# viAct

# Construction Technology Trends: 2021-2022

## Market Predictions & Research Updates

NO BELT

NO BELT

# TABLE OF CONTENT

# Executive Summary

Digitization in construction has become the hot topic all across the industry especially after the safety concerns raised by the COVID-19 pandemic. Many market reports and research literature predicts a growing trend of adaptation in digital technologies due to many antecedents and scenario. Thus this report is an attempt to collect secondary literature from both market reports and research literature with objective to address the following questions:

| |
|---|
| **What are the major pain points existing in the construction jobsites?** |
| **How has COVID-19 impacted the technology adoption in the construction industry?** |
| **What are the major antecedents that have provoked the adoption of technology in the construction industry?** |
| **How well is the technological adoption backed by R&D in this field?** |
| **Which technologies were the "Talk-of-the-Town" for the construction industry in 2021?** |
| **What is the growth trend for construction tech market in the coming years?** |

The report highlights an increased liberalization in technological adoption in construction industry in the year 2021 as a result of the post-pandemic restrictions, safety mandates and remote working situations. Most of the technological advancements in the industry have been seen to focus on promoting a safer construction ecosystem and at the same time enhancing the productivity in the jobsite by automating documentation, safety surveillance and efficient remote management. Amongst all the technological advancements, AI, IoT, Robotics and BIM have been projected as the most trending technology in the construction ecosystem, both by the market reports and research publications projects. Further, it has been projected that the artificial intelligence market shall rise with the application of "Risk Management" for safety surveillance. Similarly, the major utility area for IoT and BIM market is predicted to be real-time remote operations and improved planning respectively. In addition to this, it has been found that demolition contributes highly to automation market in construction via. Robotics. Thus, there is an expected global upsurge of construction technology adoption. However, Asia Pacific (APAC) construction market is expected to project the highest growth in terms of technology adoption especially due to increased construction projects and government initiatives. Thus, in a nutshell, the overall trends predict a positive market growth in the construction technology with rise of ConTech startups updating the current construction scenario.

Construction Technology Trends: 2021-2022 | Market Predictions & Research Updates      Page 3

# Introduction

The construction business is one of the most revenue-generating one all across the world. This has made construction ecosystem constantly change in terms of the economic and social climate thereby evolving the size and scope of the industry in a constant manner. Despite timely adaptation to changes in accordance to changing requirements, construction has been the slowest industry to adopt technology. However this trend was highly affected by the COVID-19 pandemic. The spread of pandemic in the year 2020 and the imposition of restrictions accelerated the pace of technology adoption in the construction ecosystem. This adoption of technology has brought sustainable growth throughout many sectors of construction, especially in improvement of workers'working environment, for making construction projects productive, to establish remote control and monitoring of construction projects etc.

The technology adoption has eased the rapid expansion of commercial construction projects owing to the raise of metropolitan cites. Moreover, the changing scenario of the workplace in the post-COVID era has also been eased by the technology adoption as psychological safety has become a major aspect to fill inefficiencies and fight the increasing concerns over psychological safety in construction job-sites. New technological trends in construction such as Artificial Intelligence, Building Information Modeling softwares, robotics and many others have therefore been a driver of co-existence in the post-COVID era.

Many researchers have been focusing on to the point that technological transfer in the construction sector has just been very limited. However, the constant need in the market for technology adoption in construction has also accelerated the Research & Development (R&D) sector tremendously. Thus technology trend in the market needs to be related by research findings as well in order to establish a cordial relationship and to know the actual scenario of technology innovations in construction and its adoption trend in the market.

Thus, the current report presents the market trend analysis of the most adopted technologies in the construction industry by the year 2021 with predictions of its future growth and implications (as collected from the secondary sources). Apart from this, the report backs the market trends with research highlights from the most trending technologies Thus, the report is one of its kinds as it provides a simultaneous glimpse of market trend and research updates for the most emerging technologies in the construction industry.

# Point at Issue in Construction

Construction is one of the oldest professions in the world, yet the construction industry is prone to many issues till date.

U.S. Bureau of Labour statistics says each year, 9.7 of every 100,000 construction workers suffer a fatal injury, which is the fourth-highest rate of any industry. Moreover, falls accounts for 33% of all construction deaths. This suggests that eliminating falls in construction would save more than 300 lives every year. OSHA in 2020 reported that over 60% of all construction-related deaths are caused by falls, struck by equipment, caught in between, and electrocutions, termed as the "Fatal Four". National Institute of Health (NIH) reports that injury rates in construction are 71% higher than injury rates across all industries on an average.

These accidents are not only detrimental to the workforce but also hampers the productivity of the entire project. As per Midwest Economic Policy Institute fatal construction injuries are estimated to cost the US $5 billion each year in health care, lost income, reduced quality of life, and lost production. Liberty Mutual reports workers' compensation claims for non-fatal falls account for $2.5 billion annually. More than 130,000 construction workers missed days of work due to injuries in 2019, decreasing productivity says U.S. Bureau of Labour statistics.

Many authors have reported the cause for this to be slow technological adoption in the sector. According to the McKinsey Global Institute industry digitization index, the construction industry ranked second from last (21 of 22) in its list of digitized sectors. It came in just above agriculture and hunting in its levels of digitization across several categories, including digital spending, digitization of work, and business processes.

