

WORK HEALTH & SAFETY:

HOW INTELLIGENT VOICE-ASSISTANTS ADDRESS UNDER-REPORTING IN HEAVY INDUSTRIES



Ask Harry

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Introduction

The development of intelligent voice-controlled digital assistants has revolutionised how organisations can interact with and manage data. As natural language processing (NLP) technology matures, these tools become increasingly valuable for organisations in heavily regulated industrial settings such as mining and other heavy industries where efficiently capturing critical safety data is vital.

A correctly implemented digital assistant can automate tedious and time-consuming manual entry tasks, quickly collect data from multiple sources, generate accurate compliance reports and provide proactive alerts on potential compliance issues. The impressive technology can reduce human error in identifying and managing safety risks, deliver customised solutions to personnel needs, support hands-free access to safety information in hazardous environments and allow prompt incident reporting with significant accuracy and reliability.

Despite the benefits, certain risks will require mitigation measures to counter corporate security violations through cyber-attacks or a failure of accuracy or reliability by incorrectly interpreting spoken commands. This paper aims to provide research into how deploying digitally enabled Workplace Health and Safety (WHS) frameworks that incorporate AI-powered intelligent voice assistants can improve compliance while minimising liabilities for multinational corporations situated across the globe.

The problem of under-reporting WHS incidents in heavy industry

Reporting failures have significant implications for the ongoing welfare of employees and their communities and have costly consequences for businesses and stakeholders. Despite the critical importance of effective safety management, research has shown that various WHS risks get overlooked.^{1,2,3} Further research indicated a range of motivations for a worker's failure to adhere to WHS reporting policies and procedures. While there are multiple drivers, there appear to be three common threads:

- **fear of repercussions**
- **inefficient or unclear reporting processes**
- **indifference to the importance**^{4,5}

Organisations that fail to manage their critical risk activities effectively, or thoroughly investigate incidents, leave themselves vulnerable to the following outcomes:

- **Risk of injury or illness:** Underreporting can lead to a false sense of security and increase the potential for harm within the workplace
- **Barriers to improving productivity:** It is incredibly challenging to learn from prior mistakes and apply those learnings towards productivity improvements or waste reduction measures without WHS reporting diligence.
- **Hampered business intelligence:** Without effective recording procedures and data analysis, companies will fail to comprehend employee risk exposure throughout the production lifecycle. Additionally, learning and adapting to adverse events is almost impossible without access to performance analytics over time.
- **Financial losses:** If work-related incidents are directly or indirectly attributable to the failure to report or implement risk controls, a company and potentially even personnel will be held liable.
- **Corporate reputation risk:** News of WHS underreporting could attract negative attention, leading to reputational damage, which can hinder their ability to attract skilled talent or investors and potentially damage existing partner relationships. The negative publicity can also severely reduce customer trust, blocking opportunities to access new markets. Ultimately, this adversely affects long-term goals such as bottom-line performance and sustainable growth strategies.



As can be seen, failure to fulfill WHS reporting obligations can significantly increase risk. Yet, it would be folly to assume that reporting alone will stop all incidents from occurring. Unfortunately, near-misses, incidents and adverse events will happen. However, if organisations are to learn, improve and mitigate, all relevant personnel and their managers must undertake regular and reliable reporting and share the knowledge effectively.^{6,7,8,9}

To combat some of the challenges mentioned earlier and improve overall business outcomes, organisations have begun to use AI-based technologies such as voice-controlled digital assistants powered by natural language processing (NLP). The technology is highly applicable across multiple industries for documentation, reporting, workflows, collaboration and improved productivity.^{10,11,12} It can also be customised¹³ for industrial incident identification and reporting within an organisation's WHS framework.



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The potential of digital assistants to improve reporting and compliance

Al-powered digital assistants can revolutionise reporting and compliance in heavy industrial settings by automating tedious and time-consuming manual tasks, providing real-time data on critical operations, and delivering accurate compliance reports.

Able to understand complex human interactions in multiple languages via microphone-enabled devices like a phone or walkie-talkie (Krupansky 2017),¹⁴ the technology enables personnel to report and submit hazards quickly. For example, a line worker in a manufacturing plant can report a hazardous spill via a digital assistant directly into the company safety database. The worker would communicate the details of the incident and any associated risk factors for prompt recording into the system.

Due to its simplicity and practicality as a human-to-information technology interface, researchers and businesses have indicated that integrating the tech within a semi-automated safety documentation process will deliver significant value.^{15,16}



The technology enables personnel to report and submit hazards quickly.



