

# Technology as an Enabler to Improve WSH

Training Provider's Forum 2023



Provide evidence-based, insightful and practical solutions  
© 2023 Singapore Workplace Safety and Health Institute. All Rights Reserved

**Disclaimer:** Information and videos do not represent WSHI's endorsement.

# Ensuring Workplace Safety and Health @ Work

## Occupational Safety And Health Division (MOM)



### REGULATOR

Legislation, Policies &  
Enforcement



### SOLUTIONING

Provide Insights to Chart  
New Grounds for WSH  
Excellence and Innovation

## Workplace Safety and Health Council



### INDUSTRY PARTNER

Educate & Engage  
Stakeholders, Set  
Standards, Promote WSH

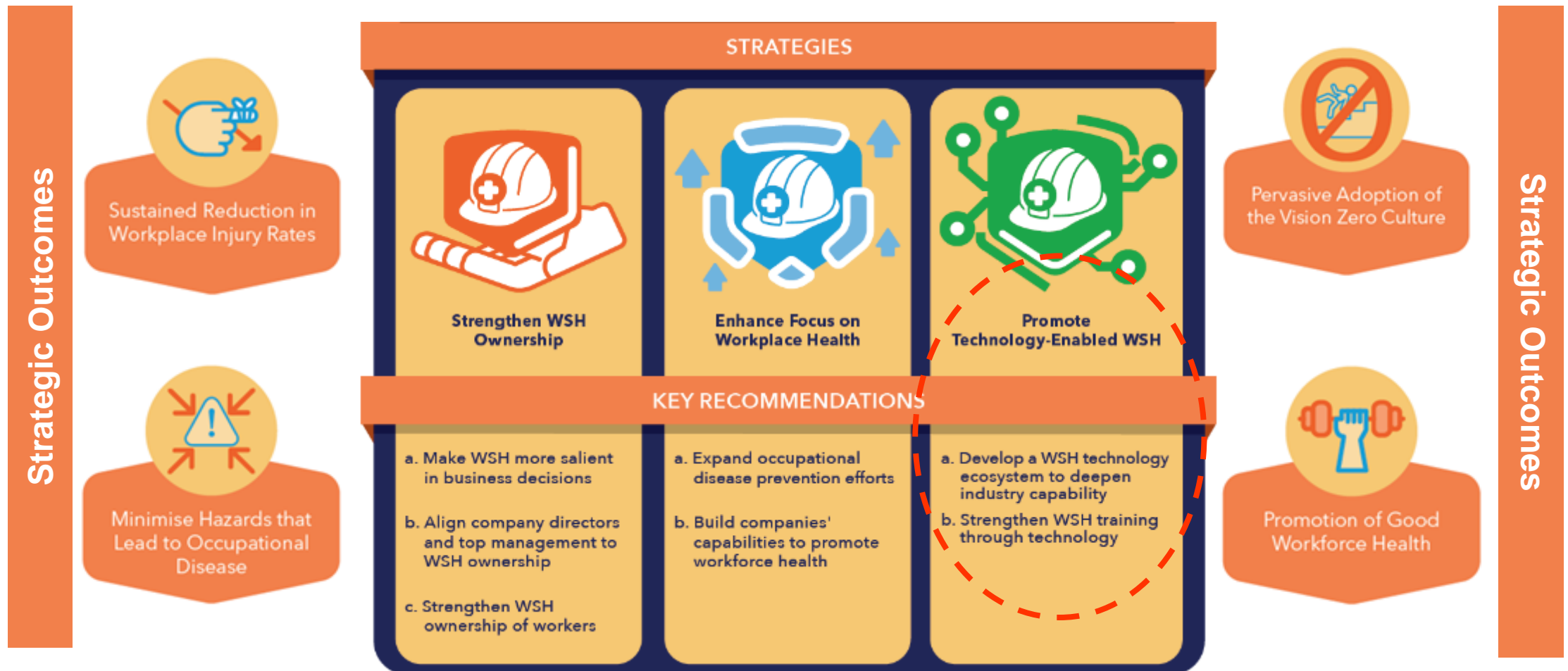
## WSHI's Role

- Uncover red flags, root causes and emerging WSH issues through data
- Develop industry WSH assessment tools e.g. iWorkHealth
- Improve WSH through technology

# Promote Technology-Enabled WSH

## is one of our key strategies to achieve WSH 2028 goals

- (1) Reduce and sustain Singapore' workforce **fatality rate at less than 1 per 100,000 workers by 2028**, in line with the safest countries in the world, and
- (2) **Major injuries rate at below 12 per 100,000 workers by 2028**