However it is very evident that the COVID-19 has changed the construction ecosystem bringing more digitization on the construction ground. In a talk with viAct (Beyond Vision), Mr. Vikas Bansal, Deputy Project Manager, AECOM has said

*"Post COVID scenario construction industry has more evolved digitally. It has helped us to make the process more efficient, save us more money and make us more competitive for our clients".*

The COVID-19 restrictions have disrupted the construction ecosystem for a while but with growing technological adoption the scenario is expected to change for better in the coming times!

# Construction Technology Adoption: Antecedents & Trends

The conventional method used in construction thus has witnessed rapid change due to the advancement in technology brought by innovative tech solutions. Digital transformation has been looked increasingly by construction professionals as a notion of advancement in the construction ecosystem. ConTech startups are thereby paving a great way out in adoption of innovative technologies in the construction industry. The Global Construction Industry report estimates that the construction industry will raise upto $10.5 trillion by 2023, with a forecasted CAGR of 4.2% from 2018 to 2023. The increasing urbanization with affordable housing schemes in the Asia-Pacific has made it the construction hotspot especially in the last few years. The region has also marked a predominant adaptation of technology especially to gear up the pace of the projects by lowering cost and improving productivity.

As said by Prof. (Dr.) Ashok Vaseashta, CEO/CTO and Executive Director for Research with the International Clean Water Institute in Virginia, USA in an interview with viAct (Beyond Vision) has also highlighted
"Hong Kong, China, Singapore, India are amongst some of top countries to transform from construction to ConTech with adoption of technologies like AI, IoT, Computer Vision, Robotics, BIM technology etc"

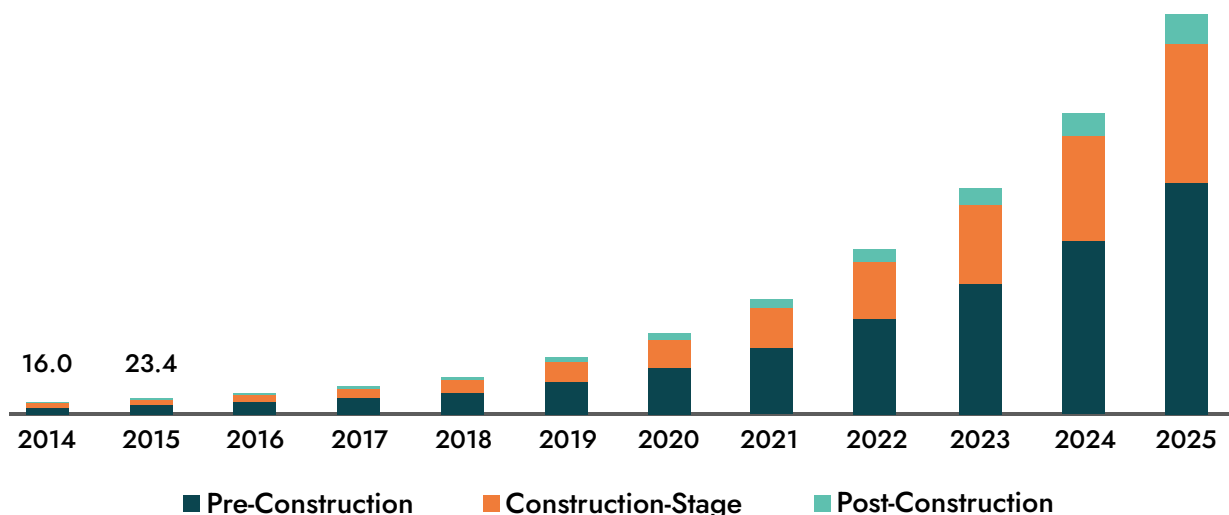## Asia Pacific AI in construction market size, by stage, 2014 - 2025 (USD Million)



Fig 1: Construction Market Size Trend (Asia-Pacific) Analysis and Prediction
(source: www.grandviewerreserach.com)

The JLL's State of Construction Tech report clearly depicts that corona virus pandemic had a big impact on accelerating tech adoption in the construction industry post 2020. ConTech startups therefore are booming with greater adaptation of technology for improving productivity, eliminating inefficiencies, and adapting to a younger workforce of digital natives to work with technology. In other words, the digital landscape is evolving in an unbelievable speed. The question for any industry no more remains "if they are going to digitalize their workspace", but rather it has shifted to "when and how are they going to keep up and adapt with ever evolving technologies". This is the same with the construction industry which is actually showing adaptation to technology. Furthermore, these technologies are highly appreciated these days because digitization is helping construction industry to evolve through thick & thin times especially by making the workflow more transparent. An industry expert, Ms. Anna Lazar, Strategic Alliances & Partnerships, Autodesk Construction Solutions, Autodesk have said in an interview with viAct (Beyond Vision)

*"I think that being able to drive digitalization in the field dramatically enhances and up levels the collaboration between the field and the office"*