Digital assistants can quickly collect data from the field, significantly reducing the time typically spent via manual data entry methods¹⁷ and delivering more accurate data than traditional methods.¹⁶ By providing real-time data and automated reports, the assistants can help managers ensure that operations comply with regulations and laws and provide proactive alerts on potential compliance issues.¹²

By leveraging machine learning algorithms, digital assistants can identify patterns in the data that may indicate non-compliance and provide detailed reports on any areas of concern. In addition to automating the reporting process, digital assistants can gather data from multiple sources via the internet and internal databases. It can assist in documenting standard safe-work operating procedures, note key performance indicators from audit reports, and much more. Further, the technology can allow employees in industrial settings to have hands-free access to real-time safety data or emergency instructions based on inputted criteria such as weather conditions and material handling data sheets. Overall, the artificially intelligent nature of these tools enables workers in industrial settings to quickly report safety incidents or issues during hazardous tasks with significant accuracy and reliability^{18,19,20,21}



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Intelligent voice-assistant: Use cases

It is important to note that one of the most valuable features of these digital assistants is their customisability. Depending on the provision of thoughtful framework design, the use cases are limited only by imagination.

When customised for industrial mining and other heavy industries, these businesses will streamline the collection of safety data out in the field and gather the necessary material for a full risk assessment.^{20,21} Furthermore, AI-powered digital assistants show significant potential for reducing human error in identifying and managing safety risks.²² Moreover, these systems may reduce the typical errors made when manually filing forms or other data-capturing instruments due to their ability to quickly detect data entry mistakes while providing accurate output.²³

Additionally, the accessibility of voice command capabilities makes the process easier and faster for workers to report an incident so that inspections and interviews by qualified personnel are practical and efficient.

Because these digital assistants can learn and adapt to individuals' needs and provide customised solutions,¹³ by implementing them into worksites can provide teams with efficient incident reporting systems with minimal effort, training and cost. The industrial WHS applications are numerous. Here are a few more examples:

Example use cases

Recording incident reports promptly:

When incidents occur, workers can verbalise what happened instantly instead of filling out forms afterwards or manually entering the details into a database. After recording all pertinent facts from eyewitnesses, the assistant automatically submits the corresponding paperwork to a centralised database. This approach significantly reduces response times compared to manual methods and ensures information accuracy by avoiding potential transcription errors.

Creating a database of workplace hazards

Digital assistants could easily create comprehensive databases of potentially hazardous conditions in an industrial environment. By querying workers about any dangers they have encountered as part of the daily reporting process and flagging a string of potentially related hazards, the assistant would preemptively alert relevant personnel for remedial action.

**Generating customised,
role or job-based data
capturing instruments:**

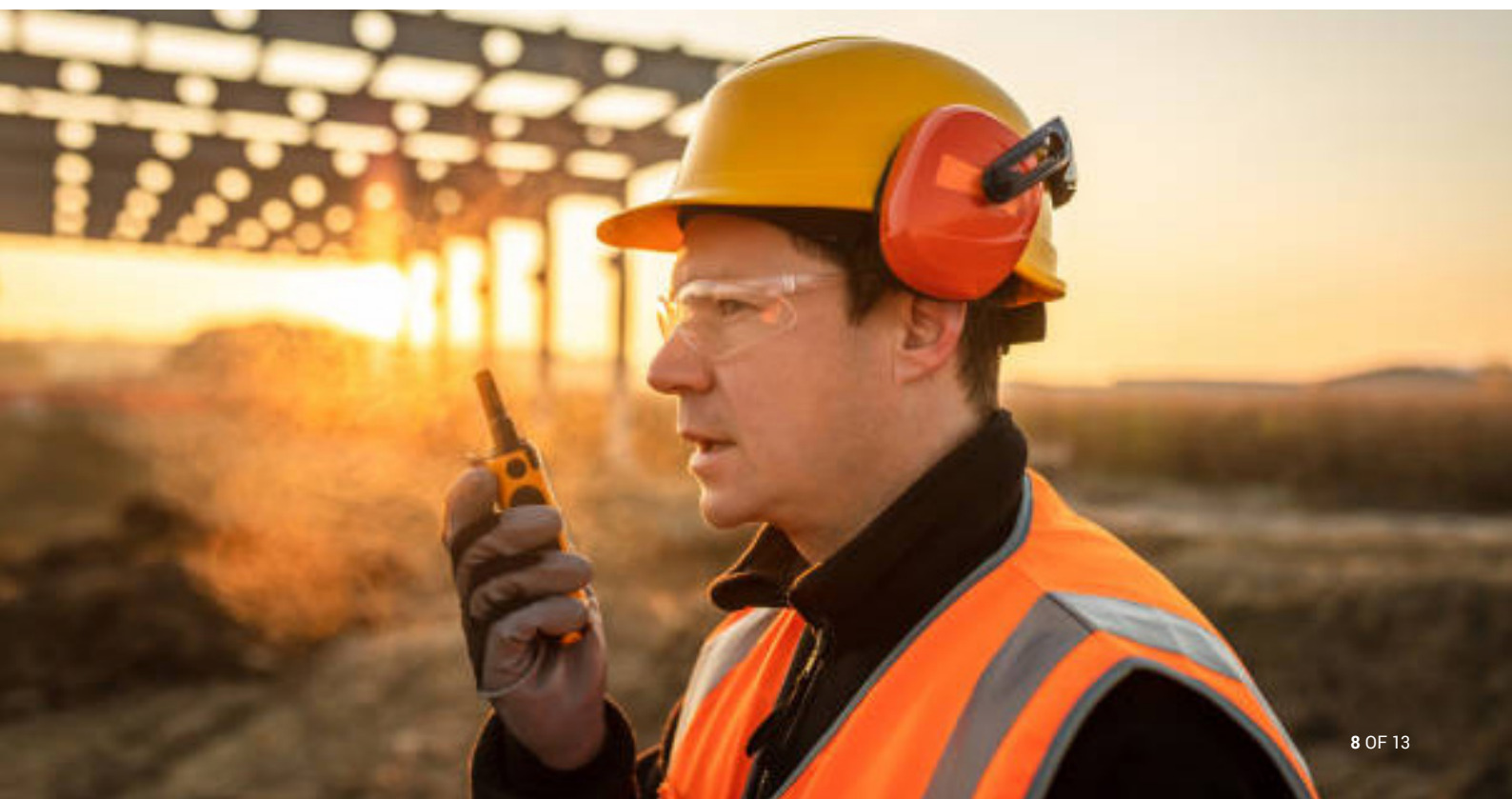
The areas for awareness and the reporting needs are different for those working at heights versus lone workers in an enclosed space. As such, a digital assistant could aid companies and employees by generating task-specific safety forms and procedures. This approach could benefit personnel with multiple roles, tasks, and responsibilities over their shift. Additionally, new personnel or unfamiliar contractors will have ready access to specific safety protocols and methods unique to the site and company.

