaga et al., 2026). Conversely, organizations that foster cultures of collaboration and continuous learning are better positioned to integrate new technologies and adapt to changing work environments because they have already developed the mindset and actions that support change (Lam et al., 2021).

Adopting new solutions often requires employees to use unfamiliar systems, develop new skills and navigate uncertainty. Psychological safety, defined as an individual's belief that they can ask questions, seek help and make mistakes without fear of negative consequences, becomes critically important during periods of change (Edmondson, 1999). Research shows that psychological safety is associated with greater learning, knowledge sharing and performance, all of which support successful change and implementation efforts (Edmondson, 1999; Frazier et al., 2017; Newman et al., 2017). Emerging evidence also suggests that it may play a direct role in technology adoption, as workers who feel safe learning from mistakes are more likely to engage with new change initiatives (Albrecht et al., 2023; Reich et al., 2026; Zhang et al., 2023). By contrast, when workers fear criticism or blame for mistakes or feel responsible for the ultimate success of the pilot, they may avoid experimenting with new technologies or sharing honest feedback with leadership. This can lead to incorrect use or reliance on workarounds while also limiting the feedback needed to support successful long-term integration.

**Technical Challenges.** Organizations also face a range of technical considerations when implementing new solutions. Since safety technologies are often deployed in complex and high-risk environments, implementation should begin with ensuring they are appropriate for the work environment. For example, devices may require intrinsic safety certifications to prevent ignition risks and should be evaluated for the potential to create new hazards, such as snags on machinery or interference with personal protective equipment (PPE). The International Labour Organization cautions that solutions such as wearables and exoskeletons that are poorly designed or improperly fitted may contribute to discomfort and injury, while excessive reliance on automation can increase safety risks when systems fail (ILO, 2025).

Organizations must also ensure the necessary infrastructure is in place to support implementation. This often requires coordination across multiple departments, including safety, operations, IT, HR, legal, procurement and the technology provider themselves. Because each stakeholder evaluates technology from a different perspective, it can be helpful to communicate benefits that are relevant for each audience. For example, HR may value a solution for improving worker wellbeing, legal for strengthening compliance and operations for increasing efficiency. Communicating these department-specific benefits can help build broader support and ensure the right individuals are engaged.

Finally, some safety technologies collect potentially sensitive information about workers, their activities or their environment. While these capabilities can provide valuable insights, they also require organizations to establish clear policies governing data collection, protection and use. Data privacy remains one of the most frequently cited barriers to implementation (Crawford, 2024), and uncertainty about how worker information will be managed can quickly erode trust. Organizations operating across jurisdictions should also consider differences in cybersecurity requirements, data privacy laws and other regulatory obligations, as these may influence technology selection and ongoing data management. Frameworks such as the **NIST Cybersecurity Framework (CSF) 2.0** and **ISO/IEC 27001** provide additional guidance for managing these cybersecurity risks.

**Human Considerations.** Research consistently shows that adoption is influenced by individual experience as much as the solution itself. While workers may initially use technology because supervisors or cultural norms encourage it, this compliance effect tends to decline over time as they develop their own opinions (Davis, 1989; Venkatesh & Davis, 2000). Successful implementation therefore depends not only on deploying technology, but also on building trust and supporting positive user experiences throughout implementation (Bradbury & Goodman, 2025).

Resistance often emerges when workers do not understand the purpose of the solution, how it benefits them or when they feel unprepared for the change (UC Berkeley, 2019). Resistance and skepticism should not be viewed solely as barriers to adoption, but also as valuable sources of feedback that can help identify gaps in communication, training, system design or implementation strategies. Common considerations impacting implementation include:

- **Lack of understanding and clarity** about why the technology is being introduced and how it will affect work (Kotter, 1995; UC Berkeley, 2019)
- **Low perceived usefulness or relevance,** where workers do not believe the technology will help them do their jobs more effectively (Davis, 1989; Rogers, 2003; Venkatesh et al., 2003)
- **Fear of failure or inadequate skills,** leading to reluctance to engage with new technologies (Kamenov, 2013)
- **Concerns about loss of autonomy, status or established work practices** associated with change (Kamenov, 2013; Rogers, 2003)
- **Lack of trust** in the technology, including concerns about reliability, privacy and data security (Doeze Jager et al., 2022; PwC, 2018)
- **Different perceptions of costs and benefits,** where leaders often focus on the organizational gains while workers experience the immediate burden of learning and adapting to new systems (Kamenov, 2013; PwC, 2018)
- **Poor technology experiences,** which can reduce worker engagement and willingness in the future (PwC, 2018; Venkatesh & Bala, 2008)

Individual characteristics can also influence how workers experience and respond to new technologies. Factors like age (Berkowsky et al., 2018; Venkatesh et al., 2003), education level (Riddell & Song, 2017), digital literacy and technology skills (Nikou et al., 2022), prior technology experience (Venkatesh et al., 2003) and openness to innovation (KPMG, 2025) may all influence how workers react to new technologies.

Likewise, neurodiversity may shape how workers respond to implementation efforts. Research suggests that neurodivergent individuals, including autistic workers and those with ADHD, dyslexia and other neurological differences, may demonstrate different cognitive, communication and learning preferences that create both strengths and challenges during technology adoption (Walkowiak, 2021). Rather than viewing these differences as barriers, organizations should recognize that support may need to be tailored to accommodate a broader range of worker needs.

Cultural and language differences may also influence how workers engage with new technologies. Research suggests that language barriers can limit workers' ability to access and understand information about new technologies, particularly when training materials are not available in languages they are comfortable using (Gupta et al., 2023). Likewise, cultural factors can shape perceptions of trust, usefulness and ease of use, influencing whether workers are willing to incorporate the technology into their daily work practices (Venkatesh et al., 2003; Sanguineti & Maran, 2024). To support successful implementation, organizations with multilingual and multicultural workforces should provide training materials in employees' preferred languages and use communication approaches that reflect different cultural backgrounds and learning preferences. These strategies can improve employees' understanding of new technologies and increase the likelihood that they will adopt them successfully.

Collectively, these organizational, technical and human considerations highlight the complexity of technology implementation. The T.R.U.S.T. model consolidates these concepts into a practical framework to help organizations anticipate implementation challenges and develop strategies that support successful, sustained adoption.

Throughout this report, "workers" refers broadly to people whose job may be affected by a technology, whether or not they use it directly. "End users" refers specifically to individuals who directly interact with the technology. Even when technologies are used only by management or in certain roles, the resulting decisions often shape the conditions under which employees work. Because these different interactions create different needs and challenges, organizations should consider not only what a technology does, but also how workers broadly experience it, even when they are not necessarily end users.

### Theoretical Grounding

The T.R.U.S.T. Framework was developed through a review of existing research spanning technology acceptance, organizational change management, implementation science and workplace safety (see Appendix D). While existing models, such as the Technology Acceptance Model (TAM) (Davis, 1989), the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) and the ADKAR model of change management (Hiatt & Creasey, 2012) provide valuable insights into why individuals adopt new systems and how organizations navigate change, no single model fully addresses the unique implementation challenges associated with workplace safety technologies.

Rather than replacing these established models, the T.R.U.S.T. Framework integrates concepts from each to provide a practical, human-centered approach to safety technology implementation. It shifts the focus away from predicting technology acceptance to identifying the organizational conditions that influence whether technologies are trusted, adopted and ultimately deliver meaningful benefits.

The framework is built on the premise that successful implementation is fundamentally a matter of building trust. Research has consistently shown that trust increases individuals' willingness to accept vulnerability and uncertainty during periods of change (Cao & Le, 2024; Mayer et al., 1995; Wu et al., 2011). In organizational settings, higher levels of trust have been associated with lower resistance to change and greater employee adaptability, engagement and support for implementation efforts (Doeze Jager et al., 2022). When workers are asked to adopt new technologies or change their existing workflows, questions, concerns and skepticism are natural responses. Viewed through this lens, these responses become valuable sources of feedback to refine strategies, strengthen support and ensure the technology meets the needs of workers and the organization.