# Technology as an enabler to improve WSH and productivity

- Remove workers from risky activities;
- Improve workers' situational awareness and reduce human error;
- Deter risky behaviour;
- Assess and alert on ill health that may increase risk of work accidents
- Automate tasks;
- Reduce or eliminate delays in workflows;
- Increase employee morale and retention; and
- Provide opportunity for training and upskilling

**7 in 10 businesses have work safety and health technology in place**

[SINGAPORE BUSINESS REVIEW, July 2022](#)

Seven in 10 companies in Singapore have work safety and health (WSH) technology in place, Minister for Manpower Tan See Leng revealed.

For the companies that have yet to adopt WSH digital solutions, the minister urged them to tap on the Productivity Solutions Grant (PSG).

As of June 2022, Tan said there have been more than 500 SMEs that have tapped on the PSG to adopt technology solutions that facilitate the improvement of [WSH standards at their workplaces.](#)

"Examples of these solutions include the electronic Permit-To-Work (or e-PTW) to control selected high-risk work activities, such as working at height, to ensure safe execution of work on-site," Tan said in a reply to the Parliament.

There is immense potential for industry to tap on effective market-ready WSH solutions to disrupt unsafe / labour-intensive processes as well as value create by changing the way traditional risky work is carried out.

# Refer to Industry Digital Plans (IDPs) for the WSH Tech suitable for specific high risk industries






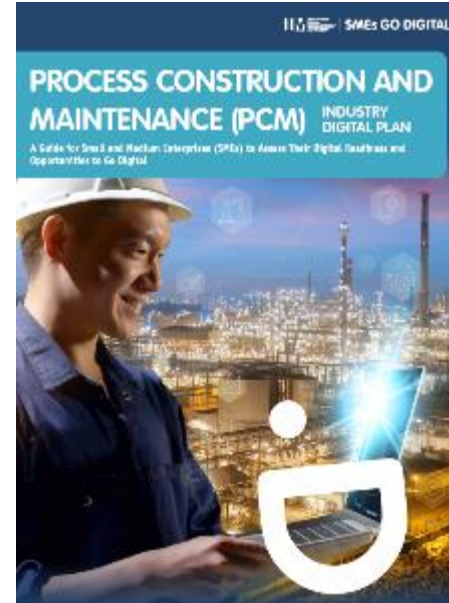
-  **Digital Wearables for Workers' Health and Safety**
-  **e-Permit-to-work (e-PTW)**
-  **Integrated and Smart Worksite Monitoring and Inspection**



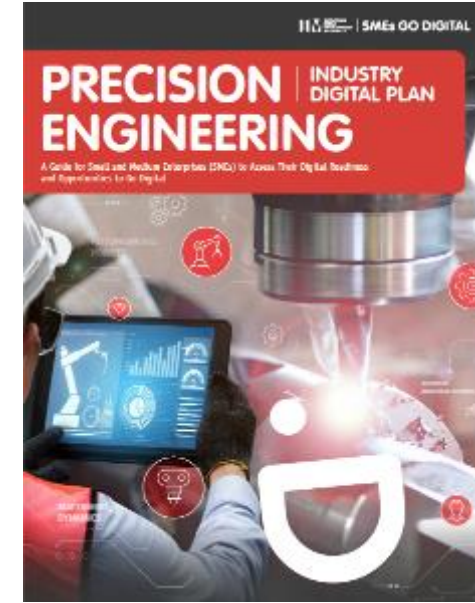
-  **Fleet Safety Management**





-  **e-Permit-to-work (e-PTW)**
-  **Centralised Platform with Data Analytics**
-  **Autonomous Robots & Drones for Operations**



-  **Digital Wearables for Workers' Health and Safety**
-  **e-Permit-to-work (e-PTW)**
-  **Field Management**
-  **Integrated Inspection System**
-  **Semi-Automated Robots**



-  **Manufacturing Operation Management**
-  **Production Resource Planning**
-  **3D Visualisation and Simulation**
-  **Augmented/Visual Reality**
-  **Autonomous Robots**

# Scan QR codes for grants on market-ready technology

## Productivity Solutions Grant (PSG)



Supported by:



SMEs GO DIGITAL

In support of:



The Productivity Solutions Grant (PSG) supports businesses in the adoption of IT solutions or equipment that improve productivity.

Receive up to 70% funding support for eligible costs.

## Advanced Digital Solutions (ADS)



The **ADS** supports businesses in adopting solutions for safe re-opening and long-term digitalisation to digitise workflows and reduce reliance on manpower.

