A Toolbox to help frontline personnel learn from incidents

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Energy Institute worked with seven major energy companies to produce a progressive web app (PWA) to deliver learning from incidents (LFI) information to frontline personnel, including contractors. The purpose was to reduce the number of fatal or serious incidents. Key challenges to overcome included how to make the tool widely available, and provide relevant information to personnel at a time when they needed it. The tool was developed in early 2019 and approximately 60 pieces of content sourced from industry and shared on the tool. The tool was then piloted within the seven companies, being used in 46 countries and by over 1800 personnel. Feedback was collected using a variety of methods, including site usage data, an online survey, and written feedback. Feedback was extremely positive, strongly suggesting that the tool will help reduce incidents, and will help provide information to frontline personnel when they need it. The content shared on the tool was highly praised, and users requested the tool to hold more content and in multiple languages. This paper discusses the origins of the project, the design of the tool, how it was piloted, analysis of the pilot results, and improvements that can be made to the tool.

1 Introduction

In 2018, the Energy Institute (EI) began working with seven major energy companies to develop an online tool ('Toolbox') to assist frontline personnel to learn from previous incidents. To set the context for this paper, Toolbox is a progressive web app (PWA) – which in basic terms is a website that delivers app-like functionality. It was developed between September 2018 and April 2019 and piloted globally May-July 2019. Toolbox hosts learning from incidents (LFI) information, in the form of videos and text-based information, for delivery to frontline personnel, including supervisors. It aims to improve LFI and reduce fatalities, major injuries and process safety incidents by providing information that frontline personnel can use to improve the way they carry out high risk tasks.

This paper describes the background to the project, its development, how Toolbox is intended to be used, the results of the pilot study, and next steps.

1.1 Background

"A number of industry commentators have noted that the energy and allied industries still need to improve in learning lessons from incidents. This view is prompted by the reoccurrence of similar events and by evidence of the difficulty of achieving long-term changes in behaviour and working processes following incidents. (EI, *Learning from incidents, accidents and events*, 2016). Energy companies typically have various processes in place to share learning internally, varying from folders containing hard copy incident alerts, incident alerts held electronically in an online database or emailed to the workforce, and even videos and other resources specifically developed to learn from incidents considered to be highly relevant.

Several companies have individually attempted to create 'apps' (applications used on mobile devices) to share such information, with mixed success. The seven companies involved in this project believed that the creation of a single app to share LFI information would be a powerful tool for improving LFI, but previous attempts had encountered several challenges:

1. **Access:**
   Access to internally produced web apps or systems were typically limited to company staff, or to predefined contractors. Where access could be granted externally, this required the use of a log in (to restrict access to certain personnel or companies), which created a blocker to use of the app.
2. **Amount of content:**
   Content was typically drawn only from one organisation or publicly available materials. Lessons learned ~~from other organisations~~ were not being shared between organisations or, therefore not learned from by others. This created a limited amount of high quality content that could be included on a company-specific app. However, industry recognised that, if they could pool content, then this would add up to a significant amount of content.
3. **Quality of content:**
   There was a limited amount of high quality content focused on high risk/high consequence activities. There were lots of incident investigation reports, but only a limited number of these were turned into high quality content ('lessons learned', videos etc.) that could be shared with frontline workers. Feedback from workforce was that a lot of the text-based content available was too lengthy or did not contain the right information to help them learn. There was a desire for content that is more 'emotionally engaging'.
4. **Relevancy and timeliness:**
   Industry felt that providing learning to frontline workforce at a time when it is not relevant, e.g. well in advance of the workforce undertaking a similar job, is counterproductive, either because the workforce will not see the relevancy, or that any lessons might be forgotten. A key challenge was therefore how to enable users to find content that is relevant to them, and close to the point of work (i.e. timely)? Can content be 'pushed' to users when they need it?
5. **How to share lessons learned between organisations:**
   Although incident alerts may be shared via trade organisations (e.g. Step Change in Safety, IOGP, IADC etc.), the information included is not always optimal for learning. Organisations often develop more refined information, such as videos, for internal usage, but this material is seldom shared more widely. Given that many organisations use the same contractor companies, the seven companies involved believed that there would be much benefit in being able

to share and pool learning materials. Overcoming legal objections to the sharing of material would be a key challenge.

6. **How to share learning with frontline workers:**
Finding a mechanism to deliver information to frontline workforce, compatible with various devices (PC, Android, iOS etc.), without putting in place unnecessary blockers that might discourage usage, is challenging. Devices used within the seven companies varied widely. Any solution would also need to take into account the operating limitations of sites, such as lack of internet on site, and usage of mobile devices only in certain safe locations.

