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Artificial Intelligence (AI) in Construction Market – Global Industry Size, Share, Trends, Opportunity, and Forecast Segmented by Application (Planning and Design, Safety, Autonomous Equipment, Monitoring, And Maintenance), By Region, By Competition 2018-2028.

Abstracts

Global Artificial Intelligence (AI) in Construction Market has valued at USD 3.81 Billion in 2022 and is anticipated to project robust growth in the forecast period with a CAGR of 22.95% through 2028, Artificial intelligence in the construction industry is experiencing a digital transformation. Focusing on technologies like artificial intelligence and machine learning at every stage of engineering and construction, from design, preconstruction, construction, and operations to asset management, is developing the construction industry's potential to new levels.

As a technological shift emerges in the construction industry, it is becoming beneficial for the companies that upgrade the technology. Thus, adopting AI products and services in construction is expected to contribute considerably to market growth in the coming years.

Key Market Drivers

Efficiency and Productivity Improvement

Efficiency and productivity improvement are central driving forces behind the flourishing adoption of Artificial Intelligence (AI) in the global construction industry. In a sector historically marred by project delays and cost overruns, AI presents a compelling

solution for enhancing project management, scheduling, and resource allocation, ultimately revolutionizing how construction projects are executed. AI leverages advanced technologies like machine learning, computer vision, and predictive analytics to optimize project workflows. These technologies enable construction companies to make more precise estimations, reduce planning errors, and better allocate resources, resulting in projects that are not only completed more swiftly but also within budget. This leads to a substantial reduction in costly delays and overruns, making AI a game-changer for project efficiency.

Furthermore, AI's data analysis capabilities help construction professionals identify trends and patterns that can improve decision-making. This includes forecasting material requirements, labor needs, and equipment usage, which further contributes to streamlined processes and efficient resource allocation. Automation, powered by AI, is another key factor in productivity enhancement. Tasks like repetitive data entry, documentation, and even some physical construction processes can be automated, reducing the time and effort required by human workers. This frees up human resources to focus on more strategic and creative aspects of the construction process.

AI also excels in risk management and mitigation. It can predict potential problems by analyzing historical project data, enabling proactive measures to be taken. This minimizes disruptions, rework, and associated costs. Additionally, AI can improve supply chain management, ensuring that materials and equipment are readily available when needed, further increasing productivity.

Collaborative tools and platforms that use AI facilitate real-time communication and coordination among project stakeholders. This keeps all parties informed and on the same page, fostering better collaboration and reducing communication-related delays. In summary, the construction industry is experiencing a profound transformation through AI-driven efficiency and productivity enhancements. With its ability to optimize resource allocation, reduce project delays, automate routine tasks, and enhance data-driven decision-making, AI is positioned as a cornerstone for improving construction project outcomes. As the global construction landscape becomes increasingly complex, the integration of AI will play a pivotal role in delivering projects more efficiently, cost-effectively, and with higher quality, ensuring long-term competitiveness for construction companies.

Cost Reduction

Cost reduction is a pivotal driver propelling the global Artificial Intelligence (AI) in the

construction market. In an industry notorious for budget overruns and inefficiencies, AI offers transformative solutions to mitigate these challenges. By harnessing machine learning, predictive analytics, and automation, construction companies can significantly cut operational costs and enhance their overall profitability. AI-driven resource allocation and project management streamline construction processes, optimizing labor and material utilization. This not only reduces waste but also minimizes the need for expensive rework, ultimately leading to substantial savings. Moreover, predictive maintenance powered by AI can preemptively identify equipment issues, minimizing costly downtime and emergency repairs.

Cost efficiency extends to improved safety practices. AI-powered sensors and surveillance systems enhance on-site safety by identifying potential hazards in real-time. Fewer accidents translate to lower insurance premiums and legal liabilities, preserving financial resources. AI's data-driven decision-making capabilities enable construction firms to make informed choices, reducing the risk of costly mistakes. Whether it's choosing the most cost-effective building materials, refining project schedules, or optimizing energy consumption, AI provides valuable insights that drive cost-effective decisions.

Furthermore, automation and robotics, underpinned by AI, reduce the reliance on manual labor for tasks such as bricklaying and 3D printing. Labor costs form a significant portion of construction expenditures, making automation an attractive avenue for cost reduction. The construction industry is highly competitive, and cost-efficient practices provide a significant edge. Firms adopting AI technologies can complete projects faster, at a lower cost, and with improved quality compared to their counterparts relying solely on traditional methods. This competitive advantage can translate into increased market share and profitability. In summary, cost reduction serves as a compelling catalyst for the adoption of AI in construction. With AI's capacity to optimize resource allocation, prevent costly accidents, enable data-driven decision-making, and automate labor-intensive tasks, the construction industry stands to benefit significantly from reduced operational expenses. As global construction projects continue to rise in complexity and scale, AI's cost-cutting capabilities position it as a crucial component for the industry's future success.