On tracing the research literature, it is quite evident that global adoption of technology in construction ecosystem has been brought by many antecedents which have otherwise caused much inefficiency in the traditional construction ecosystem. The bibliometric analysis in the SCOPUS database using the search string "Technology innovation AND Construction" depicts the following number of publications in the various technological aspects for the past 5years (as in Fig. 2).
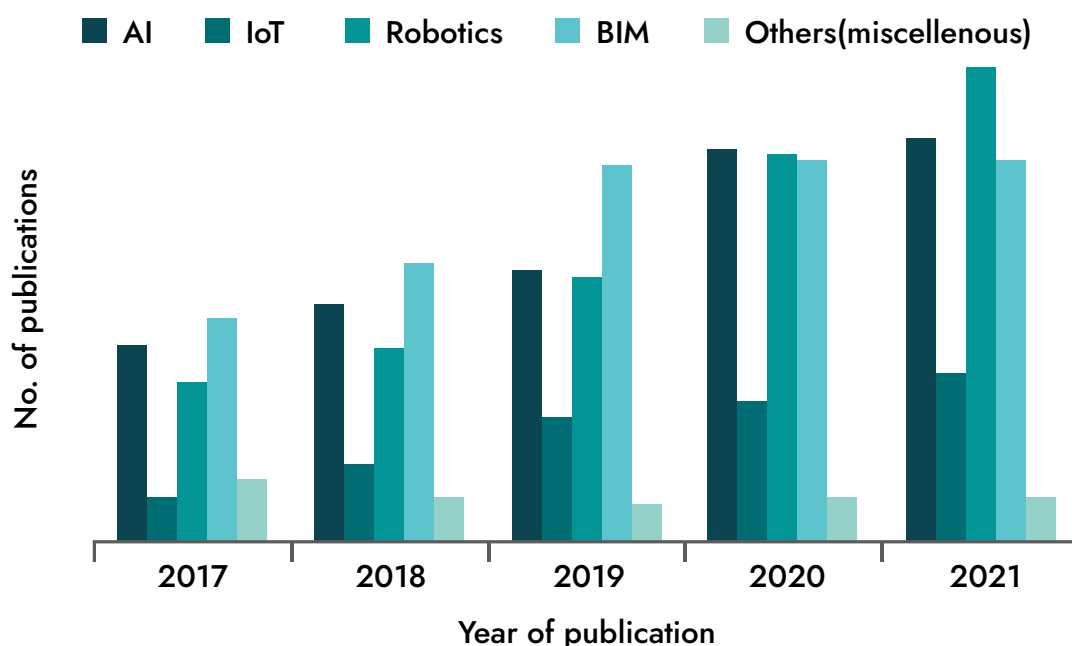


**Fig 2: Bibliometric analysis of technological innovations in construction industry**

An in-depth systematic review of around 10 papers from the SCOPUS database, for the year 2021 with high citation scores showcases that research has focused to address many such gaps through technological adaptation. The above table clearly showcases the major concern of the technology adoption in the construction sector is to enhance safety and productivity of the jobsite. The table 1 below is a comprehensive collection of various antecedents that have led to increasing adoption of construction technology.

## Table 1: Antecedents associated with technology adoption in construction industry

| S.No. | Problem Statement (Antecedent) | Proposed Solution | Author & Publication |
|-------|-------------------------------|-------------------|----------------------|
| 1 | To improve efficiency & productivity in construction | AI + BIM | Locatelli et al. 2021 |
| 2 | To improve project documentation | AI | Amer et al., 2021 |
| 3 | To improve worker's safety by monitoring helmet compliance | IoT | Kuhar et al., 2021 |
| 4 | To improve operational safety in worksite | AI | Lu, 2021 |
| 5 | To improve safety from free falling objects at job-site | AI + IoT | Martínez-Rojas et al., 2021 |
| 6 | To improve overall safety surveillance of the construction site | BIM | Li & Tang, 2021 |
| 7 | To improve safety by mitigating accidents via. virtual fencing | IoT | Rey-Merchán et al., 2021 |
| 8 | To improve productivity in construction industry | BIM | Liu et al., 2021 |
| 9 | To inspect and improve the quality for mechanical, electrical and, plumbing (MEP) provisions layout in the construction site. | Robotics | Jawad et al., 2021 |
| 10 | To improve productivity by high level task planning | Robot | Wang et al., 2021 |
| *AI= Artificial Intelligence; BIM= Building Information Modeling; IoT= Internet of Things | | | |