EI funded research (Murphy et al (2019)) established a LFI lifecycle model (fig.1) describing how organisations typically learn from incidents. Briefly, this model describes how, following an incident or near miss, that incident is typically reported, investigated, often communicated to the workforce in the form of an 'incident alert' (e.g. 1-2 page document), the workforce engage with that learning ('reflecting'), and actions are taken as a consequence. Drawing upon this research, EI identified several further challenges:

7. **Content:**
Incident alerts are often poorly produced, including too much detail, not enough, or not relevant for the audience, often because these were produced from incident investigation reports by 'back office' staff with little to no engagement from those affected by or involved in the incident. Any solution would need to carefully consider what LFI information should be included.

8. **Mode of communication and relevancy:**
Incident alerts are often poorly communicated. Typically, these are emailed out to staff or pinned on noticeboards. They were not targeted to relevant staff, there were too many of them to read, and so were seldom read. Any solution would need to make it easy for users to locate relevant information, or even find a way to push relevant information to users.

9. **Reflecting:**
The researchers found that many organisations miss out the reflecting phase. The act of 'communicating' incident alerts was often seen as the final stage of the LFI lifecycle, with no follow up. Also called 'sense making', reflecting is considered a vital part of how adults learn. In this context, following the communication of an incident alert, this phase is about providing the time, space and opportunity to allow the recipients (i.e. the front line workforce) to engage with that incident, understand why it happened, how it is relevant to them and their work, and decide what they are going to do about it – i.e. make changes to how they work to prevent this happening to them.

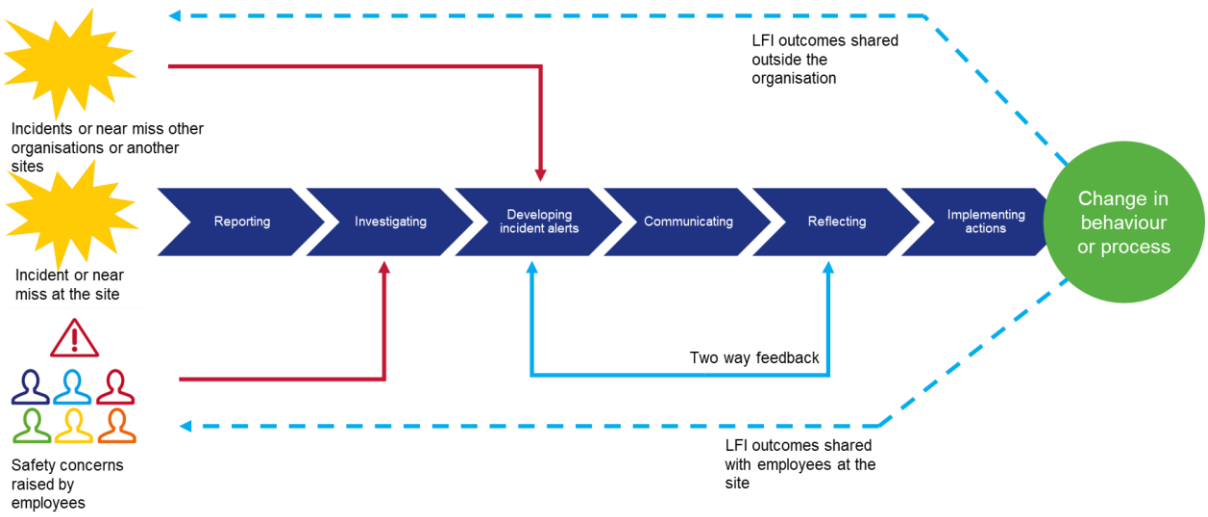

Fig.1 Learning from incidents lifecycle model (from Energy Institute, Hearts and Minds: Learning from incidents)

2 Project outline

2.1 Project vision

With these challenges in mind, the vision for the project was defined:

- To create a web-based application that could be accessed from a mobile device or desktop PC to house lessons learned from incidents.
- The target audience for the tool would be 'toolholders' and first line supervisors – i.e. frontline workforce, including contractors. HSE professionals and others would also find the tool highly useful but would not be the primary focus.

- The tool would hold content shared by all seven project members, meaning they would need to overcome legal objections to sharing this content.
- Content would need to be 'just in time', 'just enough' and 'just for me':
    - Just in time: Content would be used by workers at a point in time close to the carrying out of the work. This varied company by company to mean just before undertaking a task, that day, or that week.
    - Just enough: content would provide the right level of information to ensure it is useful and will enable the workforce to apply learning to their own work, but not too much detail that it becomes impractical.
    - Just for me: content needs to target the user, and relevant to the task they are undertaking.
- There was a strong desire to make content interesting and engaging – e.g. to create an emotional connection to the user.
- Lastly, the focus of the tool would be on reducing fatalities and serious injuries. It would therefore focus on high risk/high potential tasks/incidents and process safety, and not on personal safety (slips, trips, etc.).

