

# Bionic Enhancement

Bionic enhancement technologies such as advanced wearables and exoskeletons have the potential to expand the boundaries of current physical barriers. Smart clothing, bionic arms, and even futuristic brain-computer interfaces can support the logistics workforce, especially older workers, in areas such as training, communication, process execution, and optimization. Most importantly, they can also minimize health and safety risks in the supply chain.



## KEY DEVELOPMENTS & IMPLICATIONS

Aging workforces and labor shortages in mature markets are driving the need for exoskeletons with the market projected to exceed a billion dollars within the next decade, up from around \$200 million in 2017.<sup>2</sup> Initial logistics use cases will focus on improving health and safety, particularly in reducing the stress and strain caused by repetitive movements in manual handling activities. This is a key issue in transportation and warehousing which has one of the highest rates of occupational injury and illness in the US private sector.<sup>3</sup>

Beyond exoskeletons, breakthroughs in sensors and nanotechnologies have allowed for previously unimaginable bionic solutions. Initial industrial trials of advanced solutions in human augmentation have become prevalent in the market, such as using implants for security and access control and innovative interfaces that allow for steering computers through brain waves (e.g., Neuralink). Forward-thinking companies will utilize bionic enhancements to support the workforce in coming decades.

**Exoskeletons** are robotic suits that boost the wearer's strength and endurance, greatly reducing the physical strain of manual handling activities. They are becoming increasingly applicable and demanded in logistics to replace bulky tools to lift heavy objects. Various solutions focusing on parts (or all of) the body are being developed for mass adoption (e.g., Panasonic Power Loader Suit).

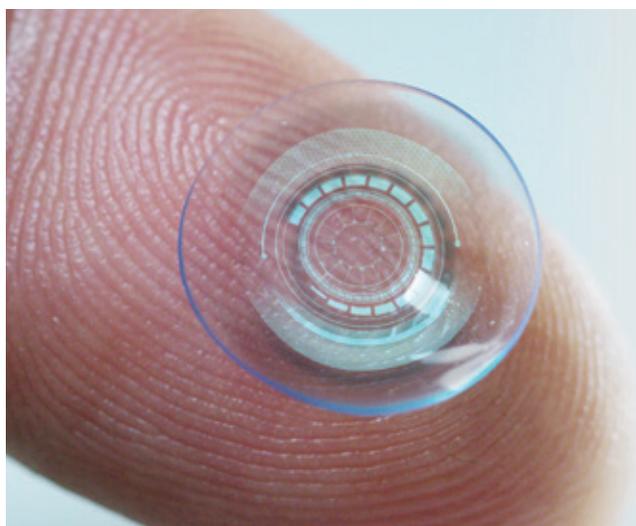
**Human augmentation** is the use of technology to boost the physical and cognitive abilities of humans and enable new forms of human-machine interaction. Smart contact lenses and smart chip implants can be used for security procedures as well as access control. Advanced chips are also being used to "connect" humans for exchanging concepts without the necessity of speech. Brain-computer interfaces that focus on using brain waves for controlling machines could potentially enable new ways of immersive interaction between humans and machines.

## KEY OPPORTUNITIES

- Increased efficiency through real-time operational analytics from wearables, enabling proactive correction
- Revolutionary potential for hands-free task execution through gesture and thought-control technologies
- Significant reduction and even elimination of work-related injuries, raising health and safety standards

## KEY CHALLENGES

- No cost/benefit indicators available so far as this trend is, at best, in its early stages of industrial adoption
- Most bionics are currently immature for enterprise usage but are developing quickly
- Ethical challenges with human enhancements



## Enabling New Hands-free Operations – Samsung Contact Lens

- Samsung has patented a smart contact lens with a built-in camera, which is controlled by blinking
- The camera projects an image onto the contact lens which augments the user's view; antennas allow the user's vision to be projected to an external device for processing
- In logistics, smart contact lenses could one day become ubiquitous and used for secure identification and augmented reality applications

Source: Samsung

Trend Assessment

Timeframe: > 5 years

Impact: Low

Sector Relevance:



AUTO



E&M



TECH



ENERGY



LSH



RET&CON