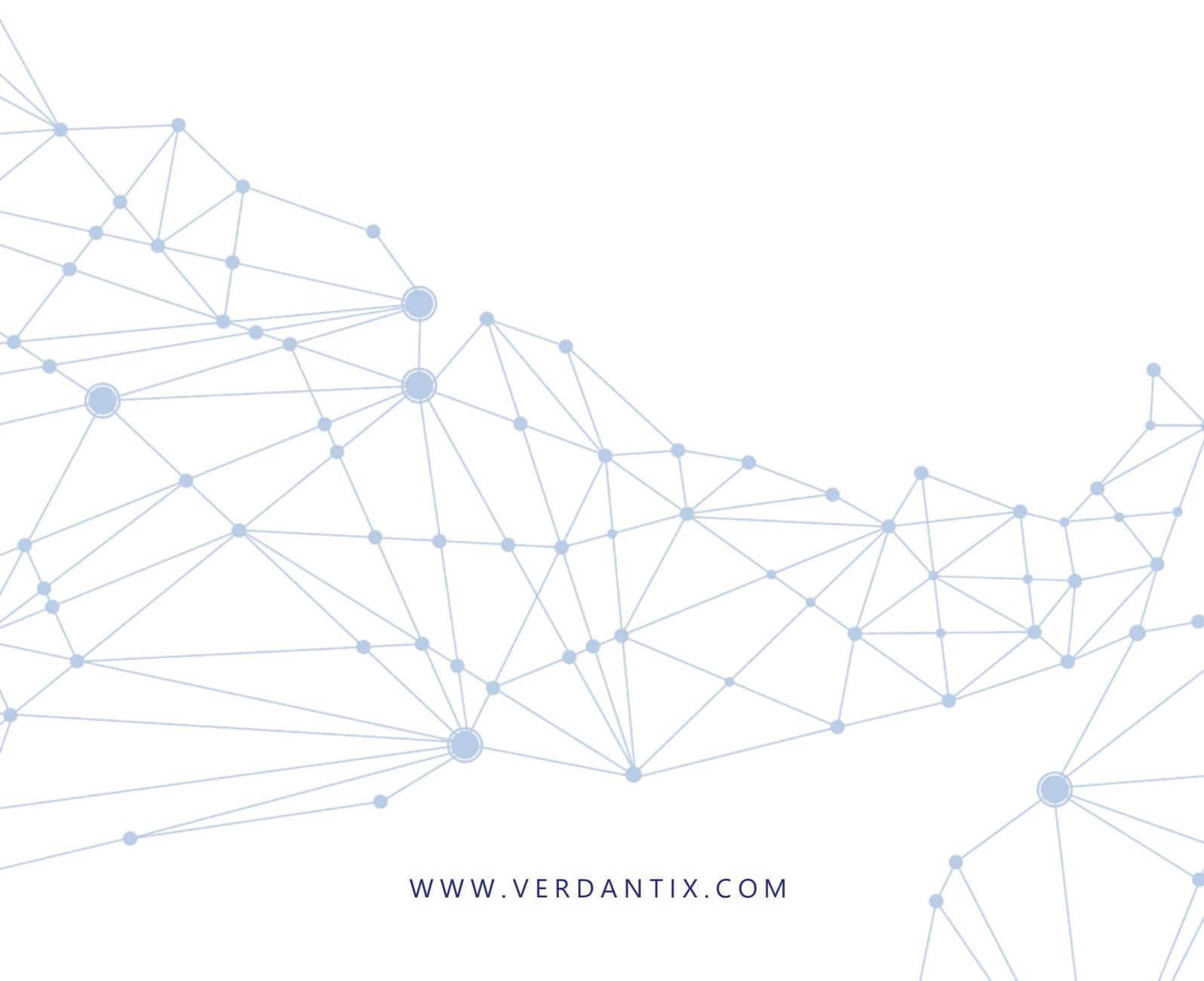




Smart Innovators: Industrial Wearables

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ORGANIZATIONS MENTIONED

Airswab, Amazon, Atheer, Boeing, Carré Technologies, Cartrefi Conwy, Chevron Corporation, DAQRI, dorsaVi, Duke Energy, Electric Power Research Institute (EPRI), Equivital, Extronics, ExxonMobil, Gensuite, Gilbane Building Company, Honeywell International, Humantech, IBM, Intellex, Intellinium, International ThermoDyne, Kenzen, Kinetic, Logical Safety, M3SH Technology, MacDonald-Miller Facility Solutions, MakuSafe, Modjoul, Optalert, Porsche, Reactec, RealWear, S3-ID, Skanska UK, SolePower, SoloProtect, Soter Analytics, Triax Technologies, Upskill, Vale, Vault Intelligence, Vigo Technologies, VINCI Construction UK, XOi Technologies.