2.2 Toolbox design

The Toolbox platform was developed between January – April 2019. A number of design choices were made to maximise the chance of success.

Platform:

The platform was built as a PWA. In basic terms, a PWA is a software application delivered through the web. It works on any platform that uses a standards-compliant web browser, such as Google Chrome, Microsoft Edge and Apple Safari, meaning that it works on a wide variety of mobile and desktop devices. PWAs are essentially websites that provide native app-like functionality, such as working offline, push notifications and device hardware access. This means the tool does not need to be downloaded via an app store. The key features of the Toolbox platform include:

- A robust search engine called 'Funnelback'.
- Push notifications – the ability to send notifications directly to a user's device, e.g. when new content is uploaded.
- Offline functionality – the ability to save content for viewing offline, including both text-based content and videos.
- Share – the ability to share content with colleagues, via email, WhatsApp, text message and social media.

Profile – the ability to store a user profile on the user's device, e.g. to save content to and to select categories of content to receive push notifications. As the user profile is created using cookie data, the saved content is device-specific.The downside to this approach is that older web browsers that are still in common use, e.g. Microsoft Internet Explorer, are not fully compatible with the more 'app-like' functionality, such as working offline and push notifications. Incompatible features were therefore hidden on browsers that do not support them.

Open access:

To minimise barriers to use, and given the requirements to share learning with contractors and not just company staff, it was decided to make Toolbox open access. This means that users would be able to access all content on Toolbox without restriction, without the need to log in, simply by visiting the website. This also means the tool would be free to access. The downside to this would be that it would be impossible to determine specific users of Toolbox (including companies), and this might limit the ability to implement more advanced features in future, such as social networking.

Content categorisation:

Given the focus of Toolbox is on high risk activities and preventing fatalities, and the need to allow users to quickly find content relevant to their current task, content was categorised in two ways:

- Work activities, equating to the industry sub-sector, such as aviation, pipelines, construction, marine, etc. Also included lifting and hoisting and decommissioning and demolition.
- High risk situations, drawing upon the most commonly used lifesaving rules used in industry, and with the exception of the addition of 'excavating' are aligned to the International Association of Oil and Gas Producers (IOGP) Life Saving Rules (IOGP report 459).

Content is then sub-categorised further into more specific work activities, such as chemical handling, cutting and grinding, electrical work, gas purging, etc. There are 24 categories and 54 sub-categories in total.

The categories have all been drawn from those used by one or more of the seven companies involved. Content can be assigned to any number of categories.

Content type and design:

Toolbox can hold various content types, including videos (MP4), PDFs and 'lessons learned' that display natively in the app. At the time of writing Toolbox holds approximately 130 pieces of content, including 100 lessons learned and 30 videos.

All content has originated from the seven companies. It is envisioned that, in future, content will be drawn from wider industry.

Content is intended to be high quality, and is vetted before publication to ensure it meets the objectives of the project, namely a focus on frontline operations, and prevention of fatalities or serious incidents.

All content is edited before publication to ensure it is:

- Anonymous – which is a key means of overcoming any legal objections to its publication.
- Of the right length and format – for videos the ideal length is 1-3 minutes but longer videos are acceptable; for text-based content, this is typically 350 words.
- Clear and easy to understand (avoiding abbreviations or company-specific terminology).

An agreed standard template was adopted for all 'lessons learned'. This was done for pragmatic purposes as it was realised early on in the project that each company had a different template for its incident alerts, and this even differed within companies, and to ensure consistency of delivery of information. This template consists of four sections (Table 1). Video content tends to vary much more, largely because there is not the option to re-create videos. Video content typically covers a specific incident, a task (and the various hazards of that task), or behaviours.

Reflective learning questions have been added to all content, typically 3-6 open questions (i.e. they cannot be answered yes or no) to encourage the user to consider how the incident might affect the task they are doing, and what they could change to avoid a similar incident happening to them. We have found that very little content submitted by industry to this project included reflective learning questions, so it will be interesting to see how their inclusion affects the way the user engages with the content.

Table 1: 'Lessons learned' template

What happened? • Short description of the incident. • Typically 4-6 succinct bullet points, ~100 words. • Be clear on the outcomes/potential outcomes.	**Why did it happen?** • Immediate and underlying causes. • Often a mixture of technical and human factors issues. • 4-6 succinct bullet points, ~100 words.
What did they learn? • The recommendations/lessons to help prevent similar incidents happening • Does not need to contain a complete 'how to' or good practice guidance on how to undertake this task safely. • 4-6 bullet points, ~100 words.	**Ask yourself or your crew:** 4-5 'reflective' questions (usually open questions) to help users engage with the content, e.g. • How can something like this happen here? • What would we do in this situation? • How can we improve the way we do this task?

