

Smart Exoskeleton Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, 2018-2028 Segmented By Component (Actuators, Power Source, Control System, Sensors, Others), By Type (Rigid v/s Soft), By Product Type (Active v/s Passive), By Body Part (Upper body, Lower body, Full body), By Application (Healthcare, Industrial, Military, Others), By Region and Competition

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Abstracts

In 2022, the Global Smart Exoskeleton Market reached a valuation of USD 168.68 Million, and it is poised for impressive growth in the forecast period, maintaining a robust Compound Annual Growth Rate (CAGR) of 10.52% through 2028. Smart exoskeletons, alternatively referred to as wearable robotic devices, are ushering in a revolution in how we enhance human capabilities. These remarkable feats of advanced technology are meticulously engineered to seamlessly integrate with the user's movements, offering unparalleled assistance across a spectrum of tasks and activities. By incorporating cutting-edge technologies, including sensors, actuators, and artificial intelligence, smart exoskeletons possess the capacity to amplify physical strength, enhance mobility, and alleviate physical strain.

Envision a future wherein individuals with limited mobility can reclaim their freedom and independence, effortlessly navigating their surroundings with the aid of these innovative devices. Picture athletes and workers operating at the pinnacle of their abilities, transcending their physical boundaries and attaining new levels of performance and endurance. Smart exoskeletons harbor the potential to revolutionize various industries, spanning healthcare, rehabilitation, military, and industrial applications. With their

adaptive and responsive nature to user needs, smart exoskeletons transcend the realm of being mere tools; they become companions that elevate human capabilities and open up a world of boundless potential. As technology continues to advance, one can only imagine the remarkable accomplishments that will be achieved with the assistance of these extraordinary devices. The future of wearable robotics shines brightly, promising a world where human potential is boundless and limitless.

Key Market Drivers

Adoption Of Smart Exoskeletons Among Various Industries

Smart exoskeletons have gained significant traction across various industries, including automotive, mining, construction, logistics, and more. These cutting-edge devices are revolutionizing the workplace by not only enhancing worker safety, well-being, and productivity but also addressing the issue of physical pain. By reducing the strain on workers' bodies and providing support during lifting and carrying heavy loads, smart exoskeletons minimize the risk of overexertion and musculoskeletal injuries. For example, GERMAN BIONIC SYSTEMS GMBH has developed the Cray X, a remarkable smart exoskeleton that empowers workers to lift and move with ease, even when handling weights of up to 30 kg. This innovative technology is reshaping the dynamics of the workforce, allowing employees to perform their tasks more efficiently and with reduced physical strain.

The adoption of smart exoskeletons is driven by a multitude of factors, including the ever-growing emphasis on occupational safety and worker well-being. Employers are recognizing the immense benefits of these advanced wearable devices, which not only enhance productivity but also create a safer and healthier work environment. As industries continue to embrace this transformative technology, the future of workplace safety and well-being looks more promising than ever before.

Advancements In Sensor Technologies

Advancements in sensor technologies have revolutionized the capabilities of smart exoskeletons by enabling them to gather precise and real-time data about the user's movements, posture, and biomechanics. These cutting-edge sensors are equipped to capture every subtle motion and provide valuable insights into the user's physical state. But the true power of smart exoskeletons lies in the integration of AI and machine learning algorithms. These intelligent systems analyze the vast amount of data collected by the sensors, allowing the exoskeleton to make real-time adjustments and provide

optimal support based on the user's movements and intentions. By continuously adapting to the user's needs, smart exoskeletons offer a seamless and personalized experience.

The rapid progress and innovation in robotics and artificial intelligence (AI) technologies are paving the way for remarkable growth opportunities in the global smart exoskeleton market. As research and development efforts continue to push the boundaries of what is possible, we can expect even more sophisticated and intelligent exoskeletons to emerge, transforming the lives of individuals with mobility challenges.