Key Market Challenges

Initial Investment Costs

Initial investment costs stand as a significant impediment to the widespread adoption of

Artificial Intelligence (AI) in the construction industry. While AI holds immense promise for enhancing efficiency, safety, and overall project outcomes, the substantial upfront financial commitments required for its implementation can be a formidable barrier for many construction firms. The integration of AI technologies in construction necessitates substantial investments in various aspects. Firstly, there are hardware costs for procuring the necessary computing infrastructure and devices capable of running AI applications effectively. These hardware investments can be significant, especially for smaller or mid-sized construction companies with limited capital resources.

Secondly, software and AI platform costs come into play. Developing or acquiring AI solutions tailored to the specific needs of the construction industry can be costly. Customization and licensing fees further add to the financial burden. In addition, companies need to allocate budget for ongoing software maintenance, updates, and support. Training the workforce is another critical component of the investment. Construction professionals need to acquire the skills to effectively operate and manage AI systems. This requires funding for training programs, workshops, and often hiring or contracting AI experts to assist in the early stages of implementation.

Moreover, there are infrastructure costs, such as setting up data collection and analytics tools, sensors, and connectivity solutions. Ensuring that a construction site is equipped to gather and transmit data efficiently can be both complex and expensive.

For many construction companies, the capital required for these investments can be a daunting hurdle. These upfront costs might lead to concerns about ROI and payback periods. In an industry where profit margins can be tight and projects vary in scale and complexity, this financial commitment can deter some from embracing AI technology, especially when traditional methods seem more cost-effective in the short term. To overcome this challenge, it is important for construction companies to carefully assess the long-term benefits of AI, considering factors like reduced project delays, enhanced safety, and better resource allocation. Government incentives, subsidies, or industry partnerships may also help offset initial costs. As AI technology matures and becomes more accessible, it is expected that the initial investment barrier will gradually diminish, making AI adoption in construction more attainable for a broader range of companies.

Lack of Skilled Workforce

The lack of a skilled workforce presents a significant impediment to the growth and development of the global Artificial Intelligence (AI) in the construction market. While AI holds tremendous potential for transforming the construction industry, it demands a

specialized skill set that is currently in short supply. This shortage of qualified professionals capable of implementing and managing AI technologies creates several challenges for the construction sector.

Technical Expertise: AI involves complex algorithms, machine learning, data analytics, and programming. Construction companies need skilled professionals who can design, develop, and implement AI solutions tailored to their specific needs. The scarcity of AI experts who understand the intricacies of the construction industry and can apply AI effectively hinders the adoption of these technologies.

Data Scientists: AI relies heavily on data for training and decision-making. Data scientists with expertise in collecting, cleaning, and analyzing construction-related data are in high demand. Without these professionals, construction firms may struggle to derive actionable insights from their data, limiting the benefits of AI. Machine Learning Specialists: Machine learning is a core component of AI, and it requires specialists who can build and fine-tune algorithms for predictive analytics, optimization, and automation. These experts are scarce and in competition with various industries beyond construction. AI Project Managers: Managing AI projects in a construction context requires a unique skill set. Project managers must understand the construction process, safety protocols, and the nuances of AI implementation. Finding individuals with these qualifications can be challenging.

Interdisciplinary Skills: Effective AI integration in construction often demands interdisciplinary skills. Professionals need to bridge the gap between AI technology and construction domain knowledge. The shortage of such cross-disciplinary experts complicates AI adoption. Continuous Learning: AI is a rapidly evolving field. AI professionals in construction must stay updated with the latest advancements and best practices. The need for continuous learning further highlights the scarcity of suitable talent.

Addressing this challenge requires a multifaceted approach. Construction companies can invest in training programs to upskill their existing workforce. Collaboration with educational institutions and AI training providers can help bridge the skills gap. Government and industry initiatives to encourage STEM (Science, Technology, Engineering, and Mathematics) education can also contribute to a future workforce with the necessary skills. As the demand for AI in construction continues to grow and as AI technology becomes more ubiquitous, it is expected that more individuals will pursue AI-related careers and training programs, gradually alleviating the workforce shortage. Until then, companies must adapt by seeking partnerships, outsourcing certain tasks,

and investing strategically in developing AI competencies within their organizations.

Data Quality and Availability

The quality and availability of data represent a significant bottleneck for the global Artificial Intelligence (AI) in the construction market. While AI relies heavily on data for training models, making predictions, and optimizing processes, the construction industry often faces challenges in this regard. The limitations related to data quality and availability can hamper the successful implementation of AI in construction. Data Fragmentation: Construction projects generate vast amounts of data, but this data is often fragmented and distributed across various systems and stakeholders. Integrating and standardizing this data for AI applications can be a complex and time-consuming process.