2.3 Intended usage

We recognise that the primary user of Toolbox is likely to be a supervisor, delivering an LFI to their team as part of a Toolbox talk or morning meeting, etc. Toolbox may also be used by an individual before beginning a hazardous task. In both cases, Toolbox could also be used to assist in creating a permit-to-work or undertake a risk assessment, by looking for previous incidents that have happened when undertaking a similar job.

A typical user journey begins by visiting the Toolbox website using a PC or mobile device, with the intent of finding content related to a job their team are due to undertake that day/week. From the homepage, they can search using a keyword – the search engine will look for related words in the content itself, or predefined tags. Alternatively, the user can select one of the categories described in 2.2. Doing either will display a list of search results, which can be filtered using a menu of keywords, by 'most views', 'most likes' or content type (video or text). Each piece of content includes a brief description of the incident, helping the user to find something of relevance.

Once the user has found content, they can save the content to a 'collection' (e.g. 'Monday morning meeting'). Toolbox uses cookies on the user's device to save content and build a user profile. They can also select to view content offline if they will not have access to the internet when they show the content to their team. They can also print content.

Later, when they hold a meeting with their team, they can quickly locate the content in their personal profile ('My Toolbox') and read the content to their team or show the video, e.g. on a tablet device. The reflective learning questions help the user to engage their team. The intent is that, based on the discussion, the team has a heightened awareness of the hazards of today's job, and may even adjust the plan accordingly.

The user can 'like' or 'dislike' content – which will affect its search ranking for other users. They can also click 'share' to share content.

The user can also hold a profile on their device, selecting the categories of content they are interested in. Toolbox will then send push notifications to their device when new content in that category is published.

3 Pilot study

3.1 Methodology

Between May and July 2019, Toolbox was piloted globally. At the time of pilot, Toolbox was a fully functional, publicly accessible website, holding approximately 60 pieces of content, including 10 videos and 50 lessons learned.

Locations

Toolbox was piloted within the seven organisations, at various locations, including upstream and downstream business units, and shipping. Ultimately it was tested in 46 countries across 36 business units or company sites, with the majority of usage in USA, UK, France, The Netherlands, Nigeria, and several other countries.

Hypotheses

Four main hypotheses were tested during the pilot:

1. Toolbox enables toolholders to get relevant incident learnings at the right time and right format
2. Toolbox enables toolholders to engage and discuss on key incident learnings
3. Toolbox enables toolholders to better understand hazards, risks and potential controls
4. Toolbox enables toolholders to work safer

The primary purpose of the pilot was to test the usability and acceptability of Toolbox with industry workforce, including frontline workforce. It was to gather feedback that would help improve Toolbox before final release, and to test whether workforce believe Toolbox will be useful and have a positive effect on safety, and whether it is easy to use. The pilot did not test the actual effect it had on safety – this would have been unrealistic in the timescales of the pilot, and given this was an uncontrolled pilot. Toolbox was not rolled out by any of the seven companies during the pilot, although the method of piloting did vary company to company.

Piloting methods

Toolbox was piloted in different ways in different companies. One company focused on several sites in the UK and Nigeria, asking it to be used in meetings and creation of permits to work. Other companies communicated more widely, but with little instruction or expectations set on how it should be used. One company held several focus group sessions, another held group demonstrations in meetings. All companies used a mixture of approaches.

Data collected

Data consisted of Google Analytics (number of users, location of users etc.), qualitative feedback collected by projects leads within the seven companies, 110 responses to an online user survey, and 6 user interviews held with prospective users – these were primarily to test how easily users they were able to complete specific tasks on Toolbox (such as find a certain piece of content), testing the functionality and usability of Toolbox.

3.2 Pilot results

Number and location of users

1,880 users used Toolbox 3,605 times over the course of 2 months. 30% of those users returned more than once. Users were located in 46 countries, with 60% of usage in UK and USA, with significant usage in Northern Europe, Nigeria, moderate usage in Australia, Russia, Middle East and Kazakhstan, and minor usage elsewhere (see fig. 2). On average, users spent 5 minutes exploring Toolbox. 50% of users used a desktop PC, 35% a mobile phone, and 15% a tablet.