Smart Innovators: Industrial Wearables

Workers in dangerous locations have used wearable devices (or “wearables”) for decades to alert them to hazards such as gas leaks. In the last fifteen years, the rise of digital consumer wearables such as augmented reality headsets and watches that monitor heart rates has opened the door to the launch of industrial wearables exploiting these consumer innovations. Concurrently, vendors and firms have diversified the environment, health and safety (EHS) functions in industrial settings to which wearables can be applied. This report provides EHS decision-makers, vendors of industrial wearable solutions, investors and other participants in the EHS technologies ecosystem with an overview of wearable devices applied to EHS functions. We define industrial wearables as:

Digital devices worn by workers that passively collect, store, transmit or receive information about worker location, bio-metric signs, proximate hazards and performance of technical tasks.

This definition explicitly excludes mobile apps on smart phones or handheld devices because they require active use by a worker. Also excluded is any digital sensor or software housed in a piece of equipment that is not worn by a worker.

A Broad Range Of Wearable Devices Have Relevance To EHS Priorities

Wearables designed for workers in industrial, commercial and retail environments have emerged from the wide range of consumer devices that have been brought to market in the last 15 years. Now vendors are developing wearable devices that can collect data and disseminate resources in support of EHS activities. Industrial wearables support the achievement of EHS priorities by:

- **Tracking the locations of lone workers and teams in the field.**
One of the most valuable EHS uses of wearables is locating workers whose roles separate them from other co-workers. To help ensure the health and safety of lone workers in the field, firms want to monitor their geographic locations and be alerted if individuals suddenly become immobile or undergo a significant change in elevation, indicating possible incapacitation or a fall. Location data is key for sending aid to a worker or rescuing someone who is injured, whether or not the worker can actively communicate with other personnel. For example, the Modjoul SmartBelt contains 8 sensors that can measure multiple movements and motions for each worker, as well as collect data ranging from driving speed to strain levels, GPS position and falls. To avoid adding an unusual new device, the Modjoul wearable is designed to be worn as a belt through a worker’s belt loops.
- **Monitoring vital signs of workers in hazardous settings.**
Maintaining constant observation of workers’ health metrics, especially when they enter hazardous environments, is another important opportunity for wearable devices. For example, underground mining often means working in locations with low levels of oxygen. Metal smelting can expose individuals to extreme heat. Even before an individual is self-aware that his/her wellbeing is at risk, tracked vital signs already may show changes and impacts to physiological processes. If such physical measurements are monitored and action is taken swiftly, then wearables can help minimize injuries and harness the predictive value of collecting these data. For example, the vendor Optalert’s early-warning drowsiness detection systems have helped the mining firm Vale reduce fatigue-related incidents by 69%.
- **Checking workplace environmental conditions.**
Wearable sensors can measure specific environmental qualities in a worker’s surroundings. Monitoring for the presence of harmful gases, unsafe oxygen concentrations, excessive temperatures, moisture levels or other conditions can help warn workers before accidents occur. To be most effective, such tracking should be continuous rather than occurring at defined times, so that changing circumstances can be identified before they are overly hazardous. S3-ID’s eLocator wearable can track a worker’s location, monitor potential contaminants such as gas and dust, and warn the user about environmental risks through haptic alerts, among other device capabilities.
- **Alerting workers about site evacuations and entry into hazardous areas.**
Worker location tracking and customized warnings also can provide for safer site evacuations and help prevent entry into risky work zones. Should the need arise to clear a worksite, specific wearables can

enable real-time monitoring of individuals' positions and signal them to evacuate immediately. Proximity warnings are useful when workers and heavy equipment are operating in contiguous areas, to minimize collisions and injuries. In this case, a combination of wearables on people and beacons distributed on equipment or around the site can identify adjacencies and trigger an alarm when risks arise (see [Smart Innovators: Worker Safety Technology](#)). Similarly, if a worker enters an area containing known hazards—such as slippery surfaces, tripping dangers or steep slopes—alerts from wearable devices can help enhance workplace safety.

- **Sharing safety information among distributed workers.**

Due to the sheer nature of their distance from one another and lack of direct contact, distributed workers can improve safety conditions by sharing data about field hazards and leveraging peer-to-peer learning of best practices. For example, wearables that allow hands-free communication with colleagues, access to remote mentors through video chat, collaborative virtual troubleshooting or worker calls for assistance are emerging in the marketplace. RealWear has developed a head-mounted wearable computer to deliver instructions and information directly to a worker, including voice communications, streaming video and static images. The potential of wearable technology to facilitate team partnering and information sharing can provide valuable EHS benefits.

- **Providing remote access to technical resources.**

Wearables can permit workers to instantly access technical resources while they are in the field, avoiding the time to locate a paper document and providing direct access to current information. For example, a heads-up, hands-free display can deliver equipment schematics, user manuals, chemical safety data sheets or training content to ensure correct technical maintenance, enhance workplace safety and facilitate team learning. Atheer has enabled efficiency gains at Porsche, which uses the vendor's AR Glasses to help dealerships diagnose technical issues and shorten service resolution time up to 40%. Similarly, Boeing has incorporated Upskill's smart glasses to decrease its wiring production time by 25% and cut its error rates to zero—by allowing a worker to review wiring schematics via the wearable's viewfinder, touchpad and head tracking interface.