Data Accuracy: Inaccurate or incomplete data can severely compromise the effectiveness of AI systems. Construction data might contain errors, inconsistencies, or missing information, which can lead to incorrect conclusions and decisions when AI models are trained on such data. Data Silos: Data silos within construction organizations can prevent efficient data sharing and utilization. These silos can hinder AI implementation, as comprehensive data access is essential for meaningful insights and predictions.

Legacy Systems: Many construction companies use legacy systems that might not be compatible with modern data analytics and AI tools. This disconnect can hinder the extraction and utilization of valuable data. Data Security: Construction data often includes sensitive project and client information. Ensuring data security and privacy while utilizing AI is paramount. Compliance with data protection regulations can be challenging, and security breaches can have severe consequences. Data Collection and Standardization: The collection of relevant data from construction sites and equipment can be a technical challenge. Additionally, standardizing data formats and quality across different sources is necessary for AI applications but can be difficult to achieve.

Limited Historical Data: AI models benefit from a large and diverse dataset, which is often limited in construction due to project-specific nature. This can affect the accuracy and reliability of AI predictions, especially for smaller companies with less historical data. Data Ownership and Sharing: The construction industry involves numerous stakeholders, each with its own data. Sharing and ownership agreements can be complex, making it challenging to access the data required for AI applications.

Addressing these challenges requires concerted efforts from the construction industry. Companies must invest in data quality improvement by implementing data validation processes and ensuring data accuracy. They should also consider modernizing their data infrastructure to better facilitate data collection, sharing, and utilization. Furthermore, partnerships with technology providers and data analytics experts can help construction companies navigate these challenges. By fostering a data-centric culture and promoting standardized data practices, the construction industry can unlock the full potential of AI, improving project management, decision-making, and overall efficiency in construction processes.

Key Market Trends

Safety Enhancement

Safety enhancement is emerging as a paramount driver in the global Artificial Intelligence (AI) in construction market. The construction industry has long grappled with safety concerns and a high rate of accidents, making it imperative to leverage AI technologies to mitigate these risks and improve overall job site safety. AI-driven safety solutions are now at the forefront of construction innovation. Computer vision, sensors, and AI algorithms are combined to monitor construction sites in real-time. These systems can detect potential safety hazards, such as unsafe working conditions, unattended equipment, or the presence of unauthorized personnel. In doing so, AI not only prevents accidents but also ensures that construction sites comply with stringent safety regulations and standards.

Furthermore, wearables equipped with AI are being used to monitor the health and well-being of construction workers. These devices can track vital signs, detect fatigue, and alert workers to potential dangers. This proactive approach to safety significantly reduces the likelihood of accidents and injuries.

AI-powered safety systems provide real-time alerts and notifications, allowing for immediate responses to critical situations. This rapid intervention ensures that safety concerns are addressed promptly, preventing accidents from escalating. With an increasing emphasis on worker welfare and regulatory compliance, the adoption of AI for safety enhancement in construction is poised to grow. Construction companies recognize that investing in AI-driven safety measures not only protects their workforce but also contributes to project efficiency by reducing downtime and associated costs. As a result, safety enhancement stands as a compelling driving force in the global AI in

construction market.

Automation and Robotics

Automation and robotics are poised to be key drivers in the global Artificial Intelligence (AI) in the construction market. These technologies, underpinned by AI, are revolutionizing the construction industry by enhancing efficiency, precision, and safety in various aspects of construction processes.

AI-powered automation is making significant strides in tasks such as bricklaying, concrete pouring, and 3D printing. Construction robots equipped with AI algorithms can perform these tasks more quickly and accurately than human labor, reducing manual labor requirements and minimizing errors. This not only speeds up project timelines but also improves the overall quality of construction. Furthermore, autonomous vehicles and drones are being used for site inspection, surveying, and material transportation. AI enables these machines to navigate construction sites, collect data, and perform tasks with a high level of autonomy. This reduces the need for manual labor in potentially hazardous environments, improving site safety and productivity.

AI-driven robotics also have applications in heavy lifting and material handling. These robots can move heavy loads with precision and without fatigue, reducing the risk of accidents and injuries to human workers. The combination of automation and robotics powered by AI not only optimizes construction processes but also leads to cost reductions by reducing labor expenses, minimizing material wastage, and preventing rework. As a result, construction companies are increasingly integrating these technologies to stay competitive in an evolving industry landscape, making automation and robotics a driving force in the global AI in construction market.