### The T.R.U.S.T. Framework

The T.R.U.S.T. Framework is organized around five domains: **Transparency, Relevance, Usability, Support, and Transformation**. Together, these domains represent the conditions that organizations must establish before workers can reasonably be expected to adopt and sustain the use of new technology. The first four domains are largely within the organization's control and will ultimately influence workers' overall experience. The fifth domain (Transformation) represents the transition from implementation to sustainment, where the technology has become an integrated part of how work is performed and is delivering meaningful value.

**Table 2.** The T.R.U.S.T. Framework

| | T | R | U | S | T |
|---|---|---|---|---|---|
| Domain | Transparency | Relevance | Usability | Support | Transformation |
| Focus | Communication | Worker value | Friction & accessibility | Resources & reinforcement | Results & sustainability |
| Key Considerations | Do workers know what the technology is, how it works and how it will be used? | Can workers clearly see how the technology benefits their work, safety or overall experience? | Can workers use the technology easily and effectively under actual working conditions? | Do workers know what to do when they need help, encounter a problem or the technology fails? | Has the technology become part of how work is done, and is it creating meaningful value for workers? |

## T Transparency

Often, resistance to change stems from a lack of clarity around the purpose of the change and its impacts on employees (UC Berkeley, 2019). The first domain, Transparency, is the extent to which workers understand what a technology is, how it works, what data is collected and how that information will be used. Transparency failures are rarely intentional. Organizations often invest considerable effort into communicating new solutions through emails, training sessions, policies or announcements, assuming workers are receiving the information they need. However, workers may still have unanswered questions, misunderstand the technology or remain uncertain about how it will affect their work. Effective communication therefore requires not only providing information but also creating opportunities for ongoing dialogue and feedback.

Eighty percent of employers reported concerns around the collection of personal information through technologies and the implications for employee privacy (Crawford, 2024). Workers themselves may worry that tools will be used to track performance over safety. Others may resist changes to familiar routines or feel overwhelmed by new systems. Without clear communication about their purpose and benefits, new tools can seem intrusive or unnecessary, resulting in low engagement and poor adoption. To ease these concerns, consider these strategies:

- **Engage early and often:** Workers are more likely to accept technology when they have opportunities to shape the process rather than simply reacting to it (Reynoso et al., 2026). Seek input before selecting or deploying a solution and treat concerns as implementation data rather than resistance to overcome. Discussions about the hazards workers face, their current work practices and the realities of introducing technology can help determine whether it addresses a genuine need and can be integrated into daily work. *If significant concerns persist, consider whether modifications or a different system is necessary.*
- **Create clarity before deployment:** Workers should understand why change is being introduced, what problem it is intended to solve and how it will affect their work (Bradbury & Goodman, 2025). Clearly communicate what data is collected (if any), who can access it and how the technology will be used in practice. Be transparent about expected outcomes and changes to existing processes.
- **Proactively address impacts on the workforce:** New technologies can change the way people work and, in some cases, eliminate the need for certain roles. Communicate these impacts openly and as early as possible so workers understand what to expect. Explain what jobs or tasks are likely to change, whether any roles are expected to be eliminated and what new skills will be required to achieve success. Provide opportunities for employees to retrain or reskill whenever possible.
- **Identify and empower digital champions:** A digital champion is an employee who helps introduce new technologies and supports their implementation by communicating the benefits, sharing feedback and offering peer-to-peer support. Effective champions bridge the gap between organizational goals and worker experience throughout deployment.
- **Make information accessible and understandable.** Workers cannot support a technology they do not understand. Provide simple, jargon-free explanations that address the questions noted above. Consider the needs of workers with different language backgrounds, literacy levels, learning styles and communication preferences by using multiple formats (e.g., short visual guides, hands-on demonstrations, FAQs, translated materials, informal discussions).
- **Avoid punitive use:** Safety technologies are most effective when they support learning and continuous improvement. When workers perceive technologies primarily as monitoring or disciplinary tools, trust can erode quickly. Organizations should prioritize coaching, mentorship and learning opportunities to earn long-term acceptance and sustained use. Data and technologies should not be used for punitive purposes except when necessary to address serious or repeated misconduct.
- **Make the technology visible:** Whenever possible, show workers exactly how the technology functions in practice. For example, demonstrate what a camera can and cannot see, show how wearable or sensor data appear on dashboards or walk through how alerts are generated. Making the system visible helps reduce uncertainty.

**Cognitive Trap #1:**

***The Illusion of Transparency***

We tend to overestimate how clearly our thoughts, intentions and communications are understood by others (Gilovich, Savitsky, & Medvec, 1998). Leadership may assume workers understand a new technology because it was addressed in training, when important questions and concerns remain unaddressed. Provide plenty of opportunities for workers to practice with the technology, ask clarifying questions and share feedback.

## R Relevance

Relevance is the degree to which workers believe a technology is meaningful or beneficial to the tasks they perform. Research consistently shows that perceived value is a key driver of technology adoption (Davis, 1989; Venkatesh & Davis, 2000). Organizations often select technology based on enterprise-level priorities like increased efficiency, risk reduction or regulatory compliance, then communicate those benefits down. However, workers themselves are more likely to evaluate a new tool or initiative through the lens of their own job responsibilities and daily experiences (Bradbury & Goodman, 2025). Questions such as "Will this help keep me safe?", "Does this address a problem I actually face?" and "What does this mean for me?" often shape workers' perceptions more than organizational goals or business outcomes do.

Within the T.R.U.S.T. Framework, relevance is not determined by whether a technology provides value to the organization, but whether workers can see and experience that value in their daily work. To strengthen relevance during implementation, consider the following practices:

- **Involve workers in selection and evaluation:** Involving workers in pilots, demonstrations and evaluation activities provides leaders with valuable insight into how the technology fits existing workflows. Early involvement can also help organizations identify poor-fit solutions before significant time and resources are invested.
- **Tailor messages to different audiences:** The value of a technology may differ across roles, departments and job functions. Whereas workers may focus on personal safety, comfort and ease of use, leaders across the organization often evaluate technology differently. Frame benefits in ways that are relevant to each audience rather than relying on a single message for everyone.
- **Demonstrate value early:** Individuals are more likely to embrace a technology when they can see how it benefits them. Sharing pilot results, testimonials or success stories from peers can help translate abstract benefits into meaningful outcomes.
- **Continuously reassess relevance:** Work conditions, priorities and risks evolve over time. Periodically gather feedback to ensure that technologies continue to address operational needs and worker challenges over time, not just at implementation.

**Cognitive Trap #2:**

***The False Consensus Effect***

Often, we tend to assume that others will share our beliefs, behaviors or values (Ross, Greene, & House, 1977). In the context of safety technology, leaders may assume workers value technology for the same reasons they do. Workers, however, often evaluate new tools based on different factors (e.g., workload, usability, comfort and effectiveness). Tailor your messaging to meet different workers and roles where they are.

## U Usability

Usability is the degree to which workers can successfully use a technology with minimal effort, frustration or disruption to their work. Research consistently identifies perceived ease of use as a major driver of technology adoption (Davis, 1989; Venkatesh et al., 2003; Venkatesh & Bala, 2008), suggesting that even technologies with clear safety benefits may struggle to gain acceptance if they are difficult to learn, uncomfortable to use or disruptive to normal work activities.