The trend shows a subsequent increase in research in the construction industry for technologies viz. AI, IoT, Robotics and BIM. The same is also seen in the market trend. Many reports have also mentioned similar dominance of these four technologies in the construction markets in the year 2021. Construct Connect reports BIM, AI and Robotics amongst the top 7 construction technology trends in 2021.UK Connect reports all the four aforementioned technologies as the prominent ones that have impacted the construction industry in 2021.
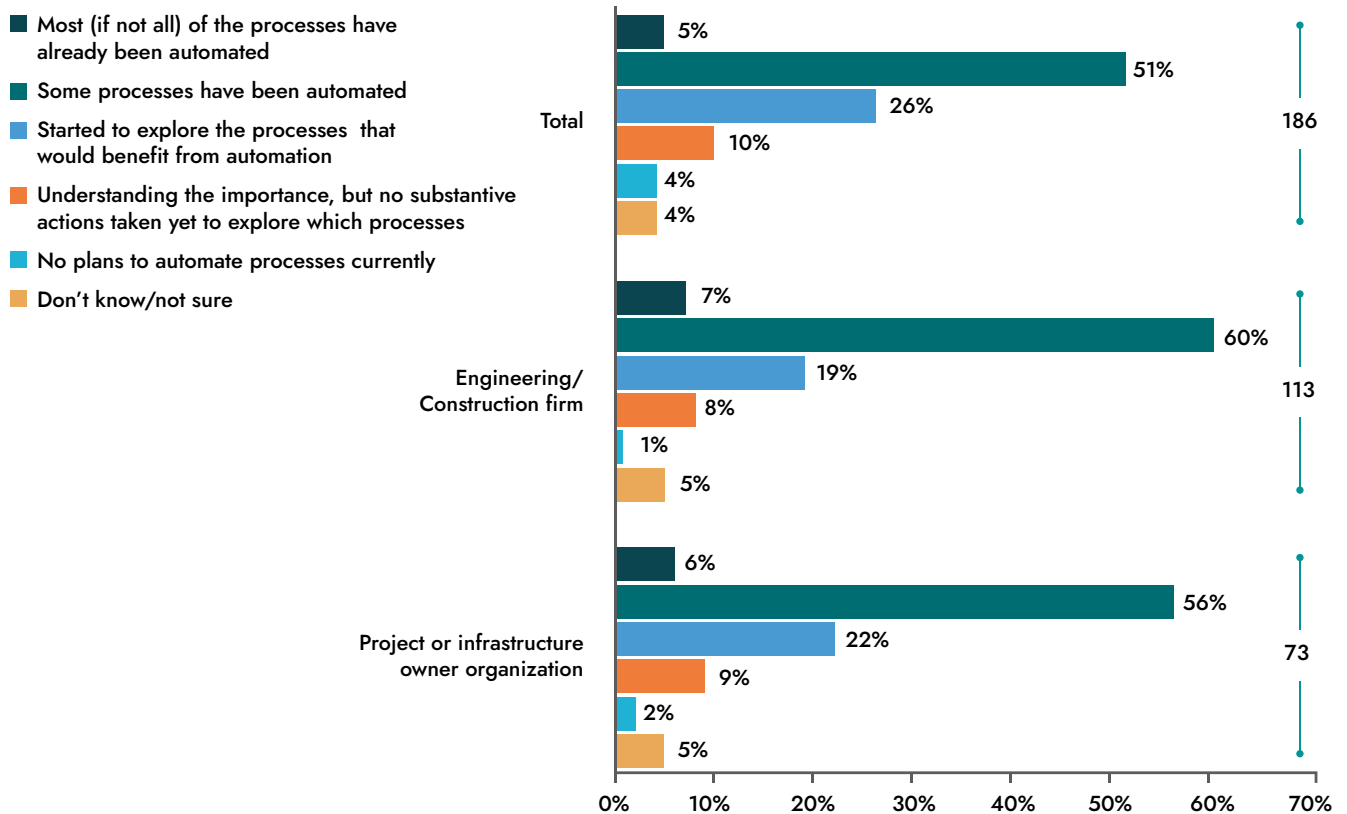
The 2021 Global Construction Survey by KPMG even lists AI, BIM, Robotics and applications of IoT as technologies that can give high overall return on investment for any construction project (Fig 3)
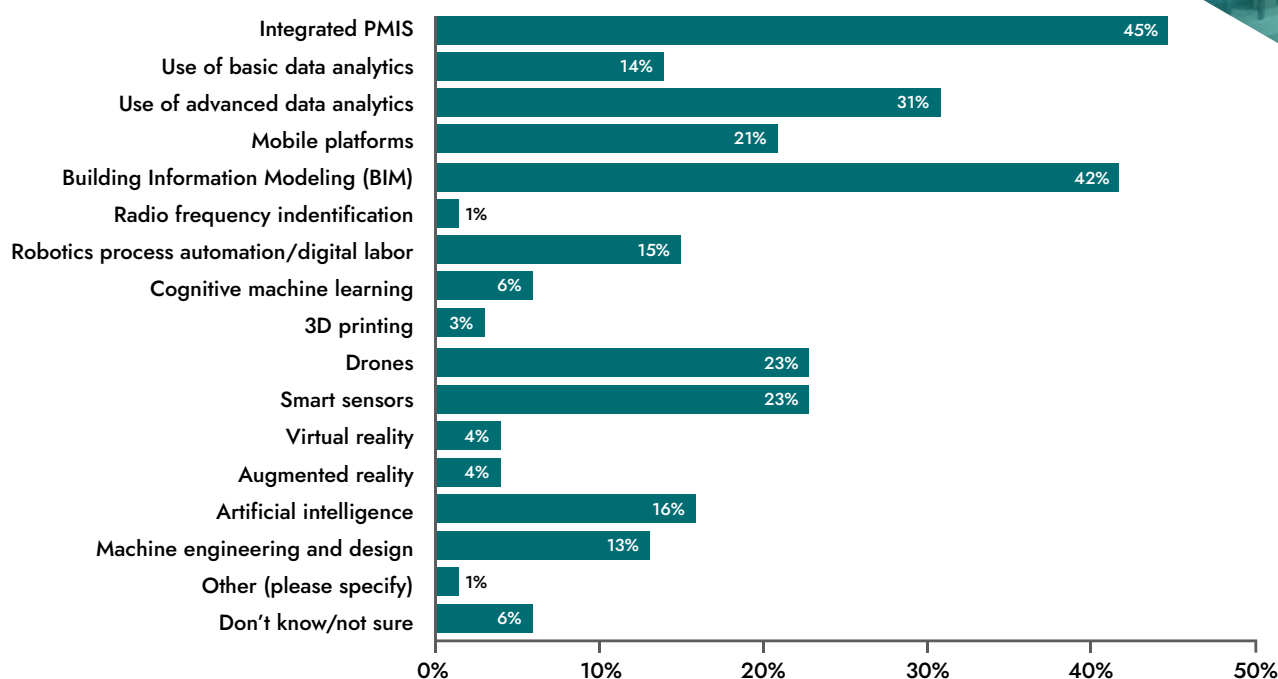


Fig 3: Most efficient technologies to improve ROI in construction project (Source: 2021 Global Construction Survey, KPMG).