- **Offering physical assistance to more safely complete tasks.**

Certain wearable devices are designed to aid their users with physical activities within industrial settings. The two most common functions are assisting with lifting larger items, as exemplified by exoskeletons, and facilitating proper posture using sensors and biofeedback. As an example, the vendor Kinetic has developed a wearable device that sends a vibration to alert the user when he/she moves in a way that can hurt one's back. Kinetic reports that customers often reduce cases of improper posture by 80% because of this feedback. These wearables currently represent a relatively small proportion of all products on the market, but EHS managers are interested in their potential applicability over time. Firms such as IBM and Reactec view exoskeletons as aiding EHS management in the longer term, compared to other wearable technologies.

EHS Decision-Makers Indicate Early Signs Of Demand For Wearable Technology

Industrial wearables offer functionality that spans a wide range of usage scenarios for EHS professionals. However, to what extent is the EHS community investing? Recent survey data shows that EHS decision-makers:

- **View technology as important to EHS management.**

EHS professionals clearly identify technology as a critical component of their initiatives and activities. Fully 88% of respondents to the most recent Verdantix study expressed that technology is either essential or valuable for the success of EHS management (see [Global EHS Leaders Survey 2017: Budgets, Priorities & Tech Preferences](#)). The interest in wearable devices for EHS activities is a natural outgrowth of this perspective. Verdantix interviews with vendors and other firms evidence the growing awareness of wearables and exploration of their use for EHS pursuits.

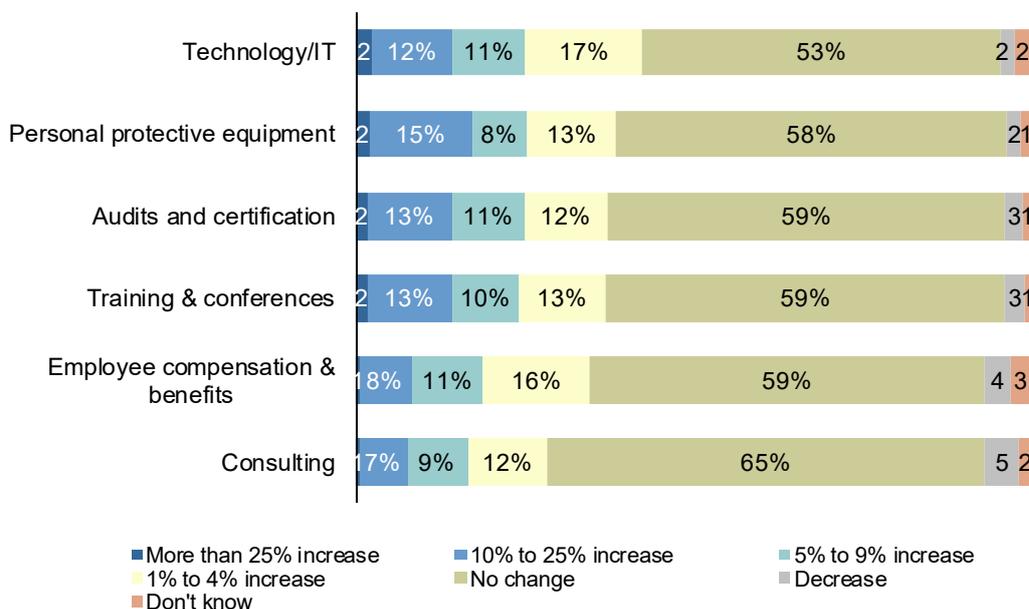
- **Plan larger technology budgets during 2018.**

Verdantix research shows there will be increased spending on EHS technology during 2018. Technology is the top priority in EHS decision-makers' 2018 spending plans, with 42% of surveyed individuals

FIGURE 1

Change In Spend Across EHS Categories In 2018

“How will your firm's spend on the following categories change in 2018 compared to your spend in 2017?”



Note: Percentages less than 5% have been written as numbers. Responses are ranked by the first four response options.
Source: Verdantix

n = 382

planning to increase their expenditures in this category (see Figure 1). EHS practitioners perceive the value of technology within their activities and have committed financial resources as proof of its importance.

- **Anticipate increased spending on PPE this year.**

Even more closely related to the likely demand for wearables, 38% of EHS decision-makers expect to spend more on personal protective equipment (PPE) during 2018 (see Figure 1). Survey respondents also spend the largest proportion of EHS budget on PPE, averaged at 32% across firms representing all levels of EHS risk (see Figure 2). Combined with an average 21% of EHS spending allocated to technology during 2018, over 50% of budgets will be in categories closely associated with wearable devices.

- **Evaluate wearable devices for their firms’ EHS activities.**

Firms across various industries are exploring the use of wearables within their operations, including their EHS functions. The depth of firms’ initial evaluation extends from general research, to vendor communication and even limited deployment. Verdantix has identified growing interest in wearable technology for EHS, including among participant responses to the 2018 operational risk survey. Fully 58% of respondents believe industrial wearables will be either significant or very significant to operational risk management initiatives in the next two years (see Figure 3).