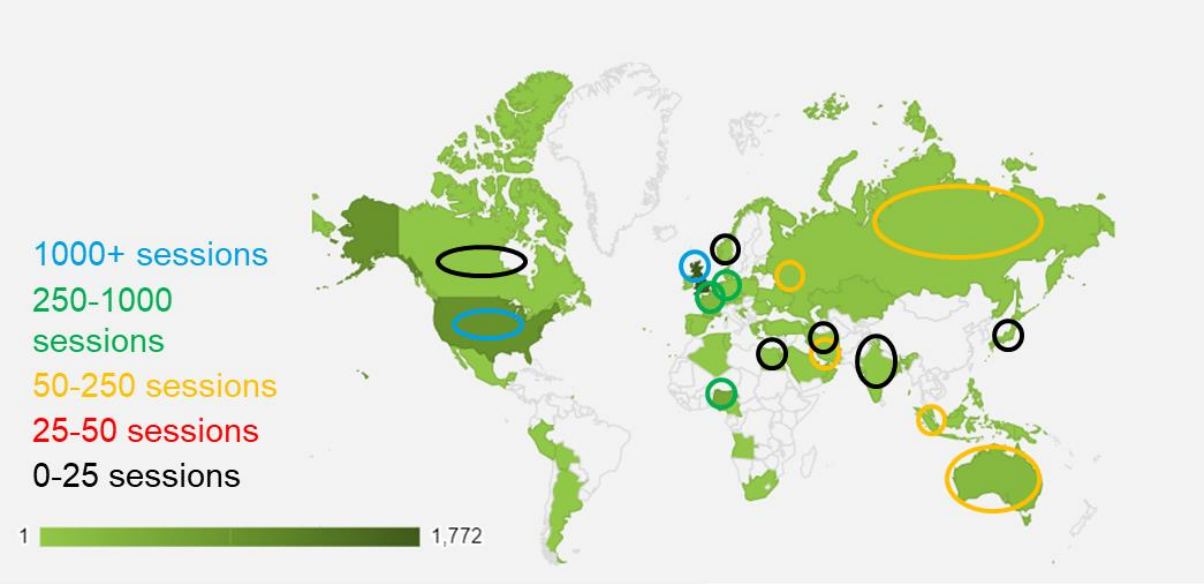

Fig. 2: Where Toolbox was used during the pilot

How was Toolbox used?

75% of surveyed users said they were 'testing' Toolbox, accounting for 50% of all usage during the pilot. Of the remaining 50% of usage, 50% was during a meeting (safety briefing, toolbox talk), 25% during a risk assessment, post-job review or creation of a permit to work, and 25% for individual or team learning before undertaking a task.

Fig. 3: How Toolbox was used during the pilot

How useful was Toolbox?

Nearly 90% of surveyed users believed that Toolbox will be useful or very useful during safety meetings and toolbox talks. Nearly 80% believed it to be useful for team and individual learning before a task. A lower percentage (55%) believed Toolbox to be useful or very useful for risk assessments and permits to work, with less than 40% believing it to be useful or very useful for post-job review.

Nearly 90% of surveyed users agreed or strongly agreed that Toolbox will improve how they work. 95% of users agreed or strongly that Toolbox will help users get safety information at the right time, and agreed or strongly agreed that Toolbox will help prevent incidents.

70% of users felt that they have existing opportunities within their job to make use of Toolbox, with 30% of users disagreeing. 60% of users felt that Toolbox needs to be linked to the company permit-to-work system, or other company systems, to encourage usage.

When asked how likely they were to recommend Toolbox to a colleague, frontline personnel gave Toolbox a score of 71 out of 100 (on a visual sliding scale).

Qualitative feedback included:

- "Wow, what an amazing tool.. really excited about using it and even looking to upload some material."
- "I will use the Toolbox Platform to assist with the delivery of messaging and sharing of industry events to actively contribute to a safer workplace and industry."
- "[Useful for] Kick off meetings with frontline workers"
- "Great concept and by all appearances, a genuine "One Stop" safety shop contender that can be accessed by anyone who needs resource material."
- "Good start. I fully endorse Companies continuing with this valuable sharing tool."
- "I will use the Toolbox Platform to assist with the delivery of messaging and sharing of industry events to actively contribute to a safer workplace and industry."
- "Easy to locate on the web, good mix of videos and one page summaries of incidents."
- "Great tool, like the simplicity of how information is found with multiple pathways. Only concern would be that this does not replace the traditional toolbox interaction in the field. This Toolbox app should be an additional part of the toolbox meetings in the field. Great way to collect lessons learned information from other companies outside [my company]."
- "Advantages: (1)The app is excellent, (2) It make toolbox meeting live with the LFI, (3) The learning are simple to understand, (4) It's so handy anywhere anytime as long as there's internet, (5) The LFI video related to the job you are working picture the reality of the job you are doing."
- "I have already recommended the application to a colleague and already used in training sessions."