**Proactive reporting
reminders and
condition alerts:**

Via a predetermined schedule or geo-location, personnel can be notified or reminded by the digital assistant to undertake a risk assessment, equipment pre-start or any other WHS reporting mechanism relevant to the task or location. Additionally, the assistant could alert the employee to be aware of recent site works, equipment repairs or conditions that may be potentially hazardous.

**Rapidly access
critical safety data:**

Workers waste a significant (as in multiple hours per day) of time searching for or accessing information (Cottrill Research 2013).²⁴ While the context of this paper is specific to safety documentation and only a portion of such waste would be relevant to this topic, by its very nature, a digital assistant is integrated into an operations data matrix, i.e. a centralised database. Implementing a digital assistant will significantly reduce the waste of resources by personnel and management accessing relevant data.



Challenges and risks

While AI-powered voice-controlled digital assistants may offer exciting opportunities for modernising the WHS reporting process, risks and challenges exist.

Risks

One of the unfortunate realities of the modern age and digitisation is the pervasive risk and significant consequences²⁵ of personal privacy and corporate security violations. As a digital assistant needs to record and store conversations to decipher commands and produce responses, sensitive business and personal information could be leaked through a cyber security breach.^{26,27}

In addition to privacy issues, accuracy and reliability is another significant risk associated with using an intelligent assistant. In the case of failure to correctly interpret spoken commands, deliver an accurate response, or trigger a specific sequence within an automation chain can lead to a severe problem and subsequent liabilities for companies that rely on the digital assistant without implementing regular, randomised quality checks.



Each country or region will have regulations on how user information is collected and used, which pose additional liability issues and compliance considerations.

Challenges

Designing intelligent dialogue models capable of interpreting complex and industry-specific terminology will require significant development and comprehensive testing before adoption. Project timelines can become delayed if not managed effectively from the beginning.

Furthermore, developing models explicitly designed around the nuances of human communication, team structures and cultural norms, rather than just knowledge-based facts, can prove challenging. Those challenges will compound when accurately capturing details relating to a typical company's multiple and complex safety documents in heavy industry.

Additionally, each company will have nuances to address to meet regulatory compliance. A company's geographical location will also fall under its specific compliance environment. This will prove to be especially challenging in the case of a multinational corporation, as a cookie-cutter approach will be insufficient. Finally, each country or region will have regulations on how user information is collected and used, which pose additional liability issues and compliance considerations, i.e. GDPR, etc.

While substantial benefits exist, particularly when considering automation and improved efficiencies available, a range of risks and technical challenges require addressing. Digital assistant integrations must be well-designed and stress-tested before deployment to ensure usability, value and compliance. Additionally, as with any workflow or automation, frequent reviews will need to take place to ensure effectiveness.

Conclusion

After implementing an AI-powered digital assistant into an industrial WHS system effectively, the tedious manual systems for capturing critical safety data are simplified. Moreover, the assistant will collect data from multiple sources accurately and quickly and generate compliance reports with greater reliability than traditional methods. Workers can replace legacy processes of lengthy forms and logbooks with voice-activated commands. Therefore, one of the significant barriers to reporting complicated or ineffective processes, can be addressed if not made redundant.

Managing the indifference of employees towards reporting occurrences and their fear of backlash is a cultural issue that has yet to be addressed by a voice assistant. However, attributing the blame can be avoided and positive reinforcement for submitting reports can be designed into the language model. Additionally, providing essential worker training and improving processes through practice analysis may improve outcomes.

Despite risks and challenges associated with digital assistants, using such a tool in heavy industries may bring significant value in terms of incident reports assisting organisations' ability to learn and improve operations and increase bottom-line performance.



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For more information
visit **askharry.it**

Australia (02) 7208 5391
USA +1 (252) 838-5250
Email harry@contactharald.com