Receive up to 70% funding support for cost of integrated digital solutions.

# WSH technology solutions



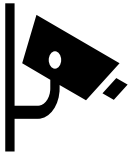
## Electronic Permit to Work (ePTW)

- Improve accountability of safety through audit trail
- Protect against falsification of PTW
- Visibility of ongoing high risk activities



## Vehicular Safety

- Improve driver's situational awareness
- Monitor signs of fatigue or distraction
- Track driving behaviour



## CCTV Surveillance with Video Analytics

- Detect unsafe worker behaviours
- Detect unsafe conditions
- Detect lone workers in distress



## Work-related Musculoskeletal Disorder (WRMSD) Monitoring & Prevention

- Detect and alert awkward postures
- Detect carrying of heavy loads over long distances
- Detect repetitive actions



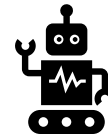
## Slips Trips Falls (STF) Prevention

- Detect STF incidents, near misses and hazards
- Identify STF prone areas for regular housekeeping
- Identify workers prone to STF



## Health & Fatigue Monitoring

- Mitigate the potential for injuries and fatalities esp. for workers who work long hours, night shifts or strenuous jobs



## Robots & Drones

- Prevent fatigue, reduce risks of WRMSD and STF for service staff
- Lower risks of disease exposure for cleaners
- Mitigate work-at-heights risks for building façade inspection



## Worker Location Tracing & Geofencing

- Prevent unauthorised entrance into restricted or high risk areas
- SOS button for lone worker



SCAN 7

More information on WSH Tech, grants and innovation programmes is available on MOM webpage

# Case example: Lack of visibility and accountability with manual Permit to Work (PTW)

## 5 jailed for falsifying safety permit after Tampines work site accident left worker dead

Today, 5 July 2019

*'The work site accident at Tampines resulted in the death of one worker who was hit by a concrete bucket when the excavator started to topple.'*



## Summary of the case:

- Excavator accident at Tampines work site resulted in a fatal injury on 5<sup>th</sup> July 2019
- Work commenced without a PTW
- The excavator toppled and the concrete bucket hit another worker who was in the pit. The worker died from multiple injuries.
- Investigation by MOM found that several people then backdated a PTW to mislead MOM's investigation



# Electronic Permit to Work (ePTW) - Video

# ePTW improves safety through better visibility and accountability

## Improves WSH

- Improved safety through audit trail – ensures qualified persons approve the PTW
- Protection against falsification of PTW – cannot backdate
- Full visibility of which high risk activities are ongoing and which PTWs have closed
- Capturing the location for each stage of PTW to ensure users are at the specified place to conduct physical checks on site
- Dashboard to help safety supervisors identify conflicting works and overdue permits

## Productivity

- Reduces paperwork and waiting time; assigns to other staff easily to cover staff absences. Companies cited improvement of about 50%.

## Workforce development

- Worksite supervisor can be trained to manage a digital permit system and use data visualization and analytics to make better informed decisions in day-to-day operations.









## Solution providers (non exhaustive)



# Vehicular Safety Technologies (VSTs)

Vehicular accidents is one of the top causes of fatal and major injuries. VSTs can improve drivers' situational awareness, deter risky behaviour, and reduce human error, which are commons causes of accidents. VSTs is applicable for worksites and public roads, for enhanced safety and operation efficiency.

## Common VSTs improve driver's situational awareness and monitor signs of fatigue or distraction

On-road solutions				On-site solutions			
 <b>Advanced Driver Assistance System (ADAS)</b>	 <b>Driver Status Monitoring Systems (DSMS)</b>	 <b>Driver Behaviour Monitoring System (DBMS)</b>	 <b>Blind Spot Detection</b>	 <b>360 Degrees Camera</b>	 <b>Proximity Sensors</b>	 <b>Access Control</b>	 <b>Video Analytics</b>
<ul style="list-style-type: none"> <li>• Forward collision warning</li> <li>• Lane departure warning</li> <li>• Headway monitoring warning</li> <li>• Pedestrian detection</li> </ul>	Alerts driver of: <ul style="list-style-type: none"> <li>- Fatigue</li> <li>- Distraction</li> <li>- Smoking</li> <li>- Phone usage</li> </ul>	Tracks: <ul style="list-style-type: none"> <li>• Speeding</li> <li>• Harsh Acceleration</li> <li>• Harsh Cornering</li> <li>• Excessive Braking</li> </ul>	Detects vehicles and pedestrians in blind spots when turning or changing lanes	Provides real-time view of area surrounding vehicle	Alerts driver when a person or an object is too close to vehicle	Authenticates worker before operation of equipment	<ul style="list-style-type: none"> <li>• Geofencing for exclusion zones</li> <li>• Detects proximity and calculates trajectory</li> <li>• Traffic management</li> </ul>