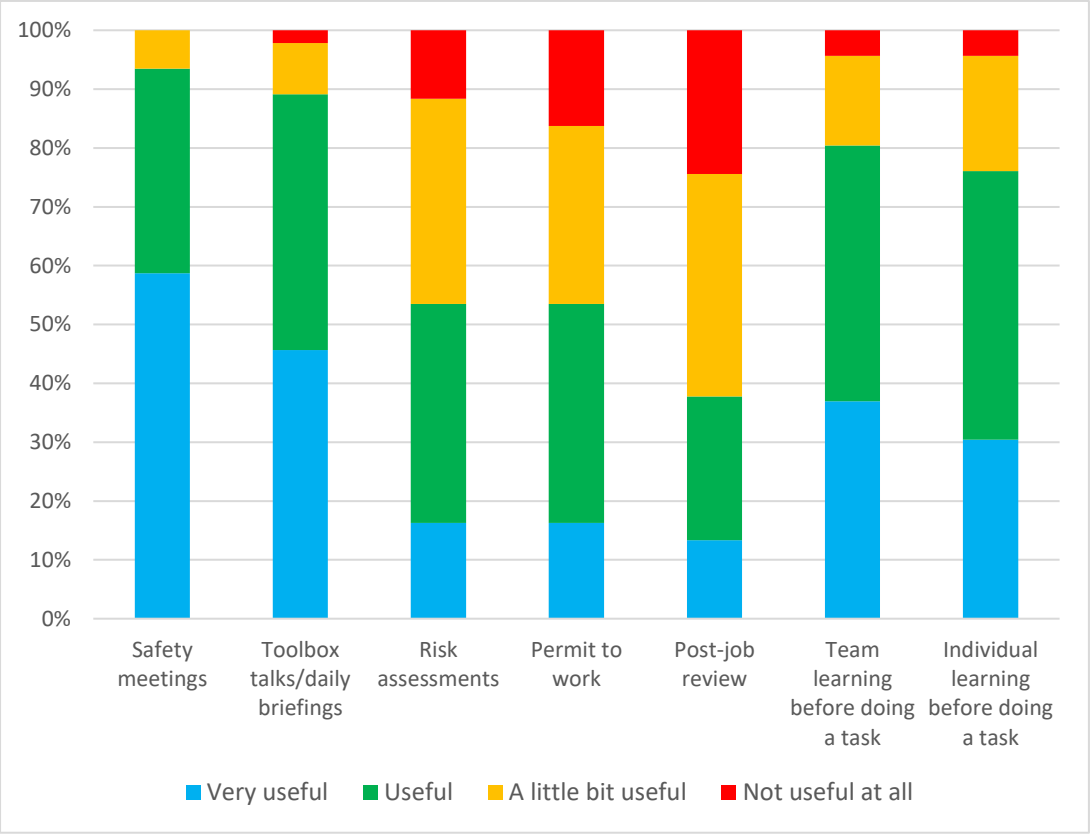

Fig. 4: The activities for which Toolbox will be useful for.

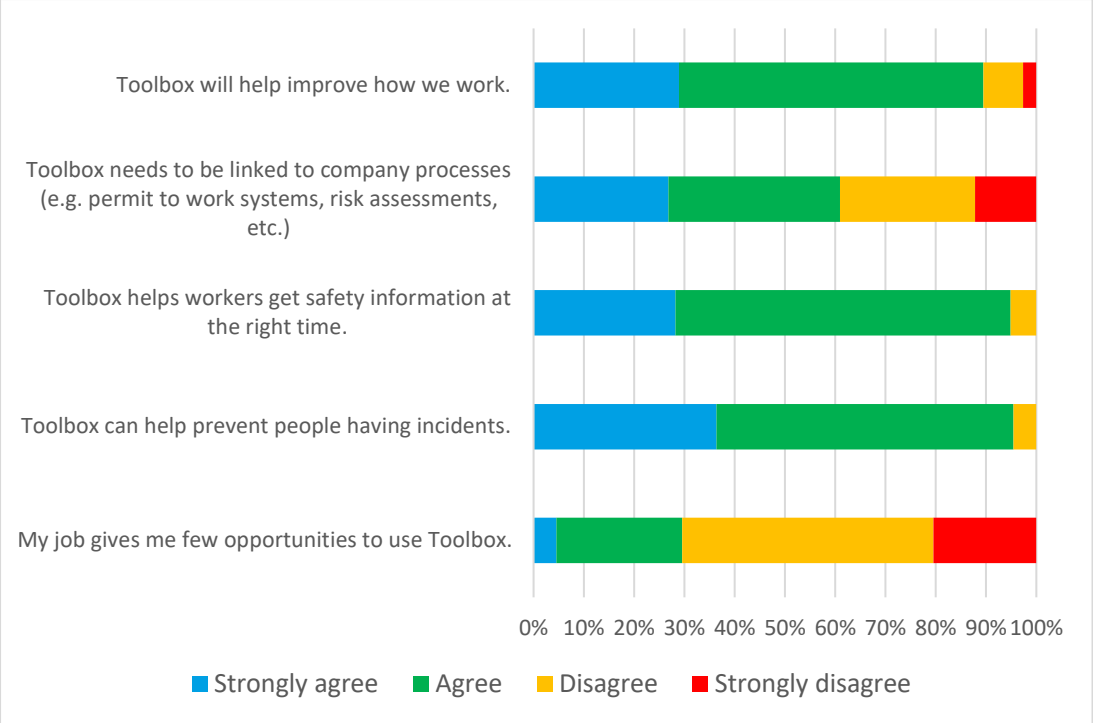

Fig. 5: Responses to various survey questions on the effect that Toolbox will have.