Survey findings reinforce the importance of usability. Employers consistently rank ease of use among the most important considerations when selecting safety technologies (Washburn, 2020). Likewise, workers report discomfort, interference with work, training demands and time pressures as common barriers to consistent use (Crawford, 2024). Other sources of friction may include:

- Additional devices, logins or documentation
- Ease of the transition (e.g., migrating data, use of new systems)
- Confusing interfaces or unclear instructions
- Language, literacy or accessibility barriers
- Unreliable performance or connectivity issues
- Distracting alerts or notifications

As a result, implementation leaders should actively identify and reduce sources of friction as quickly as possible. This requires understanding how the technology performs under actual working conditions and whether it is compatible with the organization's hazards and work environment. A technology that performs well in a controlled manufacturing facility, for example, may encounter very different issues when deployed in a dynamic construction environment. Technologies that appear simple during demonstrations may create unexpected barriers once deployed in the field. This is an ongoing process, as changes to the work environment, staffing or work itself can create new barriers long after a technology has been introduced.

**Cognitive Trap #3:**

***The Curse of Knowledge***

The curse of knowledge is the tendency for individuals who possess information or expertise to underestimate how difficult it is for others who do not share that knowledge to learn or understand the same information (Camerer, Loewenstein, & Weber, 1989). Organizations may assume a technology is intuitive because those involved in selecting, configuring or implementing it found it to be so, while workers encounter confusion or friction that was never anticipated. Engage with workers to assess usability rather than relying on assumptions from implementation leaders or solution providers.

## S Support

Support refers to the systems, resources and people that help workers successfully use a technology. While organizations often devote substantial resources to selecting and deploying new technologies, long-term success depends on providing workers with the knowledge, resources and reinforcement needed to confidently incorporate them into their daily work (Hiatt & Creasey, 2012; Kotter, 1995).

Within the T.R.U.S.T. Framework, support is viewed as an ongoing organizational responsibility rather than a one-time implementation activity. New technologies rarely function perfectly from the outset, and workers will inevitably have questions or encounter unexpected situations during adoption. In these cases, they must know who to contact when problems occur, how issues will be addressed and what alternatives exist when the technology is unavailable. Without this support, workers may develop workarounds or revert to previous practices, ultimately weakening the chance for long-term success.

Support also includes the social and organizational environment surrounding implementation. Workers often turn to supervisors and trusted peers rather than manuals or help desks when they need assistance (PwC, 2018). Leaders who model technology use, encourage questions, respond constructively to concerns and treat mistakes as learning opportunities help build confidence and reinforce adoption. Alternatively, environments where workers fear criticism or blame for asking questions or making mistakes can discourage engagement and undermine implementation efforts (Edmondson, 1999; Venkatesh et al., 2003).

This fear may be reinforced if workers believe they will be blamed when the technology itself fails. Elish (2019) describes this as a moral crumple zone, where frontline workers become the focus of blame even when the underlying causes lie in the technology, its design or how it was implemented. Organizations should establish clear accountability processes that distinguish between system failures, implementation issues and human error. When problems occur, the focus should be on understanding what went wrong and how to improve the process rather than automatically blaming individual workers.

Individuals often revert to familiar practices without continued encouragement (Hiatt & Creasey, 2012; Kotter, 1996). Reinforcement may take many forms, including peer recognition, celebration of implementation milestones, visible leadership participation or sharing of success stories. However, incentives should be used thoughtfully. Organizations that build genuine engagement and value rather than relying solely on rewards are more likely to achieve sustained use of new technologies (Venkatesh et al., 2003). At a minimum, workers should know:

- Who to contact when they have questions or need assistance
- Where to find additional training, coaching or updated guidance
- How to provide feedback and how concerns will be addressed
- What backup procedures to follow if the technology becomes unavailable (e.g., malfunctions, damage, power loss, connectivity issues)
- That questions, mistakes and requests for help are encouraged and treated as opportunities to learn
- That supervisors and peers actively reinforce the technology's adoption by modeling its use, recognizing successes and supporting workers through challenges

**Cognitive Trap #4:**

***The Fundamental Attribution Error***

The fundamental attribution error is the tendency to attribute other people's behavior to personal characteristics while overlooking situational factors (Ross, 1977). Organizations may interpret low adoption as worker resistance or lack of motivation when the real barriers might be inadequate training, insufficient support or competing priorities. Understand the underlying causes of resistance before immediately trying to defend the technology or switching strategies.

## Transformation

Transformation represents the transition from implementation to sustained operations. It refers to the extent to which a technology becomes integrated into how work is performed, creating meaningful and lasting value for workers, organizations and safety outcomes. Unlike the preceding T.R.U.S.T. domains, which focus on the conditions that support successful implementation, Transformation focuses on whether those efforts result in lasting organizational change. From a human-centered perspective, successful transformation occurs when technology is embedded within the work system in ways that support worker wellbeing, strengthen performance and deliver measurable safety benefits (European Commission, 2024).

Because technology and organizations are continually evolving, transformation is an ongoing process. A solution that performs well during a pilot may become less effective as work changes, new technologies are introduced or organizational needs evolve. Likewise, sustaining change requires reinforcement and systemic integration into everyday work (Hiatt & Creasey, 2012; Kotter, 1995). Organizations should therefore periodically evaluate implementation outcomes, gather worker feedback and determine whether technologies continue to meet operational needs. In some cases, successful implementation means refining the implementation strategy or replacing a technology that is no longer the right fit for the work environment.

Transformation therefore represents the culmination of the preceding T.R.U.S.T. domains. Technologies are most likely to produce meaningful and lasting change when workers understand their purpose *(Transparency)*, perceive them as beneficial to their work *(Relevance)*, can use them effectively under real-world working conditions (Usability) and receive adequate organizational resources and reinforcement *(Support)*. When these conditions are met, technology moves beyond implementation and becomes embedded within organizational systems and decision-making. Rather than existing as a standalone initiative layered onto existing work, it becomes part of how work is routinely performed.

**Cognitive Trap #5:**

***Outcome Bias***

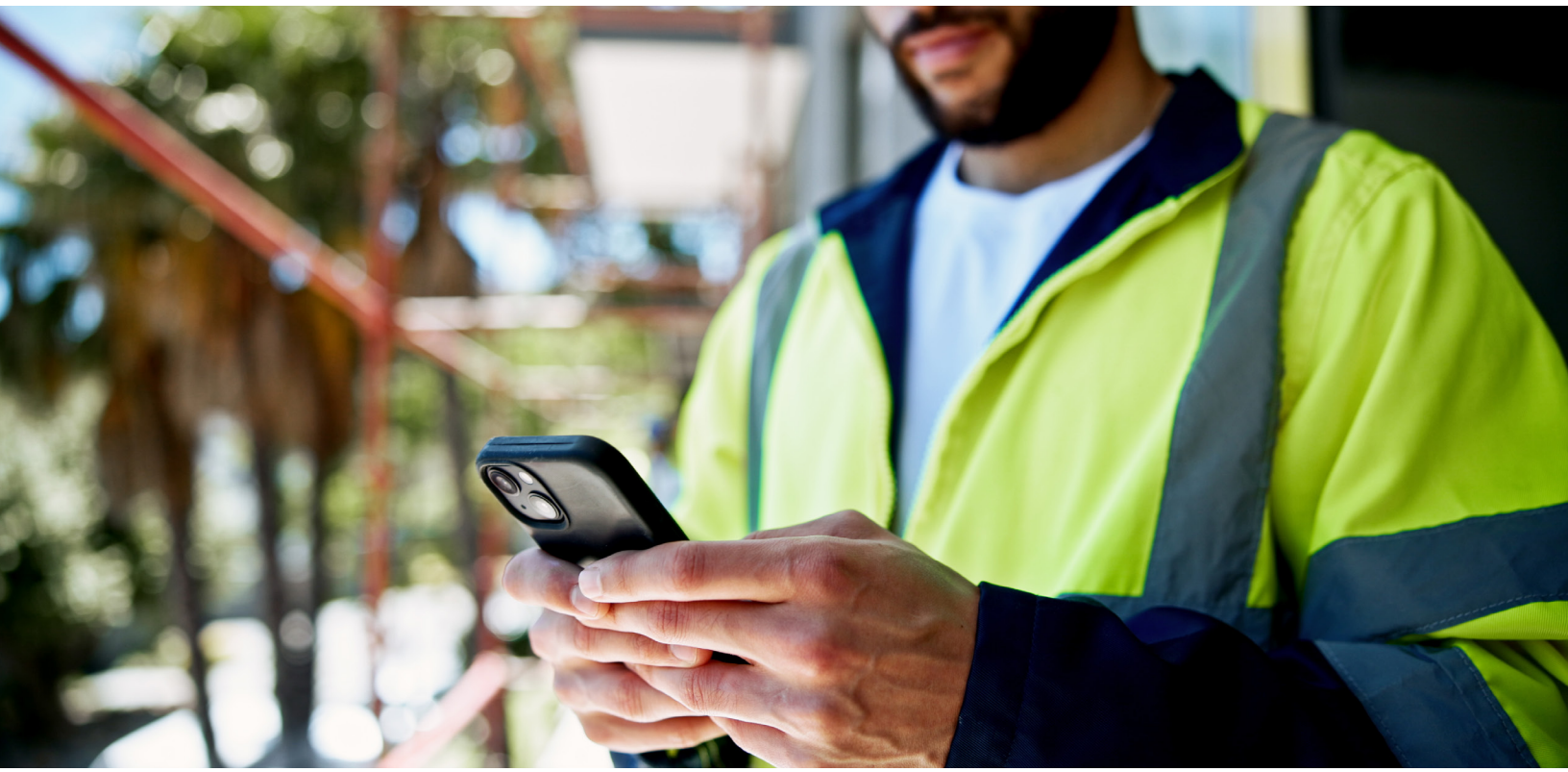
Outcome bias is the tendency to judge the quality of a decision based solely on its outcome rather than the process used to reach it (Baron & Hershey, 1988). Organizations may assume a technology was successfully implemented because it was deployed on time or initially adopted while overlooking whether it meaningfully improved safety or benefited workers.