**Pre-approved FSMS solutions @ PSG webpage**



### Solution providers (non exhaustive):

- [ARCURE](#) | [Automation Service Support](#)
- | [Goldbell](#) | [IoT Solaris](#) | [Linde](#) |
- [Nettbox](#) | [NewGene Technologies](#) |
- [Syspex](#) | [UWM Equip & Engrg](#) |
- [cynapse ai](#) (formerly [XRVision](#)) |
- [Chuan-Fa Mobileye](#) | [Grid Plus](#) |
- [GreenRoad](#) | [Guardian SEA](#) | [iZeeM](#) |
- [TNTs](#) | [SmartComm Electronics Pte Ltd](#) |
- | [Solo Pte Ltd](#) | [Syspex](#)

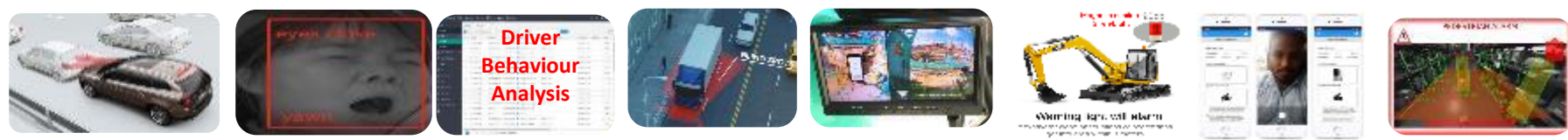


Image source: [ARCURE](#) | [Grid Plus](#) | [Mobileye](#) | [Nettbox](#) | [NewGene Technologies](#)

# Vision-based proximity alert system

# Lorry Crane Stability Control System (SCS)

**Outriggers** of lorry cranes are to be **fully extended** for stability. This may not be done in certain situations due to **space or operational constraints**.

SCS restricts crane manoeuvres when a **potential unstable condition is detected**, preventing the crane from toppling.



Image source: Fassi

## **BENEFITS:**

- detects the position of each outrigger and **automatically determines the crane capacity**
- caters to various outrigger positions, allowing lorry cranes to remain within stability limits, enhancing safety of lifting operations.

# MOM Grant on SCS

## 1. Eligibility Criteria

- i. Business is registered and operating in Singapore;
- ii. Purchase and install an acceptable SCS on new or existing lorry cranes that fulfil the following conditions:
  - a. Lorry cranes under Lifting Equipment classification codes 631, 632, 633, 638 or 639;
  - b. Lorry cranes aged 17 years or less from year of manufacture to calendar year of application;
  - c. Purchase and install an acceptable SCS from the list of Authorised Agents based on the brand of lorry crane owned; and
  - d. SCS must be purchased only after grant approval.
- iii. Purchased solutions must be used in Singapore.

## 2. Eligible Sector and Company Size

All sectors and enterprises

## 3. Funding Support Level

70% of qualifying costs, capped at \$7,000 per lorry crane and \$20,000 per company