Growing Military & Defense Sector

Soldiers face numerous challenges in their daily duties, which often involve navigating through rugged terrains, climbing stairs, or traversing steep mountain slopes while carrying heavy loads. These physically demanding tasks not only require exceptional endurance and strength but also put soldiers at a higher risk of sustaining hip, back, and knee injuries.

To address these challenges and mitigate the risks, military organizations worldwide have recognized the immense value of smart exoskeleton technologies. These cutting-edge advancements in wearable robotics provide soldiers with enhanced support and assistance, allowing them to efficiently transfer burdens and reduce the strain on their bodies. By leveraging the power of these innovative solutions, military personnel can overcome obstacles with greater ease and efficiency, ensuring their well-being and ultimately contributing to mission success.

The integration of smart exoskeleton technologies into military operations not only enhances soldiers' physical capabilities but also optimizes their overall performance. By minimizing physical exertion and fatigue, these advanced exoskeletons enable soldiers to maintain their focus and combat effectiveness for longer durations. This increased endurance and reduced risk of injuries significantly improve the operational readiness and effectiveness of military forces in challenging environments.

Moreover, the utilization of smart exoskeleton technologies in military settings opens up new possibilities for customization and adaptability. These exoskeletons can be tailored to meet the unique requirements of different tasks and environments, providing soldiers with a seamless and intuitive user experience. With the ability to adjust parameters such as assistance levels, speed, and torque, these smart exoskeletons empower soldiers to optimize their performance based on specific mission objectives. The integration of

smart exoskeleton technologies into military operations is revolutionizing the way soldiers navigate their daily challenges. By providing enhanced support, reducing the risk of injuries, and optimizing performance, these advanced solutions are shaping the future of modern warfare. As military personnel continue to embrace these innovative technologies, they can confidently overcome obstacles, ensure their well-being, and achieve mission success with utmost efficiency and effectiveness.

Increasing Adoption of Smart Exoskeletons for Occupational Safety & Worker

The increasing adoption of smart exoskeletons for occupational safety and worker well-being is driving a surge in demand for this groundbreaking technology. As industries across the globe recognize the paramount importance of ensuring the health and safety of their workforce, smart exoskeletons have emerged as a transformative solution. These wearable robotic devices are designed to augment and support human physical abilities, reducing the risk of injury and fatigue in demanding work environments.

One of the key drivers behind the escalating demand for smart exoskeletons is the pressing need to address workplace injuries and enhance the overall efficiency of labor-intensive tasks. Industries such as manufacturing, construction, and logistics have embraced these wearable devices to empower their workers. By providing mechanical support to muscles and joints, smart exoskeletons enable employees to undertake physically strenuous tasks with reduced effort and decreased risk of musculoskeletal injuries.

Moreover, the integration of advanced technologies like sensors, AI algorithms, and data analytics has made smart exoskeletons more versatile and adaptable to a wide range of applications. These technologies enable real-time monitoring of worker movements, allowing for personalized assistance and adjustments, further enhancing both safety and productivity. The ability to collect and analyze data on worker performance and health is proving invaluable for companies striving to optimize their operations while prioritizing employee well-being. The increasing adoption of smart exoskeletons is a testament to their immense potential in revolutionizing occupational safety and worker health. With their ability to mitigate physical strain, reduce workplace injuries, and improve overall productivity, smart exoskeletons are poised to play an increasingly pivotal role in shaping the future of work across various industries. As organizations continue to prioritize the welfare of their employees, the demand for these innovative devices is set to soar, paving the way for a safer and more efficient workforce.

Key Market Challenges

High Cost

The high cost of smart exoskeletons stands as a significant barrier that limits the widespread adoption of this transformative technology. While these wearable robotic devices hold immense promise in revolutionizing various industries by enhancing worker safety and productivity, their prohibitive price tags pose a considerable challenge for both businesses and individuals alike. One of the primary factors contributing to the elevated cost of smart exoskeletons is the intricate engineering and advanced technology that goes into their design and production. These devices often incorporate cutting-edge materials, sensors, artificial intelligence algorithms, and custom-fitted components to ensure optimal performance and user comfort. The research and development required for such sophisticated technology further drive up the overall cost.