The report depicts the following adoption rate of technological innovation in the construction ecosystem. The report indicates that technology investment patterns have risen in the year 2021 due to many focus areas covering every stakeholder involved in the construction workflow. Contractors have adopted these technologies to ease their manual working while project owners are adopting these technologies for tracking the job-sites remotely and performance reporting. In a similar note, construction firms are adopting to technological advancements calling for better project management and on-ground project delivery. Thus, analysis of the adoption rate (Fig. 4) in the report shows that automation of various processes using technological advancements have set a new trend in the construction industry especially in the year 2020-2021.

Fig 4: Adoption rate of technological innovation in the construction ecosystem (Source: 2021 Global Construction Survey, KPMG).

Similarly, PwC's survey report named "Construction Industry Vision 2025: Towards a digital future" reports automation of project monitoring via. Drones as the top most technology trend in construction which is being actively implemented. Other technologies and their percentage adoption are reported in the Figure 5 below.
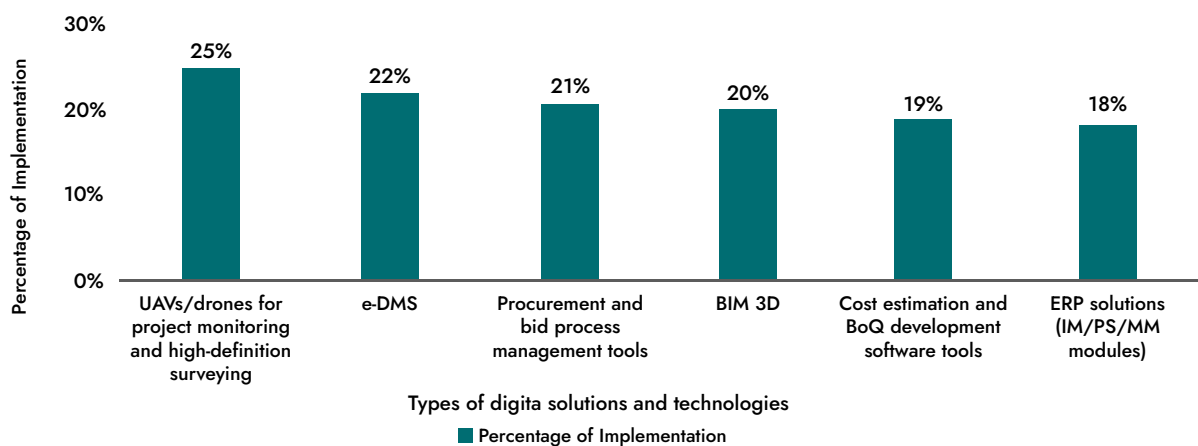


Fig 5: Top digital solutions currently being implemented in construction (Source: PwC Survey Report)

Thus, the antecedent analysis from the literature review and the market survey reports clearly demarcates that AI, IoT, Robotics and BIM are the "Talk-of-the-Town" for in the current times. However the adoption rate and future trend predictions described in the next section of the report would shed more light on the same!

# Construction Technology Market Trends & Predictions

The earlier section reports how various insufficiencies in the construction sector has been eased by the growing adaptation of advanced technologies. However, out of emerging technological advancement in the construction sector, there are four major advancements that could be traced for its upsurge in 2021. The current section therefore is an attempt to analyze the market trends for these technologies from the available secondary information.
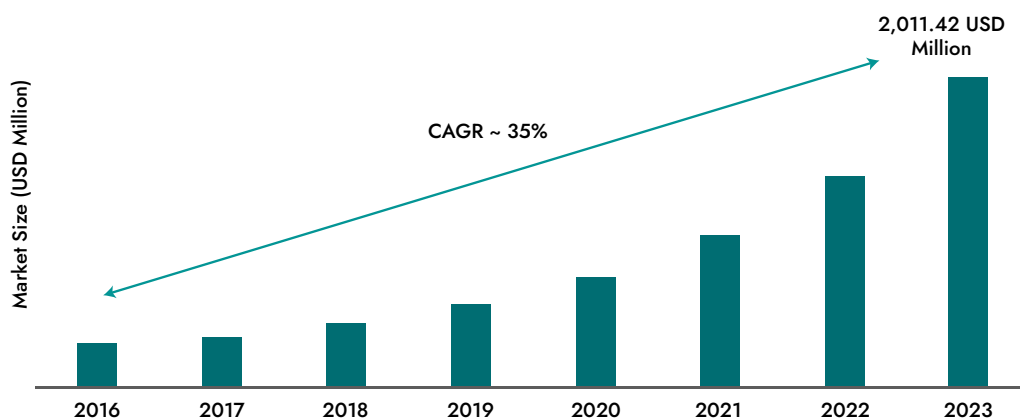
# Artificial Intelligence

Artificial Intelligence (AI) has become one of the most talked about technology in the last few years, especially in the construction ecosystem. 2021 was remarkable year that showed a huge adoption of AI and its subsets in the construction ecosystem. Being a year that was meant to co-exist with the pandemic, AI played a crucial role in improving the construction ecosystem especially in terms of promoting safety in the construction job-site along with improving productivity by preventing delays and budget overruns.