## Implementation Spotlight: Reducing Friction

Cordia, a medium-sized U.S. energy services provider, sought to improve the safety of lone workers responsible for after-hours maintenance and monitoring. The company initially deployed stand-alone wearable devices with features such as fall detection and panic buttons. Although the devices met the organization's safety objectives, workers reported false alarms, difficulty securing them to their vests and frustration with carrying additional equipment.

Rather than expecting workers to adapt to the technology, Cordia adapted the implementation to meet its workers' needs. They replaced the wearables with a safety application installed on company-issued smartphones, eliminating the need for additional hardware while maintaining features such as no-motion detection, scheduled check-ins and 24/7 emergency monitoring. Frontline workers were involved throughout the process, providing feedback that informed adjustments to check-in intervals and alert settings. By integrating the technology into tools workers already used, Cordia reduced friction, improved usability and maintained its record of zero lone-worker incidents.

**Takeaway: Successful implementation is not always about selecting the most advanced technology. More often, it is about selecting the technology that best fits the work, the environment and the people expected to use it.**

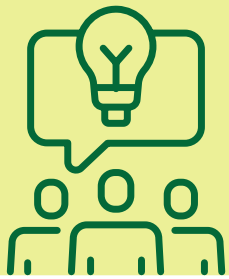


## Technology Response Patterns: Supporting Workers During Implementation

*Technology Response Patterns* provide a practical way to understand why individuals may respond differently to the same technology. A central feature of these patterns is the distinction between willingness, ability and trust. Some end users may be willing to adopt a technology but lack the time, resources or capacity to do so effectively. Others may have the ability to use the technology but question its value, distrust its purpose or fear making mistakes while learning. By considering these factors together, organizations can better identify the barriers influencing adoption and avoid treating all implementation challenges as resistance to change.

These responses may also reveal broader organizational conditions influencing implementation. For example, widespread skepticism may indicate gaps in transparency or a lack of organizational trust, while widespread signs of worker overload may suggest implementation demands that exceed workers' available capacity. Similarly, frequent apprehensive responses may highlight opportunities to strengthen coaching or psychological safety. Rather than viewing these patterns as individual deficiencies, organizations should use them as signals to identify and address underlying implementation barriers.

**Consideration:**
**Use Response Patterns to Guide Conversations**



The *Technology Response* Patterns describe common responses that may emerge during periods of change. They are intended as practical shortcuts to help implementation leaders recognize worker needs and tailor strategies accordingly. Workers may exhibit one or more of these responses at any time depending on changes in workload, jobsite conditions, leadership support and experiences with the technology. We do not recommend assigning workers to specific response categories or treating these patterns as fixed labels. While surveys can be useful, results are best interpreted in the aggregate to identify broader trends rather than used as personality tests or potentially stigmatizing classifications. Leaders should foster an environment where workers feel comfortable asking questions, expressing concerns and sharing honest feedback without fear that their responses will influence how they are perceived or affect future opportunities.

## Response #1: Supportive

The first response pattern, supportive, is characterized by a high degree of willingness, ability and trust. Workers demonstrating this pattern are generally curious about new technologies, confident in their own ability to learn and trust that the organization is acting in good faith during implementation (Guasta, Lin, & Whitcomb, 2022). While they are often described as being "good with technology," their defining characteristic is their willingness to experiment, adapt and help others do the same, not necessarily technical expertise. Consistent with Rogers' Diffusion of Innovations theory, the supportive response pattern closely resembles the Early Adopter, whose visible use of an innovation can help reduce uncertainty for others (Rogers, 2003).

Supportive responses often emerge early in implementation efforts, commonly exhibited when workers volunteer for pilots, explore new applications or features and provide feedback. Importantly, supportive does not mean uncritical support; workers may still question the technology, identify problems or recommend changes while still remaining engaged in the implementation process. Because co-workers often trust the experiences of respected peers more than organizational messaging, partnering with these individuals during implementation can help build confidence and encourage adoption through their visible use of the technology (Rogers, 2003; Venkatesh et al., 2003).

Although these workers are valuable implementation partners, organizations should avoid over-reliance on them. Asking them to serve as unofficial trainers, technical support or change leaders without adequate support can lead to frustration and burnout (KPMG, 2025). Instead, organizations should position them as trusted partners who provide feedback, model successful adoption and help identify challenges before they become widespread.

### Organizations can support these workers by:

- **Involving them early.** Encourage willing workers to participate in new technology initiatives and provide practical feedback before broader deployment.
- **Listening to their feedback.** While supportive sounds broadly positive, these individuals often identify usability challenges before they appear in formal metrics or conversations.
- **Providing recognition.** Acknowledge the time and effort these workers invest in supporting adoption; this can include formal recognition, development opportunities or increased influence in future decision-making.
- **Protecting against burnout.** Avoid treating supportive workers as unofficial trainers or managers without adjusting workloads or providing additional support.
- **Preserving their credibility.** Encourage honest feedback rather than expecting these workers to just be advocates. Their value comes from being trusted by their peers, not from serving as organizational spokespeople.

## Response #2: Pragmatism

Workers who exhibit a pragmatic response pattern are typically practical, result-oriented users who evaluate technology based on whether it helps them perform their job more safely or effectively. Unlike the supportive response, pragmatic workers prefer to see evidence before buying in. Workers demonstrating this pattern are generally willing to adopt new technologies once they can clearly see how a solution will benefit them but are unlikely to invest significant time or energy until those benefits become apparent.

Trust plays a particularly important role in pragmatic responses. Workers demonstrating this pattern are unlikely to be persuaded by employer mandates, vendor marketing or aspirational messaging. Instead, they trust what they can observe. Hands-on experience, visible improvements in day-to-day work and peer experience are often more influential than organizational messaging alone (Venkatesh & Davis, 2000).