Additionally, the limited scale of production contributes to higher prices. As smart exoskeletons are not yet mass-produced, economies of scale have not fully come into play, making it more challenging to bring down manufacturing costs. This, in turn, translates to higher prices for end-users. For many businesses, especially small and medium-sized enterprises, the substantial upfront investment required to implement smart exoskeletons for their workforce can be a financial deterrent. This cost barrier may lead companies to opt for less expensive alternatives or delay adopting the technology altogether, even if it could significantly improve worker safety and productivity.

Addressing the cost issue is crucial to expanding the accessibility and adoption of smart exoskeletons. As advancements continue in the field, economies of scale are likely to reduce production costs, making these devices more affordable. Moreover, increased competition among manufacturers and potential government incentives could help alleviate the financial burden associated with acquiring smart exoskeletons. In doing so, we can unlock the full potential of this revolutionary technology and make workplaces safer and more efficient for all.

Limited Customization

The limited customization options available for smart exoskeletons represent a significant constraint that hinders their broader adoption. While these wearable robotic devices hold immense potential for enhancing worker performance and safety, their one-

size-fits-all approach often falls short of meeting the diverse needs of various individuals and industries.

Smart exoskeletons are typically designed with a standard set of features and specifications. This can be problematic because different job roles and physical conditions require varying levels of assistance and support. Industries such as construction, manufacturing, and healthcare, each with unique demands and ergonomic requirements, may find it challenging to deploy a single, non-customizable solution effectively. The demand for customization also extends to software and user interfaces. Workers require personalized training and user-friendly interfaces that align with their specific tasks and preferences. A lack of flexibility in these aspects can hinder the learning curve and reduce the overall effectiveness of smart exoskeletons in a particular workplace.

To overcome these limitations and boost demand, manufacturers need to invest in more adaptable and customizable designs. This involves offering a range of sizing options, adjustable settings, and modular components that can be tailored to individual users and industry requirements. Improved software interfaces that allow for easy customization and training are equally vital. By addressing these customization challenges, smart exoskeletons can become more accessible and effective tools across a wider spectrum of industries, ultimately realizing their potential in improving both worker well-being and productivity.

Key Market Trends

Surge in Advancements in Robotics and AI

The surge in advancements in robotics and artificial intelligence (AI) within the field of smart exoskeletons is poised to significantly boost the demand for this transformative technology. As research and development efforts continue to push the boundaries of what these wearable devices can achieve, their potential to revolutionize various industries, particularly in terms of enhancing worker safety and performance, becomes increasingly evident. One of the most compelling factors driving this demand is the rapid evolution of AI algorithms. These sophisticated algorithms allow smart exoskeletons to not only provide physical support but also adapt in real-time to the wearer's movements and needs. AI-driven exoskeletons can learn and anticipate user actions, making them more intuitive and effective in assisting with tasks ranging from heavy lifting in manufacturing to providing mobility assistance in healthcare settings. This adaptability not only improves worker comfort and reduces fatigue but also minimizes the risk of

overexertion and injury.

Furthermore, robotics advancements have led to the development of more lightweight and ergonomic smart exoskeletons that are easier to wear for extended periods. Innovations in materials, sensors, and energy efficiency have contributed to making these devices more practical and user-friendly, making them an attractive solution for a broader range of industries.

Rise In the Research Activities for Development of More Applications

The surge in research activities aimed at expanding the applications of smart exoskeletons is expected to have a profound impact on the demand for these innovative wearable devices. As the technology matures and researchers continue to explore new use cases, the potential for smart exoskeletons to transform various industries beyond their current applications becomes increasingly apparent. While their initial adoption was primarily in fields like manufacturing and healthcare, ongoing research is uncovering opportunities in areas such as military, sports, rehabilitation, and even everyday life. This diversification in applications expands the market and draws attention to the adaptability and utility of smart exoskeletons.