Segmental Insights

Application Insights

Planning and Design Segment will dominate the market, The application of AI in the planning and design segment of the construction industry offers several benefits, ranging from enhanced efficiency and accuracy to improved decision-making. Planning and design are crucial phases of construction. Any flaws or errors committed at this stage of development may incur a severe loss to the contractors in the later stages of the project. Such scenarios lead to many budget constraints and delays in project completion.

The adoption of Building Information Modeling in the construction industry has emerged as a new way to create the 3D models that construction professionals rely on to design, build, and repair accurately over the past few years. BIM platform programmers are improving the capabilities of BIM with smart, AI-driven features. In September 2022, construction technology startup Toric, a data platform used by construction, engineering, and similar sectors that enabled anyone to integrate, transform, model, and visualize data without writing code, raised USD 22 million in funding. As part of the investment, Toric will offer new integrations for Autodesk Construction Cloud and Autodesk's BIM design tools, such as Revit, Navisworks, and Civil 3D.

Regional Insights

North America is expected to dominate the market during the forecast period. The North America market for artificial intelligence (AI) in construction has been experiencing significant growth in recent years. The region has been at the forefront of technological advancements and digital transformation in the construction industry.

The North American market for AI in construction is one of the largest and fastest-growing globally. The market is driven by increasing construction activities, demand for advanced technologies, and a focus on improving productivity and efficiency. The market encompasses various AI applications across different stages of the construction lifecycle, including planning, design, construction, and operations.

North America, particularly the United States, has been a hub for technological innovation in the construction industry. Many regional companies have been at the forefront of developing and implementing AI technologies for construction applications. The market has witnessed the adoption of AI-driven solutions such as predictive analytics, computer vision, robotics, and machine learning across construction processes.
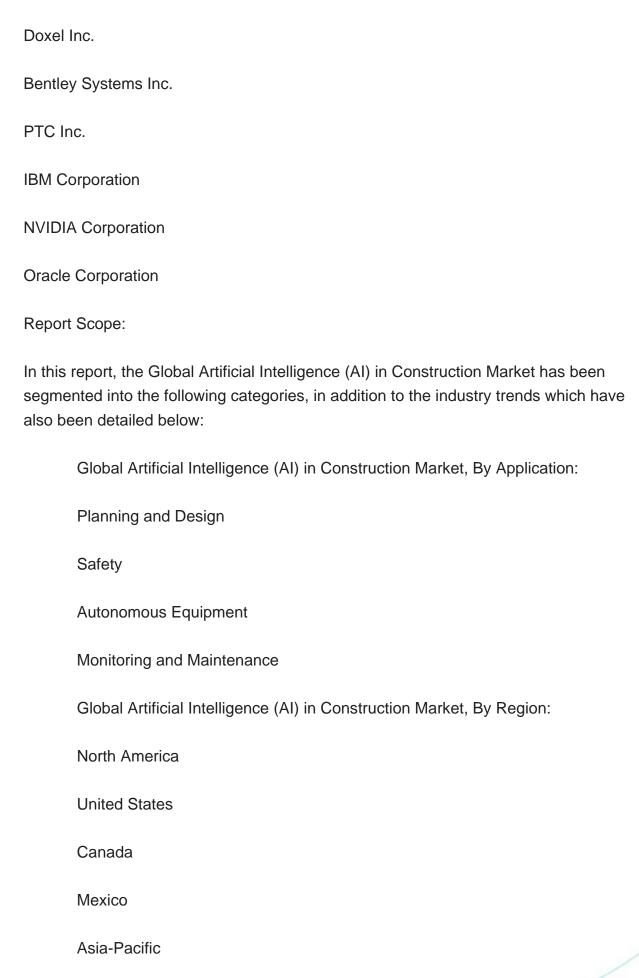
Key Market Players

Autodesk Inc.

Building System Planning Inc.

Smartvid.io Inc.

Doxel Inc.

Bentley Systems Inc.

PTC Inc.

IBM Corporation

NVIDIA Corporation

Oracle Corporation

Report Scope:

In this report, the Global Artificial Intelligence (AI) in Construction Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Global Artificial Intelligence (AI) in Construction Market, By Application:

Planning and Design

Safety

Autonomous Equipment

Monitoring and Maintenance

Global Artificial Intelligence (AI) in Construction Market, By Region:

North America

United States

Canada

Mexico

Asia-Pacific

China

India

Japan

South Korea

Indonesia

Europe

Germany

United Kingdom

France

Russia

Spain

South America

Brazil

Argentina

Middle East & Africa

Saudi Arabia

South Africa

Egypt

UAE

Israel

Competitive Landscape

Company Profiles: Detailed analysis of the major companies presents in the Global Artificial Intelligence (AI) in Construction Market.

Available Customizations:

Global Artificial Intelligence (AI) in Construction 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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