Reports & Data predict that 53% of the total AI usage in the construction was oriented towards planning and design till 2019. However, in the post-pandemic era, there has been a gradual shift towards safety as human lives gained more value during these times which is ultimately giving a positive hike to the AI adoption in the construction market.Moreover, the report also forecasts that by 2026, the valuation for the Artificial Intelligence (AI) in construction market is expected to reach USD 4.51 billion. Driving deep into the "market-o-nomics" the report suggests that in terms of technology under AI, Natural Language Processing (NLP) technology is forecasted to popularize with a growth rate of 37.3% in the forecasted period. This technology has already been adopted by many ConTech startups in the form of a variety of text processing techniques like phrase-structure parsing, dependency parsing etc. The increasing investment in the ConTech ecosystem also predicts a huge upsurge of AI in the construction. ConstructionDive recently reported 12 ConTech companies rose a total funding of $396M in the year 2021.

In terms of geography, the report says, Europe is destined to hold market share of ~23% by the year 2026, as predicted from the trends in 2021 with the raise of AI applications in the construction of both commercial and residential construction projects. Moreover the Asia-Pacific region is predicted to see the highest CAGR of 35.5% in the construction due to the increasing initiatives of governments to implement AI and its subsets in the construction projects especially to mitigate safety non-compliances.

Similar report has also been produced by Doka which predicts the following about the market progress of the artificial intelligence in construction (Fig 6). The report states that the intrusion of AI in construction industry is forecasted to register 35% CAGR by 2023 especially due to the increasing concern of safety considerations. The subset of AI that has reported to be emerged eventually in the current times for improvement of Occupational Health and Safety (OHS) is Computer Vision.



Fig 6: Market growth trend of the Artificial Intelligence in construction (Source: Doka)

This is in concordance with the aforementioned report of Report & Data which shows the following predictive trend of AI adoption for various purposes in three major regions of the world taking 2017 as the base line for the prediction (Fig 7).
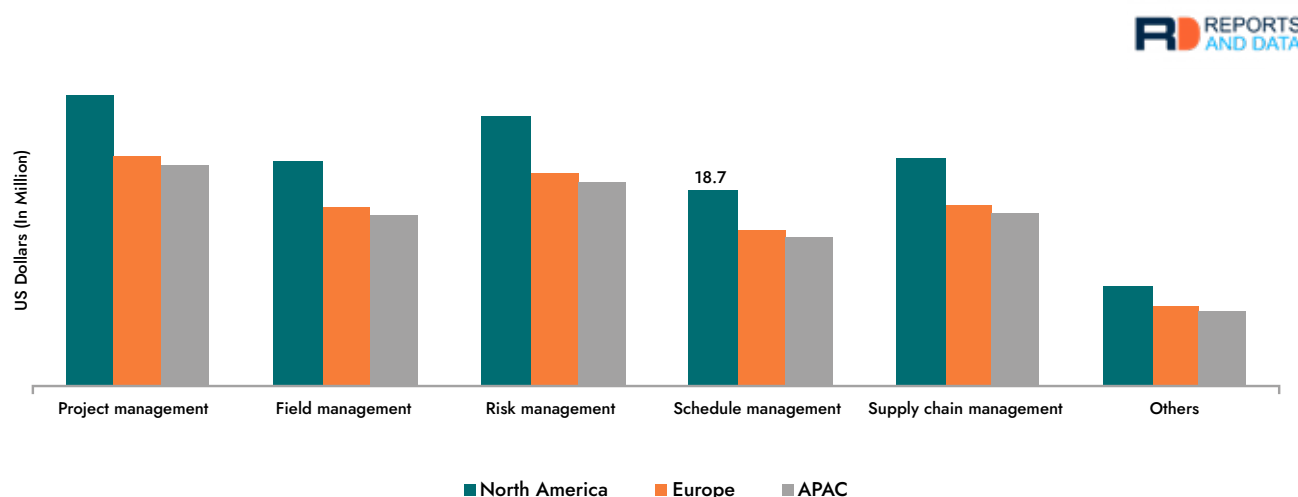


**Fig 7: Geographic wise AI market distribution globally (Source: Report & Data)**

The above market predation graph clearly supports the fact that "Risk Management" which involves AI powered surveillance of safety compliances in construction job site is gaining huge attention globally. Apart from this Project management also points out to be a significant application of AI in construction as due to increased number of construction projects the reduction of delays and over budgeting is something that also have been the point of focus.