## 4. Application Period

From March 2023 to March 2025

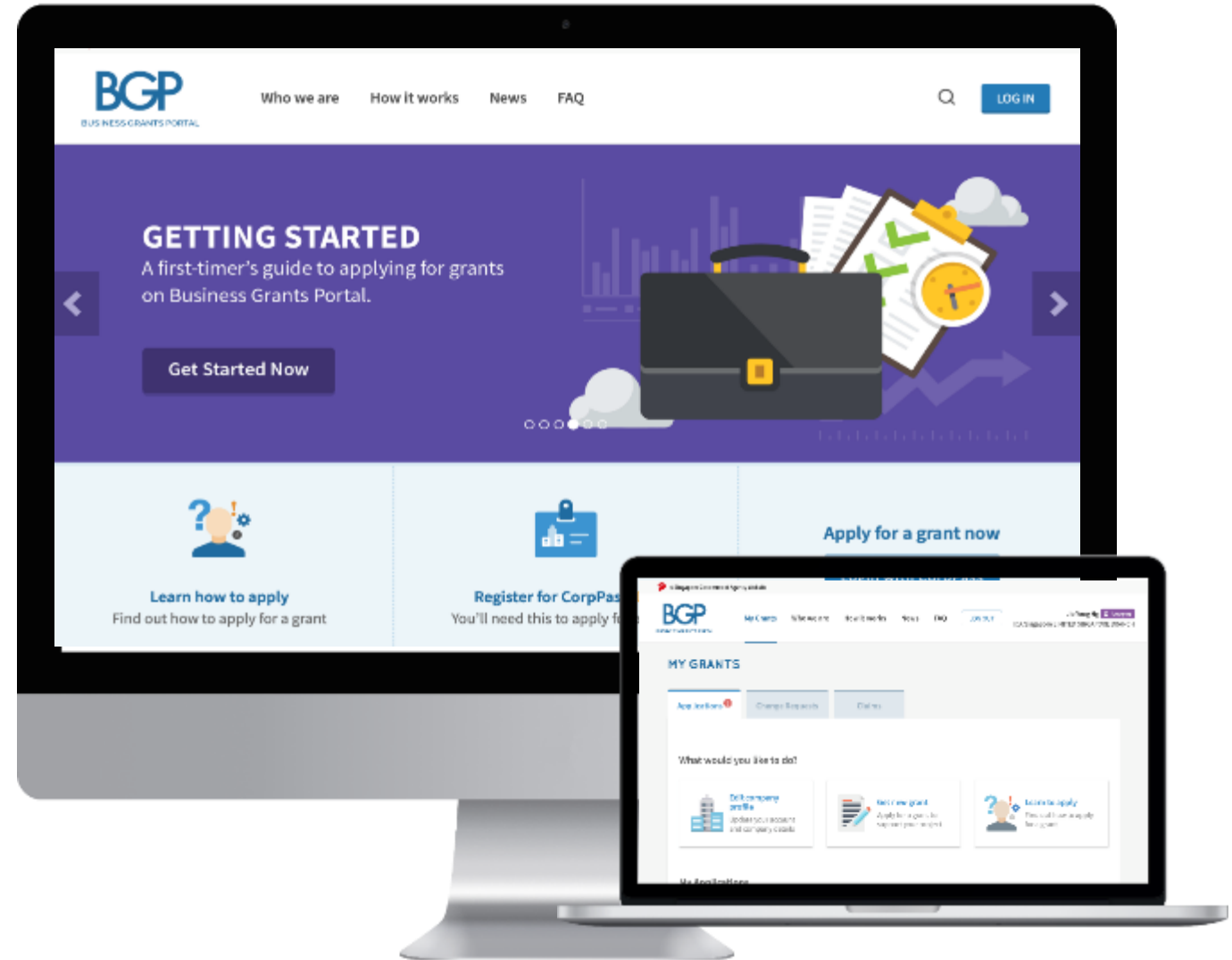
## 5. Qualifying Costs

- i. Hardware and software
- ii. Installation

# Go live on MTI's Business Grant Portal (BGP) in March 2023 to apply



**SCAN for BGP**



The Lorry Crane SCS Grant available on a first-come, first-served basis.

# Video Analytics (VA) solutions for WSH

## Use case for safety

- Provides evidence-based detection of unsafe conditions/worker behaviour
- Real time detection for early intervention to prevent accidents
- Deters workers from unsafe acts
- Enables review of safety compliance via digital dashboard
- Enables geofencing – exclusion zone for high risk areas
- Customized use cases could be developed

## Productivity benefits

- Higher efficiency and effectiveness compared to manual monitoring by workers
- Tracks workers/assets for more efficient resource deployments
- Tracks work progress

## Solution providers (non exhaustive)



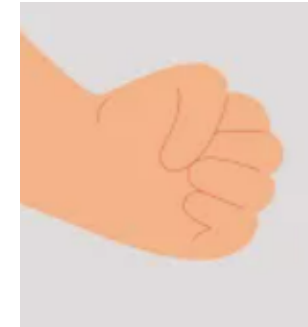
OPEN EDGES



UNDER LIFTED LOAD



HEAVY MACHINERY  
ZONE



VIOLENCE  
DETECTION



FIRE & SMOKE



# VA solution for WSH surveillance

# Drone and AI for building facade inspection

## Benefits

- Easier and safer to inspect difficult-to-access areas for buildings with complex design
- Less time taken to do inspection
- Lower cost of inspection
- Reduced reliance on manpower
- End-to-end digitalized process
- Upskilling opportunity – Users are required to obtain Unmanned Aircraft Pilot License (UAPL) to fly drones for commercial purpose
- Automation – AI enabled object detection of construction faults such as cracks, broken glass, bent/deteriorated sheet metal

## Solution providers (non exhaustive)

**H<sup>3</sup>Dynamics**

**Avetics**

 **operva.ai**

Building owners urged to use drones for facade inspections as new BCA guidelines rolled out

[The Straits Times, 21 Oct 2021](#)



SINGAPORE - With at least 30,000 buildings slated for inspection over the next seven years under new Building and Construction Authority (BCA) guidelines, facade inspectors have been urged to tap drone technology to help get the job done.