Pragmatic responses are often mistaken for strong engagement because these workers will generally comply with implementation requirements. However, their adoption is conditional. If usability problems emerge, workloads increase, support declines or benefits fail to materialize, they may quietly disengage without openly expressing concerns. This can create a significant challenge for technology adoption, because disengagement is often difficult to detect. Organizations may incorrectly assume adoption is successful based on initial compliance, while actual use is stagnant or declining.

### Organizations can support these workers by:

- **Connecting the technology to real work challenges.** Clearly explain how the technology addresses specific risks, inefficiencies or frustrations workers encounter in their daily tasks.
- **Providing opportunities for hands-on experience.** Pragmatic workers often trust their own observations more than organizational messaging or vendor claims.
- **Sharing practical examples from peers.** Real-world experiences from co-workers can help reduce uncertainty and establish credibility.
- **Addressing usability concerns quickly.** Friction, workflow disruptions and unnecessary complexity can quickly undermine a technology's perceived value.
- **Acting on feedback.** Workers often provide thoughtful feedback about what is and is not working in practice. Evaluate that feedback and make improvements quickly where possible. When changes cannot be made, explain the rationale so workers understand how decisions were reached.

## Response #3: Apprehension

Apprehension describes a response pattern in which a worker is not opposed to technology but is held back by uncertainty about their ability to succeed. They may worry about making mistakes, appearing incompetent in front of peers, asking the wrong questions or failing publicly. As a result, organizations may mistake their hesitation for resistance when the underlying challenge is low self-confidence.

Research on psychological safety and organizational change shows that individuals are more likely to engage in learning behaviors when they believe mistakes and questions will not result in embarrassment or punishment (Edmondson, 1999). Likewise, fear of failure can negatively affect adaptation to change and an individual's willingness to experiment with unfamiliar systems (Kamenov, 2013). Technology acceptance research further suggests that anxiety can make technologies appear more difficult to use than they are, particularly during the early stages of adoption (Venkatesh & Bala, 2008).

Workers demonstrating apprehension may complete training, understand the technology's purpose and express support for implementation efforts, yet hesitate when asked to use the technology independently. Employers may respond by providing additional training when the more immediate need may be reassurance, coaching and a psychologically safe environment in which to practice.

### Employers can support these workers by:

- **Creating opportunities for low-risk practice.** Allow workers to experiment with the technology before they are expected to use it independently in operational settings.
- **Fostering psychologically safe learning environments.** Encourage workers to ask questions, request help and share concerns without fear of embarrassment or punishment.
- **Providing coaching rather than correction.** Build confidence through encouragement, guidance and constructive feedback rather than criticism or punishment.
- **Pairing workers with trusted peers.** Mentors and experienced co-workers can provide reassurance and model successful technology use in a lower-stakes environment.
- **Recognizing progress, not just proficiency.** Celebrate learning, effort and improvement rather than focusing exclusively on mastery.
- **Reducing pressure during early adoption.** Avoid public evaluations, high-stakes testing or unrealistic expectations while workers are still building confidence.

## Response #4: Overload

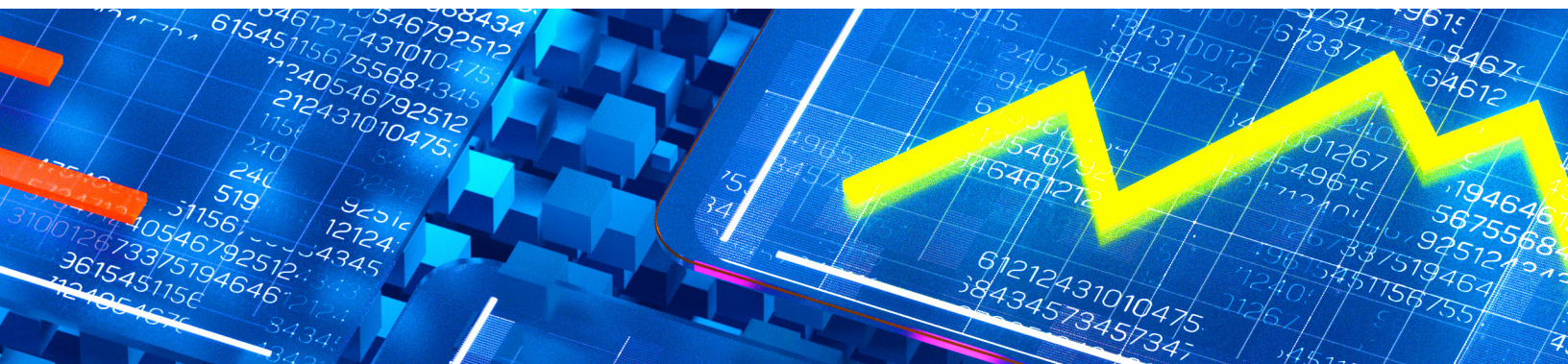
Overload describes a response pattern in which workers generally want the technology to succeed, recognize its potential value, trust the organization's intentions and possess the skills necessary to use it effectively; the primary barrier is not motivation or capability, but capacity. Workload and competing demands may leave workers with limited time, attention or energy to learn and consistently use the technology. In these circumstances, they may see the technology as just another demand competing for their already-limited resources.

Fogg's Behavior Model suggests that even highly motivated workers are less likely to adopt new behaviors when the effort required becomes too great (Fogg, 2020). Similarly, cognitive load theory suggests that when an individual's mental demands exceed their available capacity, they naturally revert to familiar routines rather than newer behaviors that require greater attention (Sweller, 1988). Consistent with these findings, Work to Zero identified lack of time, competing priorities and limited implementation resources as common barriers to safety technology adoption (Crawford, 2024), while poorly integrated workplace technologies may also increase workload and complexity (PwC, 2018). Declining or stagnant adoption should not automatically be interpreted as resistance, but as a potential mismatch between implementation demands and operational realities.

Most workers experience periods of overload, although the degree and duration vary according to workload, role and available support. This response pattern describes situations where competing demands become the primary barrier to adoption. In these circumstances, additional communication, meetings, training requirements or implementation activities may inadvertently increase frustration and resistance by adding to an already strained workload. Rather than assuming more communication or training will improve implementation, leaders should focus on reducing unnecessary burden, prioritizing competing demands and creating the time and space needed for successful adoption.

### Organizations can support these workers by:

- **Reducing friction wherever possible.** Simplify work, eliminate unnecessary steps and ensure the technology fits naturally into existing work processes.
- **Creating space for adoption.** Allow time for learning, practice and adjustment rather than expecting workers to absorb new responsibilities on top of existing workloads.
- **Prioritizing implementation activities.** Clearly communicate which priorities and tasks are most important, and avoid overwhelming workers with competing initiatives.
- **Identifying workload barriers early.** Ask workers where time pressures, staffing shortages or competing priorities may interfere with adoption.
- **Monitoring for signs of overload.** Declining participation, workarounds, missed steps and inconsistent use may indicate capacity constraints rather than resistance.
- **Adjusting expectations during high-demand periods.** Recognize that adoption may fluctuate during staffing shortages, peak production periods or other operational pressures.
- **Phase implementation where possible.** Introduce new technologies gradually, allowing workers time to build familiarity with and confidence in them before expecting their full integration into daily work.



## Response #5: Skepticism

Skepticism is often viewed as the most challenging response to technology adoption, but that characterization can be misleading. The defining characteristic of this response pattern is distrust of either the technology itself or the organization's motives for implementing it. In many cases, skepticism stems from previous negative experiences with technology, or concerns regarding privacy or surveillance (KPMG, 2025; Crawford, 2024).

Workers demonstrating skeptical response patterns evaluate whether the technology is worthy of trust. They approach new technologies cautiously, preferring to reduce uncertainty before committing to change. They want evidence that the technology works as intended, that organizational promises will be honored and that the benefits outweigh the risks. Their questions are often direct and practical: *What data is being collected? Who has access to it? What happens if the technology fails? Is this another initiative that will disappear in six months*? While these questions can sometimes be perceived as resistance, they are often attempts to understand and evaluate potential risks before committing to change.