Content

80%-90% of surveyed users agreed or strongly agreed that the content on Toolbox is clear and easy to understand, engaging and interesting, relevant to them or their team, practical with lessons that could be implemented, and useful to them or their team (although this last question was lower scoring than others, likely because of the nature of the pilot and small number of pieces of content). The key requests for how to improve Toolbox were content related: users overwhelmingly requested that Toolbox needs to include a lot more content, and in multiple languages.

Qualitative feedback included:

- “Content showing real consequences of actions”
- “I like the format of "What Happened", "Why Did it Happen", "What Did They Learn" and "Ask yourself or your crew" format.”
- “[I like] quality of the material (in particular the short video clips)”
- “A lot of information all available in one location.”
- “The content of the toolbox help my workforce to be more careful when ascending and descending from a scaffold ladder and also maintain a three points contact why using the ladder. The toolbox is very brief with an effective explainable. We normally use it during the toolbox meeting.”
- “More content [needed] over time.”
- “Multilingual [content needed] due to international environment. Would make it easier to use in various regions.”

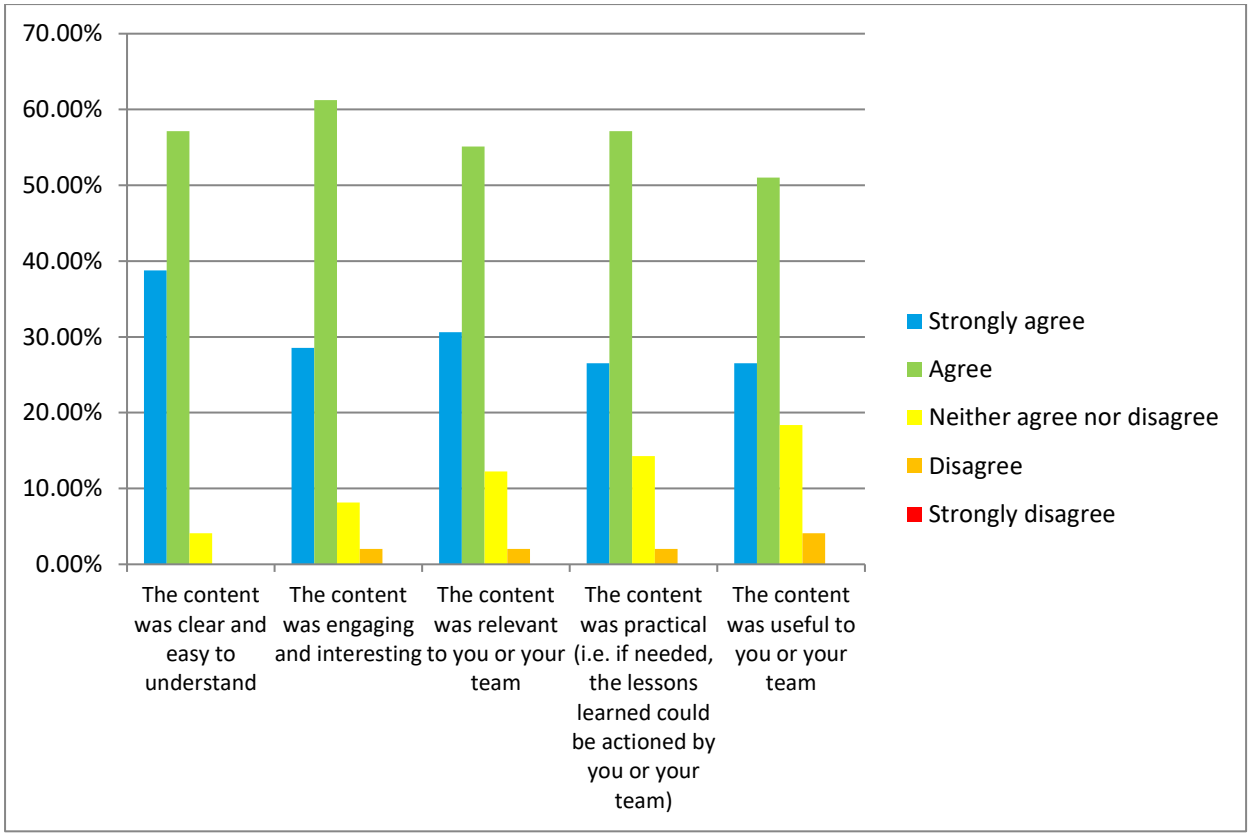

Fig. 6: How useful the content on Toolbox was found to be

Usability

Usability (simple user interface, quick and easy to use) was by far the feature the majority of users liked most about Toolbox. 90% of users reported that they found what they were looking for on Toolbox. Qualitative feedback included:

- "Easy search feature. Listing of incidents by type was helpful. Easy to navigate."
- "Ease of finding relevant information and simplicity of design. No login required."
- "Save content for future reference - helpful when sharing the same content to multiple crews"
- "Access is not limited to company intranet."
- "Easy to access, fast to view and good standard presentation of each incident."
- "Intuitive design and great search capabilities."
- "Website is intuitive, stable and generally well designed."

Conversely, it was found that some users struggled to use, could not find, or were unaware of the offline features.

- "It is not obvious how to access content saved offline."
- "[Wants] An app which could be used offline."
- "Develop and deploy App to make offline friendly."
- "Offline access to saved content fail often when there is no internet."

4. Conclusions

4.1 Limitations of pilot study

Firstly, we should acknowledge the limitations of the pilot study. Toolbox was not rolled out in an official capacity at any of the sites, and the method of testing varied greatly among the seven companies. It was not possible to measure with any accuracy what percentage of the target audience was reached during the pilot as a) usage data does not distinguish between companies, meaning we could only measure usage for all companies in a certain location, or only locations where only one company was located, and b) we have reason to suspect that a lot of usage took place in groups (e.g. meetings, demonstrations),

but this would only be recorded as a single user accessing Toolbox. Crude estimates for a small number of locations suggested that 10%-22% of the target audience accessed Toolbox, but the figure could be higher if group usage was the norm. The pilot also could not measure the actual effect Toolbox had on safety performance – this would have been unrealistic to measure given the short timescales and soft rollout and would likely require a comparative study of equivalent industry sites, one using Toolbox another not, over a timescale of 1 year or longer. We did, however, measure perceptions of whether Toolbox is likely to have a positive effect on safety performance. Furthermore, content was only available in English during the pilot. This certainly hampered its usage in non-English speaking locations.

4.2 Pilot results analysis

The piloting results were considered to be extremely positive. All four hypotheses can be said to have been proven, at least within the limitations of the pilot study:

1. Toolbox enables toolholders to get relevant incident learnings at the right time & right format

95% of frontline users agreed or strongly agreed Toolbox helps them to get information at the right time. Furthermore, 80%-95% of frontline users agreed that the content on Toolbox was useful, practical, engaging, relevant, and clear and easy to understand.

2. Toolbox enables toolholders to engage and discuss on key incident learnings

Toolbox was seen as most useful for HSE/Toolbox meetings and individual/team learning. More than half of people believed it useful for permit-to-work creation and risk assessments, but less useful for post-job review. We can therefore be confident that, for the majority of activities where work planning or job safety is considered and discussed in a group setting, Toolbox can help enable these discussions.

3. Toolbox enables toolholders to better understand hazards, risks and potential controls and 4. Toolbox enables toolholders to work safer

While the limitations of the pilot cannot conclusively prove these hypotheses, there is strong evidence to suggest that Toolbox will facilitate better understanding of hazards and improve safety. Firstly, users who responded to the survey overwhelmingly agreed that Toolbox will help improve how they work and prevent incidents. Secondly, as stated above, Toolbox was highly scored for the usefulness, practicality, etc. of its content.

4.3 Areas for improvement and next steps

For these hypotheses to hold true in the longer term, several improvements are required.

Firstly, much more content needs to be published on Toolbox. During pilot, Toolbox contained approximately 60 pieces of content. By the end of 2019 that number has doubled. Ambitions are to add 400 more pieces of content in 2020.

Secondly, content needs to be translated into multiple languages for use globally. While English will reach a large population, for global companies English is not sufficient. Piloting in some countries was limited due to the lack of local language content. Several languages have been prioritised, including French and Spanish. Ambitions are to translate approximately 100 pieces of content into several languages by end of 2020.

Thirdly, we needed to improve the offline usage functionality to make it more intuitive. Offline usage is likely to be very important considering the lack of connectivity at many sites. Inability to use mobile devices on some sites due to ignition risk will also present a more general challenge for usage of Toolbox. For this reason, it will be important for Toolbox to contain text-based information that can be printed before usage – despite video content typically receiving far more views than text-based content.

Lastly, Toolbox will need to be actively used for companies to receive any benefit. Without finding a way to embed usage of Toolbox into normal company processes, its use will likely be limited. Some companies are exploring how to link their permit-to-work systems to Toolbox to allow relevant learning to be extracted for relevant jobs. EI will also be exploring other ways to ‘push’ relevant information to users using additional functionality.

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