From the start of next year, facade checks will have to be carried out every seven years for structures that are over 13m in height and more than 20 years old. The new Periodic Facade Inspection (PFI) regime was announced by the BCA on Thursday (Oct 21).



**Heady days: Use of drones to detect defects on HDB blocks takes flight**

[CNA, 10 Aug 2018](#)

# Drones for building facade inspection (Video)

# Health Assessment Apps



A hand holding a smartphone displaying the Anura app interface. The screen shows the NuraLogix logo at the top, followed by the text "Hi, I'm Anura. Let's begin your 30s Health Check." and the Anura logo. To the right of the phone is a blue box with the NuraLogix logo and the text "NuraLogix" below it. Below the phone is a QR code.

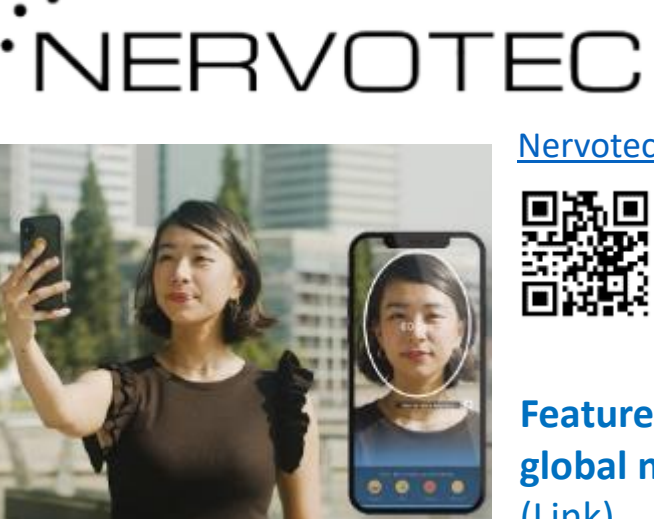
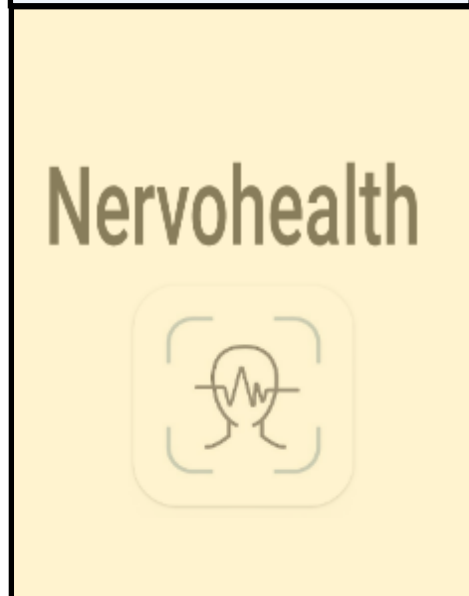
[NuraLogix](#)

**Featured in Channel 8 News  
14 July 2022 ([Link](#))**

## Anura app features

World's 1<sup>st</sup> mobile app that measures the following physiological parameters in **30 seconds**:

- Heart rate, irregular heartbeat
- Systolic, Diastolic Blood Pressure
- Breathing, HRV (SDNN), Cardiac workload
- Mental stress index
- Cardiovascular disease risks
- Overall Wellness Score



The Nervotec logo, consisting of three dots above the word "NERVOTEC" in a bold, sans-serif font. Below the logo is a photograph of a woman holding a smartphone. The phone screen shows the Nervotec app interface, which includes a QR code and a circular face scan area. To the right of the photo is a QR code.