Importantly, skeptical responses can provide valuable insight into implementation challenges. Workers' questions may reveal gaps in communication, unresolved privacy concerns, usability issues or other disconnects between organizational goals and worker experiences. Organizations that dismiss skepticism as a cultural or attitude problem may overlook early warning signs that could undermine broader adoption. In many cases, skeptical workers are identifying a preexisting trust problem rather than creating one.

### Organizations can support these workers by:

- **Answering questions directly and honestly.** Avoid vague assurances or dismissive responses to concerns. Treat questions or negative feedback as legitimate concerns rather than resistance.
- **Demonstrating organizational integrity.** Follow through on commitments, communicate decisions consistently and acknowledge when plans change.
- **Involving skeptical workers in the process.** Skeptical workers are often excluded from pilot programs or implementation planning because they are perceived as resistant. However, their questions frequently identify implementation challenges before broader rollout.
- **Being transparent about limitations and trade offs.** Credibility is strengthened when organizations openly discuss what the technology can and cannot do and how that information will be used in practice.
- **Listening before persuading.** Focus first on understanding the source of skepticism rather than immediately trying to overcome it.
- **Demonstrating that adoption is adaptable.** Show that worker feedback can influence decisions and that technologies may be modified, replaced or discontinued if they fail to deliver value or introduce unacceptable burdens.

## Conclusion: Applying the Framework

The T.R.U.S.T. Framework and accompanying Technology Response Patterns are intended to serve as practical tools for understanding and improving technology implementation in safety-sensitive environments. Together, they provide a human-centered lens for understanding why technology implementation succeeds or fails by shifting attention away from the technology itself and toward end users' experiences. The framework recognizes that successful implementation depends on establishing the conditions necessary for trust through **Transparency, Relevance, Usability, Support** and **Transformation**, while the response patterns help organizations better understand how different workers may experience and react to new technology initiatives. Rather than viewing adoption as a binary outcome of compliance or resistance, the framework encourages organizations to explore the underlying factors influencing worker behavior and tailor implementation strategies accordingly.

Importantly, neither the T.R.U.S.T. domains nor response patterns should be applied as a prescriptive checklist or diagnostic tool. Just as users might move between different responses, different domains of the T.R.U.S.T. model may be more effective depending on the type of technology, organizational culture and workforce demographics. For this reason, the framework is most effective when used as an ongoing tool for reflection, feedback and continuous improvement rather than a one-time assessment conducted during pilots (see Figure 4).

Although the T.R.U.S.T. Framework was developed as a practical implementation tool grounded in existing research, it is still an evolving framework. Future research should evaluate its application across different industries and technologies while exploring opportunities to refine and improve it. Another important area involves work environments where the organization implementing the technology is not the worker's direct employer (e.g., subcontractors, temporary workers, multi-employer jobsites), creating more complex implementation relationships. Future research should explore how accountability for domains such as Transparency and Support can be shared across organizations and how implementation responsibilities can be coordinated in multiemployer work environments.

Ultimately, human-centered technology implementation is about creating the conditions that enable workers and technology to succeed together. By combining evidence-based implementation practices with a human-centered understanding of worker experiences, organizations can build trust, support lasting adoption and create safer, healthier workplaces.

**Figure 4.** Applying the T.R.U.S.T. Framework to Safety Technology Implementation

## References


Albrecht, S. L., Furlong, S., & Leiter, M. P. (2023). The psychological conditions for employee engagement in organizational change: Test of a change engagement model. Frontiers in Psychology, 14, 1071924. https://doi.org/10.3389/fpsyg.2023.1071924

Baron, J., & Hershey, J. C. (1988). Outcome bias in decision evaluation. Journal of Personality and Social Psychology, 54(4), 569–579. https://doi.org/10.1037/0022-3514.54.4.569

Bayona, A., Hallowell, M. R., and Bhandari, S. (2024). The things that hurt people are not the same as the things that kill people: Key differences in the proximal causes of low- and high-severity construction injuries. Journal of Construction Engineering and Management, 150(8), 1–12. https://doi.org/10.1061/JCEMD4.COENG-14545

Berkowsky R. W., Sharit J., and Czaja S. J. (2018). Factors predicting decisions about technology adoption among older adults. Innovation in Aging, 1–12. https://doi.org/10.1093/geroni/igy002

Bradbury, W., and Goodman, G. (2025). Beyond management of change: Six steps to effective change management. Professional Safety Journal, 2025, 16–19. https://www.assp.org/docs/default-source/psj-articles/bpbradbury_1125.pdf?sfvrsn=f06a4c46_0

Camerer, C., Loewenstein, G., & Weber, M. (1989). The curse of knowledge in economic settings: An experimental analysis. Journal of Political Economy, 97(5), 1232–1254. http://dx.doi.org/10.1086/261651

Cao, T. T., & Le, P. B. (2024). Impacts of transformational leadership on organizational change capability: A two-path mediating role of trust in leadership. European Journal of Management and Business Economics, 33(2), 157–173. https://doi.org/10.1108/EJMBE-06-2021-0180

Crawford, K. (2024). Safety technology 2024: Examining trends in technology solutions used to reduce serious injuries and fatalities in the workplace. National Safety Council. https://www.nsc.org/faforms/work-to-zero-safety-technology-2024

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340. https://doi.org/10.2307/249008

Demir, K. A., Döven, G., & Sezen, B. (2019). Industry 5.0 and human-robot co-working. Procedia Computer Science, 158, 688–695. https://doi.org/10.1016/j.procs.2019.09.104

Doeze Jager, S. B., Born, M. P., & van der Molen, H. T. (2022). The relationship between organizational trust, resistance to change and adaptive and proactive employees' agility in an unplanned and planned change context. Applied Psychology, 71(2), 436–460. https://doi.org/10.1111/apps.12327

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. Administrative Science Quarterly, 44(2), 350–383. https://doi.org/10.2307/2666999

Elish, M. C. (2019). Moral crumple zones: Cautionary tales in human-robot interaction. Engaging Science, Technology, and Society, 5, 40–60. https://doi.org/10.17351/ests2019.260

European Commission. (2024). ERA industrial technologies roadmap on human-centric research and innovation for the manufacturing sector. Publications Office of the European Union. https://doi.org/10.2777/0266

Evemy, C. (2025). The challenge of safety metrics: Leading indicators in real-world applications. The Campbell Institute. https://www.thecampbellinstitute.org/wp-content/uploads/2025/10/1526850-NSC_Challenge-of-Safety-Metrics_Leading-Indicators-in-Real-World-Applications-1.pdf

Fogg, B. J. (2020). Tiny habits: The small changes that change everything. Harper Collins Publishers. [Print].

Frazier, M. L., Fainshmidt, S., Klinger, R. L., Pezeshkan, A., & Vracheva, V. (2017). Psychological safety: A meta-analytic review and extension. Personnel Psychology, 70(1), 113–165. https://doi.org/10.1111/peps.12183

Gamaga, K., Jayawardana, I., and Rusu, L. (2026). Organizational cultural barriers to digital innovation: A systematic literature review. Procedia Computer Science, 278, 469–476. https://doi.org/10.1016/j.procs.2026.03.014

Gilovich, T., Savitsky, K., & Medvec, V. H. (1998). The illusion of transparency: Biased assessments of others' ability to read one's emotional states. Journal of Personality and Social Psychology, 75(2), 332–346. https://doi.org/10.1037/0022-3514.75.2.332

Guasta, L., Lin, M-L, and Whitcomb, E. (2022). Safety technology pilot and implementation roadmap: Making innovation accessible. National Safety Council. https://www.nsc.org/faforms/work-to-zero-safety-implementation-pilot-roadmap

Gupta, A., Ponticelli, J., & Tesei, A. (2023). Language barriers, technology adoption and productivity: Evidence from agriculture in India. National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w27192/w27192.pdf

Hiatt, J. M., and Creasey, T. J. (2012). Change management: The people side of change. Prosci Learning Center Publications. [Print].