# Internet of Things (IoT)

IoT has been a buzz word in the construction industry especially with the commencement of remote operations in the construction ecosystem. The post-pandemic year of 2021 has witnessed successful application IoT in construction market especially for predictive maintenance, safety management, real-time monitoring, remote documentation, fleet management etc. Research& Markets has forecasted that the estimated market size of IoT in construction is estimated to reach as high as USD 25.3 billion by 2027 registering a CAGR of 16.5% (Fig 8). The major utility of for IoT that has been majorly responsible for this trend is the remote operations which are attributed by remote machine control and real-time monitoring. This has been triggered by the growing necessity of avoiding project delays by maintaining safety and productivity of the job-site.This has also been reported by a market research report on EMERGEN which reports the aforementioned factors as the major driving forces for the growing IoT market. The report also highlights that in the year 2020 the major global revenue of IoT market was accounted by the Asia-Pacific region which was around 26.3%. Moreover the report also supports the fact that remote operation sector is expected to grow the most with highest CAGR of 16.1% by 2028.

Construction Technology Trends: 2021-2022 | Market Predictions & Research Updates

# Global Market for Internet of Things (IoT) in Construction

## Market forecast to grow at CAGR of 16.1%

USD 25.3 Billion

USD 8.9 Billion

2020

2027
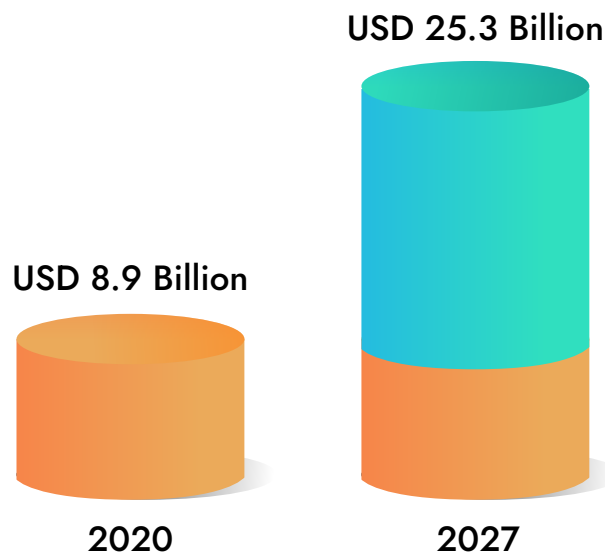
**Fig 8: Global market trend of IoT in Construction (Source: Research& Markets)**

A similar report by Allied Market Research states that the pandemic shall push the growth of global IoT in construction market from $8,179.9 million in 2019 to$19,039.8 million in 2027, growing with a CAGR of 14.0%. The report also projects that in the post-pandemic era the application of IoT in remote asset management will become the "talk-of-the-town" in the construction ecosystem.The report suggests that IoT in construction market is highly competitive as the ConTech startups are basically amalgamating the power of AI with IoT thereby bringing up AIoT as a strong foothold in the market.

However in terms of global competition, the report lists the following global players: Caterpillar Inc. (US), Oracle Corporation (US), Hitachi Ltd. (Japan), CalAmp Corp. (US), Sigfox (France), and Autodesk Inc. (US) dominating the IoT in construction market. Another report by Transparency Market Research highlights that North America has seen to be the highest investor in IoT in construction industry thereby holding the largest share owing to its developed economies.However, with increasing government regulations in the Asia-Pacific region, especially for withholding safety compliances in construction job-site, the IoT in construction market is expected to boom in these regions in the upcoming years.
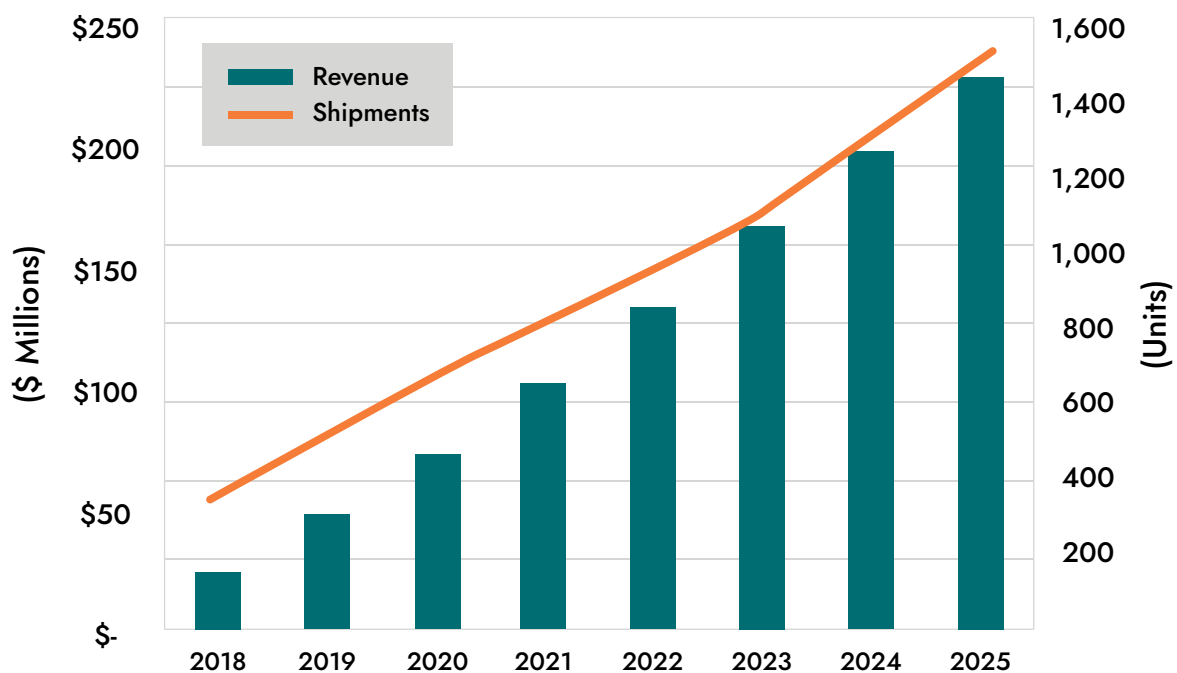
# Robotics