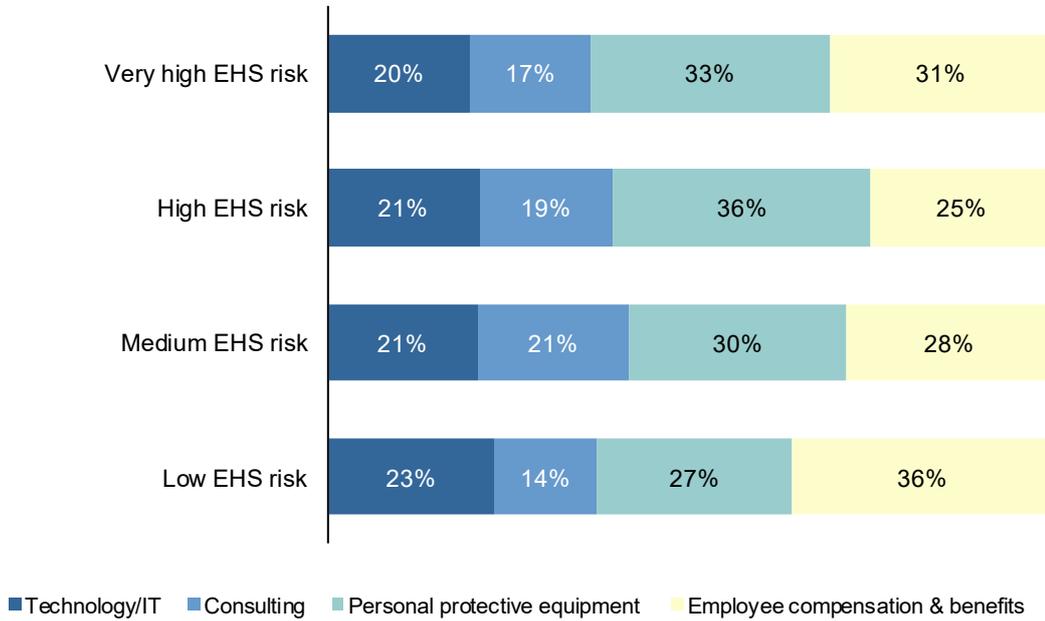
- **Convey their requirements to wearables vendors and pilot test devices.**

EHS decision-makers’ focus on and budgets for technology, PPE and wearable devices highlights the opportunity to expand integration of wearables into EHS operations. Firms have started considering the potential role for wearable devices and their specific EHS needs—by researching available devices and how they may be applied to their programmatic objectives, communicating with vendors about current product options and expectations for future product capabilities. For example, the Welsh property management firm Cartrefi Conwy first pilot tested and now has adopted a SoloProtect ID badge enabling lone workers to call for help if facing tenant aggression, verbal abuse or violence.

FIGURE 2

EHS Budget Allocation Across Four Categories

“For the following industry categories, in percentage terms, how much of your firm's annual EHS budget is allocated to the following categories?”



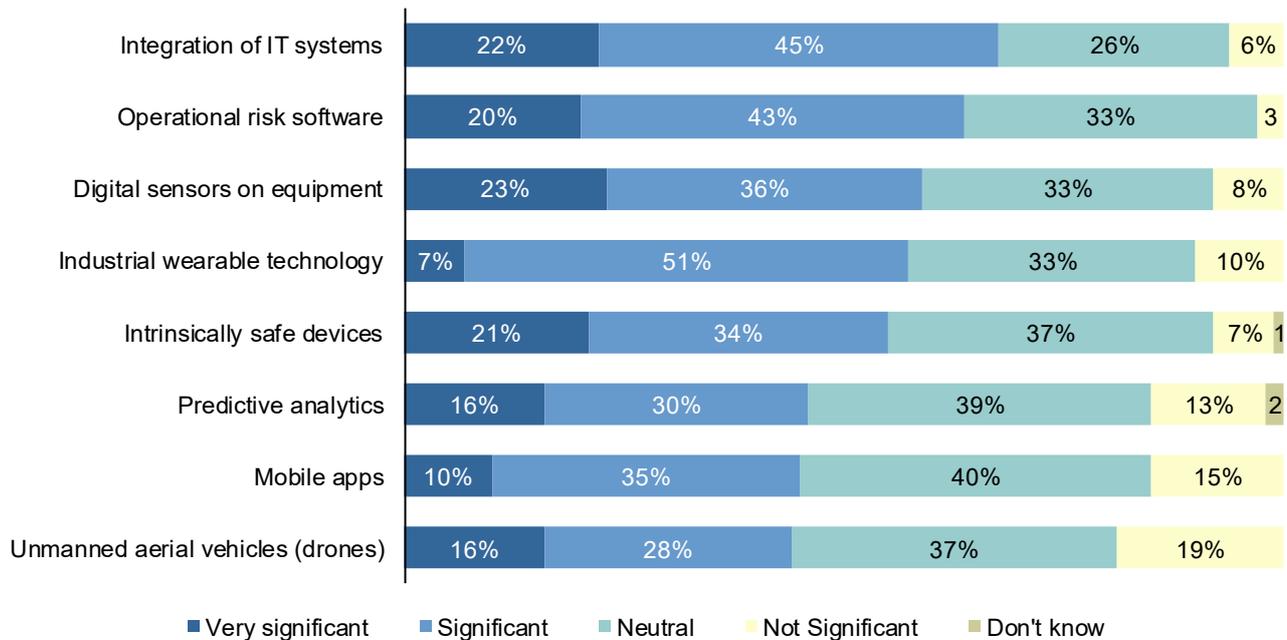
Source: Verdantix

n = 292

FIGURE 3

Significance Of Industrial Wearables To Operational Risk Management

“In the next two years, how significant will the following technologies be for your operational risk management initiatives?”