Injury Facts. (2026). Work-related incident rate trends. National Safety Council. https://injuryfacts.nsc.org/work/industry-incidence-rates/work-related-incident-rate-trends/

Inouye, J. (2020). Designing strategy for serious injury and fatality prevention. The Campbell Institute. https://www.thecampbellinstitute.org/wp-content/uploads/2020/02/Campbell-Institute_Designing-Strategy-for-Serious-Injury-and-Fatality-Prevention.pdf

International Labor Organization. (2025). Global report: Revolutionizing health and safety: The role of AI and digitization at work. https://www.ilo.org/publications/revolutionizing-health-and-safety-role-ai-and-digitalization-work

Ivensky, V. (2016). Safety expectations: Finding a common denominator. Professional Safety, 61(7), 38–43. https://onepetro.org/PS/article-abstract/61/07/38/33431/Safety-Expectations-Finding-a-Common-Denominator

Kotter, J. P. (1995). Leading change: Why transformation efforts fail. Harvard Business Review. https://hbr.org/1995/03/leading-change-why-transformation-efforts-fail-2

KPMG. (2025). The human story behind AI adoption: Understanding personas for your organization. https://kpmg.com/us/en/articles/2025/human-story-behind-ai-adoption-understanding-personas-for-your-organization.html

Lam, L., Nguyen, P., Le, N., and Tran, K. (2021). The relation among organizational culture, knowledge management, and innovation capability: Its implication for open innovation. Journal of Open Innovation: Technology, Market, and Complexity, 7(1), 1–16. https://doi.org/10.3390/joitmc7010066

Martin, D. K., and Black, A. A. (2015). Preventing serious injuries and fatalities: Study reveals precursors and paradigms. Safety Management, 35–43. https://aeasseincludes.assp.org/professionalsafety/pastissues/060/09/F2_0915.pdf

Mathur, A., Dabas, A., & Sharma, N. (2022). Evolution from Industry 1.0 to Industry 5.0. 2022 4th International Conference on Advances in Computing, Communication Control and Networking (ICAC3N), India, 1390–1394A. https://doi.org/10.1109/ICAC3N56670.2022.10074274

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. Academy of Management Review, 20, 709–734. https://doi.org/10.2307/258792

Narayanan, S., and Coxon, M. (2018). It's the last IT/OT mile that matters in avoiding Industry 4.0's pilot purgatory. McKinsey & Company. https://www.mckinsey.com/capabilities/operations/our-insights/operations-blog/its-the-last-it-ot-mile-that-matters-in-avoiding-industry-40s-pilot-purgatory

Newman, A., Donohue, R., & Eva, N. (2017). Psychological safety: A systematic review of the literature. Human Resource Management Review, 27(3), 521–535. https://doi.org/10.1016/j.hrmr.2017.01.001

Nikou, S., De Reuver, M., & Mahboob Kanafi, M. (2022). Workplace literacy skills: How information and digital literacy affect adoption of digital technology. *Journal of Documentation, 78*(2), 371–391. https://doi.org/10.1108/JD-12-2021-0241

PwC. (2018). The must-know strategies for getting employees to embrace workplace technology. https://www.pwc.com.au/digitalpulse/report-cis-tech-at-work.html

Reich, A., Wolfe, D., Price, M., Choe, A., Kidd, F., & Wagner, H. (2026). Safety first: Psychological safety as the key to AI transformation. arXiv. https://doi.org/10.48550/arXiv.2602.23279

Reynoso, M., Maikala, R., & DeBaylo, P. (2026). *Frontline worker perceptions of MSD prevention technology.* National Safety Council. https://www.nsc.org/getmedia/4af67076-de46-4a45-8812-57f5fa257e69/frontline-worker-perception-msd-prevention-tech.pdf

Riddell, W. C., & Song, X. (2017). The role of education in technology use and adoption: Evidence from the Canadian Workplace and Employee Survey. *ILR Review, 70*(5), 1184–1213. https://doi.org/10.1177/0019793916687719

Rogers, E. M. (2003). *Diffusion of innovations (5th ed.).* Free Press.

Ross, L. (1977). The intuitive psychologist and his shortcomings: Distortions in the attribution process. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 10, pp. 173–220). [Print].

Ross, L., Greene, D., & House, P. (1977). The "false consensus effect": An egocentric bias in social perception and attribution processes. *Journal of Experimental Social Psychology, 13*(3), 279–301. https://doi.org/10.1016/0022-1031(77)90049-X

Sanguineti, F., & Maran, T. (2024). Navigating the clouds: Cultural influences on technology acceptance in the workplace. *Technology in Society, 77,* 102553. https://doi.org/10.1016/j.techsoc.2024.102553

Stefanova, N. K. (2023). *Change management in the implementation of AI technology — Organizational aspects* [Paper presentation]. 6th International Conference on Advanced Research in Management, Business and Finance, Amsterdam, Netherlands. https://www.doi.org/10.33422/6th.icmbf.2023.06.107

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4

University of California, Berkeley. (2019). *Change management toolkit: Tips, tools, and techniques for leading a successful change initiative.* https://hr.berkeley.edu/sites/default/files/ucb_change_managment_toolkit_7-5-19_pagination_fix.pdf

Varshney, A. K., Garg, A., Pandey, T. R., Singhal, R. K., Singhal, R., & Sharma, H. (2024). The development of manufacturing industry revolutions from 1.0 to 5.0. *Journal of Informatics Education and Research, 4*(1), 1230–1242. https://jier.org/index.php/journal/article/view/710

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a research agenda on interventions. *Decision Sciences, 39*(2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science, 46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

Walkowiak, E. (2021). Neurodiversity of the workforce and digital transformation: The case of inclusion of autistic workers at the workplace. *Technological Forecasting and Social Change, 168.* https://doi.org/10.1016/j.techfore.2021.120739

Washburn, A. (2020). *Safety technology 2020: Mapping technology solutions for reducing serious injuries and fatalities in the workplace.* National Safety Council. https://www.nsc.org/faforms/work-to-zero-safety-technology-2020

Wu, K., Zhao, Y., Zhu, Q., Tan, X., & Zheng, H. (2011). A meta-analysis of the impact of trust on technology acceptance model: Investigation of moderating influence of subject and context type. *International Journal of Information Management, 31*(6), 572–581. https://doi.org/10.1016/j.ijinfomgt.2011.03.004

Zhang, W., Zeng, X., Liang, H., Xue, Y., & Cao, X. (2023). Understanding how organizational culture affects innovation performance: A management context perspective. *Sustainability, 15*(8), 6644. https://doi.org/10.3390/su15086644