[Nervotec](#)

**Featured in local,  
global news  
([Link](#))**

## NervoHealth app features

Mobile app that uses AI model, Remote photoplethysmography (rPPG) and Voice data to measure the following physiological parameters in **1 minute**:



















- **Vital signs** (Heart rate, HRV, Respiration rate, oxygen saturation, blood pressure)
- **Predictive analysis** (Stress levels, Chronic disease risk, flu prediction)
- **Emotions analysis** (Anger, dislike, sad, happy, surprise, fear)

# Download the Anura app

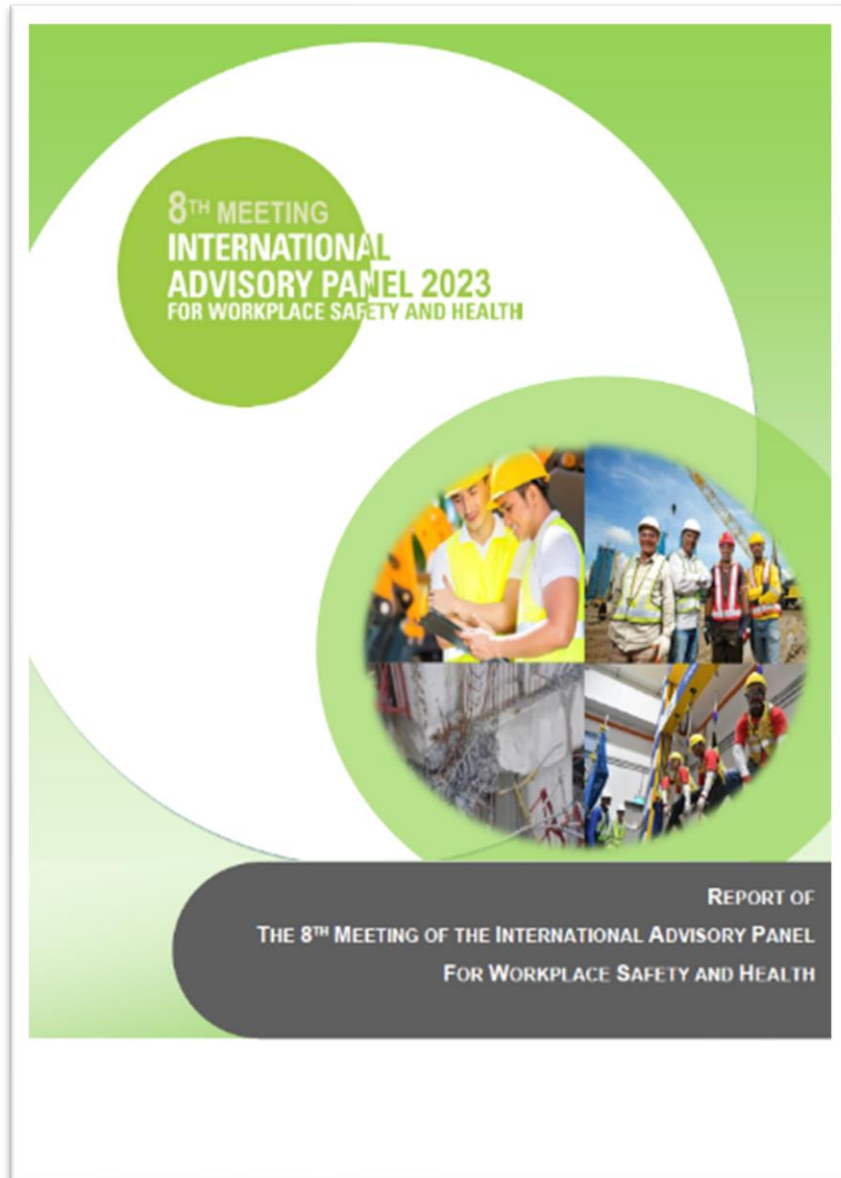
1. Download and install Anura™ app from the Apple App Store (iOS) or Google Play Store (Android).
2. Read and provide consent
3. “Get Started”
4. Fill in your profile
5. Allow access to camera
6. Start scan



# Suggested WSH Tech for training programmes

<p><b>WSQ Apply Workplace Safety and Health in Logistics and Transportation</b></p>		 <b>VSTs</b>	 <b>VA Solution WSH Surveillance</b>	 <b>Health Apps</b>		
<p><b>WSQ Supervise Safe Lifting Operations</b></p>		 <b>ePTW</b>	 <b>VSTs</b>	 <b>Health Apps</b>		
<p><b>WSQ Manage Work-At-Height</b></p>		 <b>ePTW</b>	 <b>VA Solution WSH Surveillance</b>	 <b>Drones</b>	 <b>Health Apps</b>	
<p><b>WSQ Perform Work in Confined Space Operation</b></p>		 <b>ePTW</b>	 <b>Drones</b>	 <b>Health Apps</b>		
<p><b>WSQ Apply Workplace Safety and Health in Construction Sites</b></p>		 <b>ePTW</b>	 <b>VSTs</b>	 <b>VA Solution WSH Surveillance</b>	 <b>Drones</b>	 <b>Health Apps</b>

# Change Management is key for successful WSH Tech Implementation



The IAP supported the adoption of suitably-deployed WSH technology to improve WSH outcomes. This could be done by incorporating such WSH technology requirements into contracts, starting with Government contracts. However, the IAP emphasised the need to adopt a sound change management plan for workers, vendors and subcontractors on the purpose and expected benefits of the WSH technology to be adopted. This facilitates their buy-in, provides assurance and eases the transition to new work processes.