Note: Percentages less than 5% have been written as numbers. Responses are ranked by the first two response options.
Source: Verdantix

n = 221

Industrial Wearables Being Deployed For EHS Functions

Utilizing wearable devices for environment, health and safety activities within firms can help achieve goals with innovative technology and interact with frontline workers in new ways. Verdantix researched numerous devices being evaluated for EHS functions in industrial settings—from technology still undergoing its initial R&D, to tools receiving significant private equity investment and pre-commercial attention, and even wearables that are considered state-of-the-art safety devices and being widely adopted within specific sectors such as construction and mining.

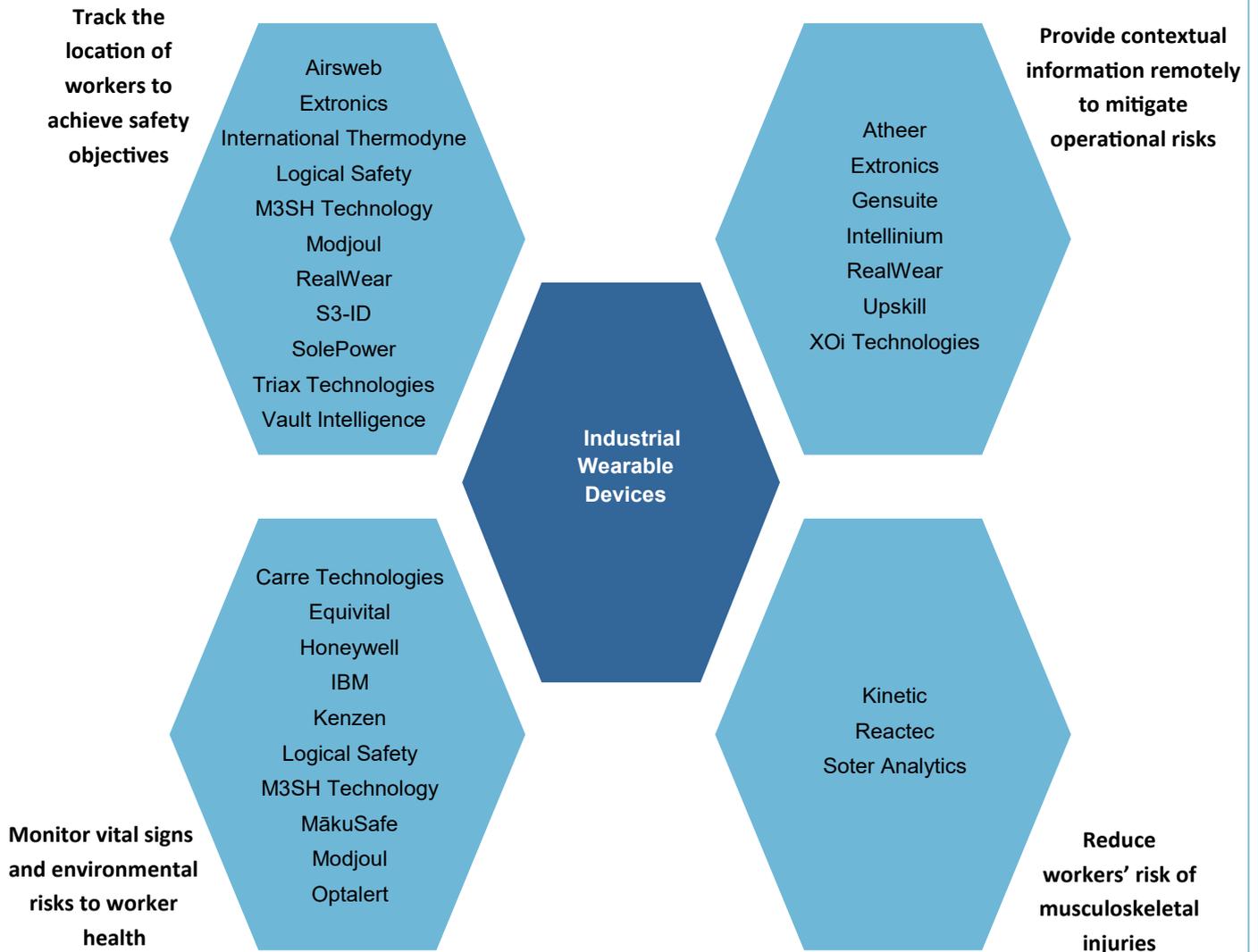
Wearable Functionality Maps To Four Distinct EHS Use Cases

Wearables can be categorized in various ways, such as the body location where the device is worn or whether it is a standalone item or combined with another piece of equipment or clothing. Verdantix has determined that the most useful classification of individual wearables is the functionality they provide to meet four EHS use cases (see Figure 4). According to this functionality-based segmentation, wearable devices offer the ability to:

- **Track the locations of workers to achieve safety objectives.**
Knowing where workers are located is critical for evacuations, safety headcounts and keeping individuals out of dangerous places. Sensors can count the number of workers across a worksite or even identify specific workers. Location tracking enables EHS managers to tally workers following an evacuation or determine when an individual has not moved for an extended period of time and could be immobilized. Wearables also can alert personnel to leave an area that unexpectedly becomes hazardous and avoid collisions with heavy equipment. Triax Technologies has developed a system of worker clips, equipment tags and worksite sensors that monitor the locations of workers, prevent worker-equipment collisions and issue alarms for evacuations (see Figure 5-1). For example, Gilbane Building Company has used Triax wearables to reduce the time to identify and respond to a construction worker's fall or other injury by over 40% compared to manual reporting.
- **Monitor vital signs and environmental risks to worker health.**
Understanding the health and environmental conditions faced by workers, especially lone workers, can help EHS practitioners reduce harm to their workforce. Wearable devices can measure a range of wellness criteria such as heart rate, blood pressure, body temperature, signs of fatigue and many others. For example, the vendor Optalert has developed glasses that measure a truck driver's eye movements as biomarkers for drowsiness and software that calculates that driver's real-time drowsiness score (see Figure 5-1). The computed score of 0 to 10 is displayed to the driver to enable behavioural change and recorded for corporate data tracking. Wearables also can gauge environmental conditions of concern—including elevated concentrations of natural gas, decreased ambient oxygen, and high-risk temperature. Monitoring any combination of these metrics can help identify hazardous work conditions as they arise or even before.
- **Provide contextual information remotely to mitigate operational risks.**
Field workers often are separated from colleagues and other information sources that can help them complete their job tasks. Wearables can address this imbalance by delivering data directly to a worker without leaving the worksite. For example, sharing real-time video or data feeds with a co-worker thousands of miles away and heads-up displays of augmented reality (AR) can help diagnose an operational risk immediately and in real time. Such wearables can decrease the potential for errors by lone workers, reduce the time for completing tasks and minimize the need for worker travel among different facilities. XOi Technologies' Vision platform integrates various data sources for lone workers (see Figure 5-2). For example, technicians of MacDonald-Miller Facility Solutions use Vision to record videos informing their customers about new equipment and its maintenance, helping engage those companies and reduce questions about monthly bills for equipment servicing.
- **Reduce workers' risk of musculoskeletal injuries.**
Improper lifting of heavy materials or poor posture can lead to worker injuries and operational downtime. Wearable technology can reduce the likelihood of these problems occurring in the workplace. For example, exoskeletons either can adjust a worker's motions for safer lifting or bear some of the load

FIGURE 4

Industrial Wearables Support Four EHS Use Cases



Source: Verdantix

weight themselves. Other wearable devices can guide a worker’s movements by measuring physical forces and providing immediate audible biofeedback or follow-up training. Reactec wearables monitor Hand Arm Vibration (HAV) when workers are using power tools, to more accurately record vibration exposure and analyse the contributing risk factors (see Figure 5-2). As one example, a construction firm utilized Reactec’s HAVmeter system when building the Glasgow Central Rail Station and reported lower risks to worker safety along with labour cost savings of £3,000 for data collection.

FIGURE 5-1

Mapping Wearables Vendors To EHS Use Cases

Primary EHS Use Case	Workplace Hazard	Wearable Vendor	Wearable Product
Track the location of workers to achieve safety objectives	Entering known hazardous location	Airsweb	Safety Nudge
		RealWear	RealWear HMT-1
	Heavy machinery-worker collisions	Logical Safety	Life & Fall Tracker
	Immobilized worker	Modjoul	Modjoul SmartBelt
	Worker position monitoring for individual safety and site evacuation	Extronics	T3 Tag
		International Thermodyne	Opal System
		M3SH Technology	M3SAFE
		S3-ID	eLocator
		SolePower	Smartboots
		Triax Technologies	Spot-r Clip
	Vault Intelligence	Vault Solo	
Monitor vital signs and environmental risks to worker health	Drowsy or fatigued equipment operator	Optalert	Drowsiness Detection Glasses
		Vigo Technologies	Fatigue Monitor
	Monitoring worker health conditions	Carre Technologies	Hexoskin
		Equivital	EQ02 LifeMonitor
		IBM	IBM Employee Wellness and Safety Solution
		Kenzen	Kenzen Patch
		Logical Safety	Life & Fall Tracker
		MākuSafe	MākuSmart
	Unsafe environmental conditions	Honeywell	Honeywell BW Ultra
		IBM	IBM Employee Wellness and Safety Solution
		Logical Safety	Life & Fall Tracker
		M3SH Technology	M3SAFE
		MākuSafe	MākuSmart
		Modjoul	Modjoul SmartBelt
	Worker down/falls	Logical Safety	Life & Fall Tracker
		Triax Technologies	Spot-r Clip
		SolePower	Smartboots