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**Appendix A.** Sample Conversation Prompts Based on Technology Responses

| Technology Response Pattern | You May Hear ... | Possible Responses ... |
|---|---|---|
| **Supportive** | • *"Can I try it first?"*<br>• *"This could save us a lot of time."*<br>• *"I have some ideas to make this better."*<br>• *"How do I sign up?"* | • *"We'd value your honest feedback on the technology."*<br>• *"If something doesn't work, let us know."*<br>• *"We were able to correct this issue because of your feedback."*<br>• *"What is something you would improve?"* |
| **Pragmatism** | • *"Just tell me what I need to do."*<br>• *"This doesn't seem worth my time."*<br>• *"I'm going to wait until other people start using it first."*<br>• *"How does this apply to my job?"* | • *"What would make this worth your time?"*<br>• *"What has your experience been like so far?"*<br>• *"Where could this be the most helpful?"*<br>• *"A teammate used this to prevent an incident by …"* |
| **Apprehension** | • *"What if I do something wrong?"*<br>• *"I'm not very good with technology."*<br>• *"Can someone show me again?"*<br>• *Silence; hesitation to speak or ask questions.* | • *"Let's work through it together."*<br>• *"What challenges are you facing in using the technology?"*<br>• *"We've drafted some FAQs and short how-to guides to make it easier."*<br>• *"What can we do to help?"* |
| **Overload** | • *"This is just one more thing I have to do."*<br>• *"I don't have time for another system."*<br>• *"We're being asked to do more with less."*<br>• *"I can't keep up with all these changes."* | • *"We'll provide additional support while you're learning the new process."*<br>• *"What's creating the most friction?"*<br>• *"If this creates more work than it saves, we want to know."*<br>• *"What can we do to make this easier?"* |
| **Skepticism** | • *"We've tried something like this before. What makes this different?"*<br>• *"I've been doing it this way for years."*<br>• *"How do we know we can trust it?"*<br>• *"What data is being collected?"* | • *"Let's show you the back end so you know what information is being collected."*<br>• *"Keep those questions coming. If something isn't working, we'll address it."*<br>• *"What can we show you to make you feel more confident in this?"*<br>• *"We'll show you the evidence we're using to support this decision."* |

**Appendix B.** Applying the T.R.U.S.T. Framework and Technology Response Patterns

| Implementation Phase | Applying the T.R.U.S.T. Framework | Applying the Response Patterns |
|---|---|---|
| **Before Implementation** *(Build understanding and invite participation)* | • Assess organizational readiness across each T.R.U.S.T. domain<br>• Identify potential barriers related to Transparency, Relevance, Usability and Support<br>• Develop communication, training and implementation plans<br>• Define worker-centered measures of success (see Appendix C) | • Use listening sessions, surveys or focus groups to surface concerns before launch<br>• Develop response-specific communication and support plans<br>• Recruit engaged workers to participate in pilots and testing<br>• Leverage any lessons learned from previous pilots to address challenges up front |
| **During Implementation** *(Reinforce positive experiences and respond to concerns)* | • Use the T.R.U.S.T. domains to identify and address emerging implementation challenges<br>• Reinforce transparency through regular communication and engagement opportunities<br>• Address usability issues promptly, and remove implementation barriers where possible<br>• Provide coaching and support as workers gain experience | • Observe worker responses and use them to guide conversations and support<br>• Pair workers exhibiting apprehension with trusted peers or mentors<br>• Focus on high-value use cases and reduce implementation burden where possible<br>• Address concerns through demonstrations, transparency and evidence<br>• Share peer-driven success stories to build credibility and peer learning |
| **Sustained Implementation** *(Reflect, refine and strengthen trust)* | • Periodically reassess each T.R.U.S.T. domain<br>• Evaluate whether workers continue to experience value from the technology<br>• Track both usage and sustained adoption over time<br>• Update training, policies and support as work evolves<br>• Use lessons learned to improve future technology implementations | • Monitor whether workers are changing or altering their responses to technology over time<br>• Use response trends as leading indicators of implementation challenges<br>• Investigate increases in skepticism, apprehension or overload as potential system issues<br>• Adjust communication, training and workload strategies based on emerging needs |

**Appendix C.** Human-Centered Measures of Success

| Area | Description | Example Indicators |
|---|---|---|
| **Integration into Work** | Assess whether the technology has become part of normal work practices. | • Technology is used consistently without reminders or prompts<br>• Technology is incorporated into standard operating procedures<br>• Workers rely on the technology as a normal part of work<br>• Reduced reliance on manual or legacy processes |
| **Worker Experience** | Evaluate whether workers perceive the technology as beneficial and worth using. | • Positive perceptions of the technology's value and ease of use<br>• Reduced frustration, avoidance or workarounds<br>• Increased confidence using the technology independently<br>• Workers recommend continued use of the technology |
| **Safety Outcomes** | Determine whether the technology contributes to improved safety performance. | • Reduced worker exposure to hazards<br>• Fewer incidents, injuries, illnesses or near misses<br>• Earlier hazard identification and reporting<br>• Improved compliance with safety procedures or critical controls<br>• Improved worker health, wellbeing or recovery |
| **Operational Performance** | Assess whether the technology improves how work is performed. | • Improved communication and coordination<br>• Reduced downtime, delays or administrative burden<br>• Faster completion of safety-related tasks<br>• Faster access to information to support decision-making |
| **Sustainment** | Evaluate whether adoption persists over time. | • Consistent use over time without reminders or prompting<br>• Worker feedback is periodically collected and acted upon<br>• Technology remains funded and maintained<br>• New employees are routinely trained in the system<br>• Implementation strategies are refined as work conditions change<br>• Successful shift from pilot/project team to full implementation |

***Note:*** *This table provides examples of key performance indicators organizations can use to evaluate technology implementation success. For best results, these measures should be used alongside technology-specific performance and adoption metrics.*

**Appendix D.** Research Foundations of the T.R.U.S.T. Framework

| Theory | Citation | Key Contributions to the T.R.U.S.T. Framework |
|---|---|---|
| **Technology Acceptance Model (TAM)** | Davis (1989) | • Identified perceived usefulness and ease of use as primary drivers of adoption<br>• Reinforced the importance of *Relevance* and *Usability*<br>• Contributed to the *Pragmatism* and *Overload* response patterns |
| **Technology Acceptance Model 2 (TAM2)** | Venkatesh & Davis (2000) | • Highlighted social influence, result demonstrability and experience as drivers of continued adoption<br>• Reinforced *Relevance, Support* and *Transformation*<br>• Contributed to the *Supportive* response |
| **Technology Acceptance Model 3 (TAM3)** | Venkatesh & Bala (2008) | • Demonstrated how experience, computer anxiety, self-efficacy and ease of use influence adoption<br>• Reinforced *Usability* and *Support*<br>• Contributed to the *Apprehension* and *Pragmatism* response patterns |
| **Unified Theory of Acceptance and Use of Technology (UTAUT)** | Venkatesh et al. (2003) | • Integrated multiple technology acceptance theories into a unified model of adoption<br>• Identified performance expectancy, effort expectancy, social influence, facilitating conditions and individual characteristics as influencing adoption<br>• Reinforced *Relevance, Usability* and *Support*<br>• Contributed to the *Pragmatism, Apprehension, Overload* and *Skepticism* response patterns |
| **Diffusion of Innovations** | Rogers (2003) | • Identified innovation characteristics that influence adoption: advantage, compatibility, complexity, trialability and observability<br>• Reinforced the importance of peer influence and visible success<br>• Contributed to the *Supportive* and *Pragmatism* responses |
| **Cognitive Load Theory** | Sweller (1988) | • Demonstrated that competing demands and limited cognitive capacity reduce the ability to adopt new behaviors<br>• Reinforced the importance of reducing implementation burden and cognitive overload<br>• Contributed to the *Overload* response |
| **Fogg Behavior Model** | Fogg (2020) | • Proposed that behavior occurs when motivation, ability and prompts converge<br>• Reinforced the importance of reducing friction during implementation<br>• Strengthened the *Usability* domain and the *Overload* response |
| **Psychological Safety Theory** | Edmondson (1999) | • Demonstrated that learning and adaptation improve when workers feel safe asking questions and making mistakes<br>• Reinforced *Transparency* and *Support*<br>• Contributed to the *Apprehension* response |
| **ADKAR Model of Change Management** | Hiatt & Creasey (2012) | • Emphasized awareness, desire, knowledge, ability and reinforcement as prerequisites for successful change<br>• Reinforced *Transparency, Relevance, Usability* and *Support*<br>• Contributed to the *Pragmatism* and *Apprehension* responses |
| **Kotter's Change Model** | Kotter (1995) | • Emphasized leadership commitment, communication, urgency, short-term wins and reinforcement during organizational change<br>• Reinforced *Transparency, Support* and *Transformation* |

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