# Considerations for successful change management

## Communicate

- Staff need to understand **why changes are implemented**, not just that they are happening.
- Provide platform for staff to **ask question /voice concerns /give suggestions**, so that they are more motivated to see it through to the end.

## Empathy

- Acknowledge all efforts, even from individuals and teams who are struggling with the change.
- Create platforms for **staff to express concerns and provide support where possible**.

## Monitor

- **Determine what success looks like before starting.**
- It can be efficiency, productivity, future-proofing the business, improve WSH etc. Think big and start small. Collect data, analyze and adjust the strategy if required.

## Training

- **Train** staff on how to use the new tech to reach **a level of mastery**.
- Relevant training to help them understand that using tech solutions **does not mean forgoing existing safety measures**.

## Encourage & Cheer

- **Praise staff** for their hard work in **adapting to the change**, even for small wins or milestones.
- Provide platform such as 1-on-1 conversations or announcements, to **gather feedback and address resistance**.





# Resource Guide

## A resource guide on Workplace Safety and Health Technology GRANTS AND INNOVATION CHALLENGES



SCAN HERE

### Grants – Productivity Solutions Grant (PSG)

All sectors

<b>Overview</b>	The Productivity Solutions Grant (PSG) supports the adoption of pre-scoped IT solutions, equipment and consultancy services that improves productivity, aligned to the industry roadmaps such as the Industry Transformation Maps (ITMs) and Industry Digital Plans (IDPs).
<b>Eligibility</b>	<b>You are:</b> <ul style="list-style-type: none"><li>• A local Small and Medium Enterprise (SME) looking to</li></ul> <b>You need to:</b> <ul style="list-style-type: none"><li>• Be registered and operating in Singapore.</li><li>• Have a least 30% local shareholding<sup>1</sup> (for selected so</li><li>• Purchase/lease/subscribe the IT solution(s) or equipn</li></ul> <p>1. Have at least 30% local equity held directly or indirect</p> <b>Support level:</b> <ul style="list-style-type: none"><li>• Up to 70% of funding support for eligible costs.</li><li>• Each company is subjected to an annual grant cap of</li></ul>

### Innovation Challenge – Open Innovation Platform (OIP)

All sectors

<b>Overview</b>	The OIP is a crowd-sourcing platform that connects and matches real business challenges or digitalisation opportunities of Problem Owners to Problem Solvers. IMDA will launch Innovation Calls on the OIP every few months. Each Innovation Call comprises a set of challenges from different Problem Owners from different sectors. Each challenge is accompanied with prize monies for the best solutions that are selected based on the criteria of Problem Owners. The aim of OIP is to bring tech solutions to more businesses quickly and enable digital transformation on a greater scale.
<b>Eligibility</b>	<b>You are:</b> <ul style="list-style-type: none"><li>• All Enterprises, Infocomm Media (ICM) start-ups and innovators are eligible to participate in OIP as <b>Problem Owners, Problem Solvers, or Both</b>.</li><li>• <b>Problem Owners</b> should have an unsolved business challenge, and be willing to put up prize money for quality and innovative ideas.</li><li>• <b>Problem Solvers</b> should have digital technology expertise and innovation capabilities, and an interest to co-innovate with potential customers or partners in Singapore.</li></ul>
<b>Benefits</b>	<b>Problem Owners</b> on the OIP benefit from gaining access to a large community of Solvers with multi-disciplinary expertise, and can crowdsource for innovative ideas to support their digitalisation needs. A structured and iterative open innovation process facilitated by IMDA reduces their search costs and expands overall innovation capacity. <b>Problem Solvers</b> who are part of the OIP benefit from having visibility of potential customers and curated problem statements. They have opportunity to apply to challenges, win prize monies, and co-innovate with Problem Owners to develop, validate and test their solutions. If successful, winning Solvers are also able to go on to commercialise and go to market jointly with Problem Owners, who may serve as reference customers for Singapore



CONTACT US



Email: [contact@wshi.gov.sg](mailto:contact@wshi.gov.sg)