Source: Verdantix

FIGURE 5-2

Mapping Wearables Vendors To EHS Use Cases

Primary EHS Use Case	Workplace Hazard	Wearable Vendor	Wearable Product
Provide contextual information remotely to mitigate operational risks	Hands-free information access to task list and worksite data	Atheer	AiR Enterprise
		Gensuite	Inspection Tool and Equipment Tracker
		RealWear	RealWear HMT-1
		Upskill	Skylight
		XOi Technologies	XOi Vision/XOEye
	Team collaboration and messaging	Intellinium	Safety Shoes
		Gensuite	Inspection Tool and Equipment Tracker
		RealWear	RealWear HMT-1
		Upskill	Skylight
		XOi Technologies	XOi Vision/XOEye
	Training workers for new activities or equipment	Upskill	Skylight
		XOi Technologies	XOi Vision/XOEye
	Worker sending alert for help	Extronics	T3 Tag
Intellinium		Safety Shoes	
Reduce workers' risk of musculoskeletal injuries	Improper posture and ergonomic risks	Kinetic	Kinetic Reflex
		Reactec	ATEX HAVmeter and HAVWEAR
		Soter Analytics	Soter Spine

Source: Verdantix

Industrial Wearables Must Overcome Adoption Hurdles To Reach Critical Mass

Use of wearables for EHS management is an emerging market that, in many ways, is still being defined. Wearable vendors include technology start-ups, large firms with a focus on innovation and partnerships among firms for product development and commercialization. Verdantix expects that the market will grow slowly over the next three years, as wearables transition from pilot testing to wider corporate deployment, expand within sectors that have been early adopters and spread beyond the initial core industries.

Vendors Need To Understand Success Factors To Accelerate Growth

Broadening and deepening firms' adoption of wearable devices for EHS uses requires that vendors understand and respond to the key influencers of market demand. Demand for industrial wearables is affected by:

- Prioritization of health and safety within corporate culture.**
 The extent of a firm's focus on workplace safety is one of the most influential variables in determining whether wearables can be implemented successfully. Verdantix research shows that the adoption of any

new EHS technique requires a firm to view the added system as a tool within a wider safety toolbox, not as a solution on its own. A firm must have a culture of prioritizing EHS actions, leading on worker wellbeing and integrating new technologies and processes. Within this setting, the firm first should understand its current EHS weaknesses, then identify how a wearable device could address a specific need, compare available technologies and integrate the selected product into EHS operations. Of course, the capacity to pay for a wearables system—including the costs for product purchase, system implementation and data analysis—is another factor affecting corporate capacity to prioritize EHS management.

- **Worker willingness to wear digital devices which track and monitor them individually.**
A firm seeking to add wearables for EHS management must engage workers to be aware of their usage concerns and preferences. The primary apprehension among most workers and labour unions is data privacy. To address these concerns, Equivital recommends that firms collaborate with workers early during the wearables decision-making process, to most effectively characterize and respond to privacy issues. Verdantix concludes that the best strategy is to be transparent—show workers which data points will be gathered, the process and team that will review the data, any anonymization of confidential data, and how the data will be used to improve task safety. In Europe, Amazon has had success with EHS audits performed on Kindle devices that include scanning employee security passes by pre-engaging with unions and works councils to explain the benefit to employees.
- **Usability of wearables in the context of workers' existing activities.**
Ease of use also is critical for workers to adopt and utilize wearables. Particularly important factors include a device's simplicity of operation and user interface, the product's size and weight, limiting or even eliminating the need for recharging, incorporating technology within existing equipment or clothing rather than adding new devices or changing a worker's daily activities, and minimizing or avoiding the need for worker training. For example, an oil and gas firm reports prioritizing wearables that have a long battery life and can run for 8- to 12-hour shifts. International ThermoDyne has developed a fabric which turns energy from heat differentials and body movements into usable electricity, avoiding the need for device charging. By incorporating this fabric into safety vests and hard hats, workers are not adding another device. Finally, if the signal stops, the EHS team knows that either the worker has removed the PPE or he/she has stopped moving.
- **Availability of technology infrastructure and expertise to leverage benefits.**
Another success factor for wearables includes a sector's familiarity with using technology and willingness to explore innovative EHS methods. The robustness of a firm's data and communications infrastructure, including Wi-Fi coverage, is an internal feature that can affect the implementation of wearables. Without connectivity, location tracking wearables are a pointless investment. Combining data from wearables with other safety data such as incident reports and ergonomic hazard analysis is also important. That's why Honeywell Connected Worker partners with Intellex (see [Intellex Sets Out Four Strategies To Enable Superior EHSQ Performance](#)). Given that the deployment of wearables in an industrial setting is an innovative use of the technology, the technology introduction and change management expertise of the EHS team and collaborating groups such as IT and operations significantly impacts the success of projects.
- **Functionality which meets customer usage requirements.**
A wearable device's technical capabilities are important for facilitating a firm's adoption. Verdantix has identified several success criteria for the product itself: 1) ability to display data via a dashboard and share data with a firm's existing EHS analysis platform; 2) capacity to derive useful safety information and generate EHS predictions to help prevent future incidents; and 3) ability to easily connect to a firm's data infrastructure in real time through Wi-Fi or via an alternative connection that enables two-way data exchange with workers. Wearables vendor Atheer suggests that offline data collection is a functional requirement for a workplace that has limited data infrastructure, such as underground mines. Similarly, International ThermoDyne's technology utilizes a proprietary radio signal to avoid relying on a customer's data infrastructure—or lack thereof.
- **Adherence to regulations for workplace safety.**
Vendors and firms should apprise themselves of the latest regulatory issues related to a device and its use. For example, certain work environments require that any equipment be certified safe to wear and will