Researchers are also striving to make smart exoskeletons more accessible by designing devices that cater to specific populations or conditions. This includes developing exoskeletons tailored for children with mobility impairments, the elderly, or individuals with neurological disorders. Such customization and specialization open up new markets and increase demand as more people and industries recognize the potential benefits. As the research landscape continues to evolve and uncover new possibilities for smart exoskeletons, the demand for these devices is likely to surge. The ability to address a broader spectrum of physical challenges, coupled with ongoing advancements in technology and interdisciplinary collaborations, will make smart exoskeletons a transformative solution in numerous fields, ultimately shaping the way we work, live, and interact with technology.

Segmental Insights

Component Insights

Based on component segment, actuators accounted for nearly one-third of the total market share in 2022 and are projected to maintain their leadership in terms of revenue throughout the forecast period. Furthermore, this segment is anticipated to exhibit the

highest compound annual growth rate (CAGR) from 2024 to 2028. This can be attributed to the remarkable feature of actuators in enhancing the overall efficiency of smart exoskeletons by effectively controlling any unintended movements. The study also extensively explores other essential components such as sensors, power sources, control systems, and various additional elements to provide a comprehensive understanding of the subject matter.

Type Insights

Based on the type, in the year 2022, rigid exoskeletons are expected to dominate the market as they currently hold the majority share. These exoskeletons offer exceptional protection to the wearer, safeguarding them from any potential harm in the event of a fall or accident. This makes them highly sought-after in various sectors such as medical, military, and industrial settings. However, the market for soft exoskeletons is projected to witness significant growth during the projected period. This can be attributed to the increasing utilization of carbon fibre in their production, which enhances their durability and performance. Soft exoskeletons, known for their lightweight nature, are gaining popularity not only in the military and industrial sectors but also in other areas due to their versatility and adaptability. The advancements in both rigid and soft exoskeleton technologies underscore the ever-evolving landscape of exoskeleton development. With each passing day, these remarkable innovations continue to shape the future of human augmentation, revolutionizing industries and improving the quality of life for individuals around the world.

Regional Insights

North America is anticipated to account for the largest revenue share in the target market. This is primarily attributed to the rising incidences of neurological disorders, such as Parkinson's disease and spinal cord injuries, as well as higher healthcare and personal care expenditure in countries within the region. The market in Asia Pacific is expected to witness the highest compound annual growth rate (CAGR), driven by the increasing demand for exoskeletons for medical purposes, including rehabilitation and assistance for individuals with mobility impairments. Moreover, countries such as Japan, Singapore, and China are actively involved in the rapid development of exoskeleton-related technologies, supported by significant funding from both private and public sectors. These factors are expected to further propel the growth of the exoskeleton market in the Asia Pacific region.

Key Market Players

ATOUN Inc.

Cyberdyne Inc.

Ekso Bionics Holdings Inc.

Rewalk Robotics, Inc.

Bionik Laboratories Corp.

Parker-Hannifin Corp.

Bioservo Technologies AB

Rex Bionics Ltd.

Bioness Inc.

B-Temia Inc.

Report Scope:

In this report, the Global Smart Exoskeleton Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Smart Exoskeleton Market, By Component:

Actuators

Power Source

Control System

Sensors

Others

Smart Exoskeleton Market, By Type:

Rigid

Soft

Smart Exoskeleton Market, By Product Type:

Active

Passive

Smart Exoskeleton Market, By Body Part:

Upper body

Lower body

Full body

Smart Exoskeleton Market, By Application:

Healthcare

Industrial

Military

Others

Smart Exoskeleton Market, By Region:

North America

United States

Canada

Mexico

Europe

France

United Kingdom

Italy

Germany

Spain

Asia-Pacific

China

India

Japan

Australia

South Korea

South America

Brazil

Argentina

Colombia

Middle East & Africa

South Africa

Saudi Arabia

UAE

Kuwait

Turkey

Egypt

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Smart Exoskeleton Market.

Available Customizations:

Global Smart Exoskeleton market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

Company Information

Detailed analysis and profiling of additional market players (up to five).

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