not increase the risks to a worker. The vendor M3SH Technology has applied its extensive experience within the mining industry to develop wearables that can be safely used under those conditions. For any new technology, governments typically monitor the private sector, identify best practices and then write regulatory policies that recognize specific methods as mandatory minimums or industry standards. From this perspective, governments may begin favouring wearables as tools to achieve specific EHS goals, which would encourage their increased adoption.

- **Compliance with regulations for worker privacy.**

As noted previously, data privacy is a concern to workers and labour unions but also is the subject of increased government scrutiny. Firms must abide by the European Union's GDPR requirements alongside emerging public and private standards for data confidentiality and security, such as not using workers' personal data to manage for productivity. Vendors should remain aware of both current and potential future expectations for collecting and managing worker data across industries.

Fast Adopting Industries Hold The Key To Wearables Success

Vendors are seeking to deepen deployment within industry sectors that have been quick to incorporate wearable devices into EHS functions, as well as expand customer awareness and product testing among firms considering the role that wearables could play in achieving their EHS objectives. The near-term market success of wearables requires successful adoption among a range of firms. Vendors should orient their commercialization efforts to:

- **Expand wearables deployment among early adopters.**

The most effective means of increasing wearables' market coverage is encouraging uptake among first-mover industries. Sectors in which EHS risks are well-defined and can be addressed by specific wearable technologies—such as construction, mining and chemical processing—have led in adoption. Vendors should work to accelerate deployment among firms utilizing or pilot testing devices for specific needs and amid competitors within an individual sector. For example, Logical Safety is assisting firms to prevent worker-equipment collisions in mining settings and uses its successful track record to secure new customers. MäkuSafe markets its technology to insurance carriers to boost the efficiency of claims data collection and management. Insurers then encourage their clients to utilize the MäkuSmart platform to prevent injuries and avoid worker compensation expenses, such as an average \$35,000 to \$45,000 per wrist sprain.

- **Understand the EHS needs of firms exploring wearable technologies.**

Vendors should reach out to firms examining wearables for their operations and more fully understand their EHS motivations, decision-making, success metrics and implementation concerns. For example, Duke Energy and the Electric Power Research Institute (EPRI) have been testing RealWear's AR Smart Glasses to provide workers with information to repair damaged utility infrastructure. During a simulated storm response, the glasses automatically sent equipment orders to warehouses for the repairs that were needed. This simulation showed the potential for reducing time and errors in the field. Shipping, logistics, chronic healthcare and first responders are examples of sectors that are collaborating with vendors to study how wearables might enhance EHS activities and operational safety.

- **Reach out to firms and sectors that are not broadly considering wearable devices.**

For firms and industries that have not widely adopted wearables for EHS purposes, vendors must understand potential use cases, educate firms and sectors about wearables in general and then convince individual firms to conduct pilot testing. Intellinium utilizes a four-step process to help firms explore and deploy wearable devices, including describing specific use cases and requirements, conducting field trials, and scaling the technology across a firm. As another example, vendors are approaching sectors such as healthcare to harness wearable devices to track the locations of facility workers and patients, monitor patients' vital signs and measure the efficacy of medicines during drug trials.

- **Promote wearables as components of the Industrial Internet of Things.**

Of growing interest across numerous sectors is the Industrial Internet of Things (IIoT)—wirelessly connecting numerous devices and sensors throughout industrial processes to more efficiently and effectively manage business operations. For example, employing wearables to monitor worker health,

integrating beacons into facilities to avoid worker-equipment collisions, adding RFID tags to track products coming off an assembly line, and having truck drivers wear glasses to monitor fatigue can create a safer manufacturing and distribution system. Vendors should leverage market awareness and adoption of IIoT schemes to generate deployment opportunities for EHS functions. Extronics promotes its technology's ability to collect inputs from IIoT devices and more quickly respond to safety concerns, which reduces downtime and increases workplace productivity.

- **Leverage case studies of successful implementation to enhance interest among all firms.**

Vendors should generate and disseminate case studies of beneficial EHS deployment across all these commercialization strategies to increase market demand. Vendors developing wearables and firms using those devices have shared numerous illustrations of the technology's positive impact to date. By using a wearable sensor from dorsaVi, VINCI Construction UK reduced the time that bricklayers bent their backs greater than 20 degrees by 85%, decreased repetitive high-risk movements by 70% and increased worker productivity by 17%. DAQRI smart helmets with augmented reality capabilities are being pilot tested by Skanska UK to deliver real-time information to its workforce about the surrounding environment and help limit safety incidents.

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