With upsurge of technological innovations, automation in the construction industry has become increasingly popular in the construction ecosystem. As per Markets & Markets Report, the construction robotics is expected to rise at a CAGR of 16.8% by 2023. The market valuation is expected to go as high as USD 166.4 million by 2023. The major reason behind the adoption of he robotization for construction activities is to improve productivity and safety of the project jobsite in order to improve quality of the projects. With growing urbanization worldwide, the construction demolition has also become a considerable part of the construction. The report suggests that construction demolition has become the major area in which robotics is expected to grow at the highest CAGR by 2023. This is to prevent elimination of human presence from hazardous demolition operations thereby promoting safety in the construction operations.This fact is also supported by the Robotic Industries Association which states 90% of the total market share for construction robots till date is occupied by demolition robots.

Another report by Transparency Market Research projects expansion of construction robotics market to reach a value of US$ 470.61 million with an expected rise in CAGR of 10.4% by 2026. Both the aforementioned reports also point towards maximum raise of this sector in the Asia-Pacific region. Further predicting the trend, another report by Tractica says that by 2025 the upsurge of construction robotics will bring huge opportunities for both developers and suppliers as well. It presents a sharp rise in the market size of construction robots taking the baseline as 2018 (as in Fig 9).
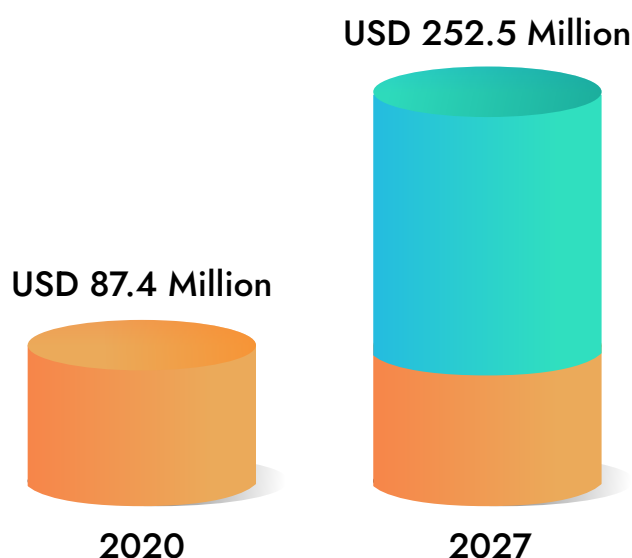


Fig 9: Revenue and Shipment trend in Construction robotics sector (Source: Tractica)

In 2018, the International Federation of Robotics and the Robotic Industries Association, has predicted a CAGR of 8.7% between 2018 and 2022 which seems to become a reality in the coming year due to the upsurge of technological adoption in this context, especially after the pandemic when every industry is becoming liberal with technology adoption. Mordor Intelligence also reports that owing to the crash in the construction industry due to restrictions imposed by COVID-19 and simultaneous increase in the demand of 3D printing in the construction market has expected to raise the Construction Robot Market to reach USD 95.10 million by 2026 with a CAGR of around 13.6% during the forecast period (2021 - 2026). Research & Market also projects similar trajectory as reported in Fig. 10 below.

## Global Market for Construction Robots

**Market forecast to grow at CAGR of 16.4%**

USD 252.5 Million

USD 87.4 Million

2020    2027

https://www.researchandmarkets.com/reports/4845716

**RESEARCH AND MARKETS**
THE WORLD'S LARGEST MARKET RESEARCH STORE

**Fig 10: Global market trend of Robotics in Construction (Source: Research & Market)**

Moreover, even in this field the APAC region has been marked as "fastest-growing regions" in terms of contribution in global construction robot market. In this context, China, Japan, and South Korea is playing pivotal role as reported by Maximize Market Research. Similarly, Research & Market also reports that the noteworthy geographic markets in construction robots currently are US and APAC markets like that of China and Japan are considered to grow fast with a CAGR of 15.8% and 14.5% respectively over the 2020-2027 period.

# Building Information Modeling (BIM)

During the post pandemic era, another technology that is trending in the construction ecosystem is BIM. The increasing surge of establishing remote monitoring in the construction jobsites for better design planning and execution, BIM has become popular amongst AEC users. Estimates by projectdelivery.autodesk.com suggest the following trend (as in Fig. 11) for advantages imparted to the AEC market by adoption of BIM. Thus, the increasing usability of BIM by the AEC sector leads to an estimated rise of the global BIM market upto USD 7,536.0 million in 2027, growing at a rate of CAGR 15% from 2020-2027 as reported by Allied Market Research.

## Project Outcome Improvements From Using a Collaboration Solution on BIM Projects (by Type of Company)

Percentage of respondents, by discipline, who report receiving these projects
outcome improvements at a high or very high frequency from using a collaboration solution on their BIM projects
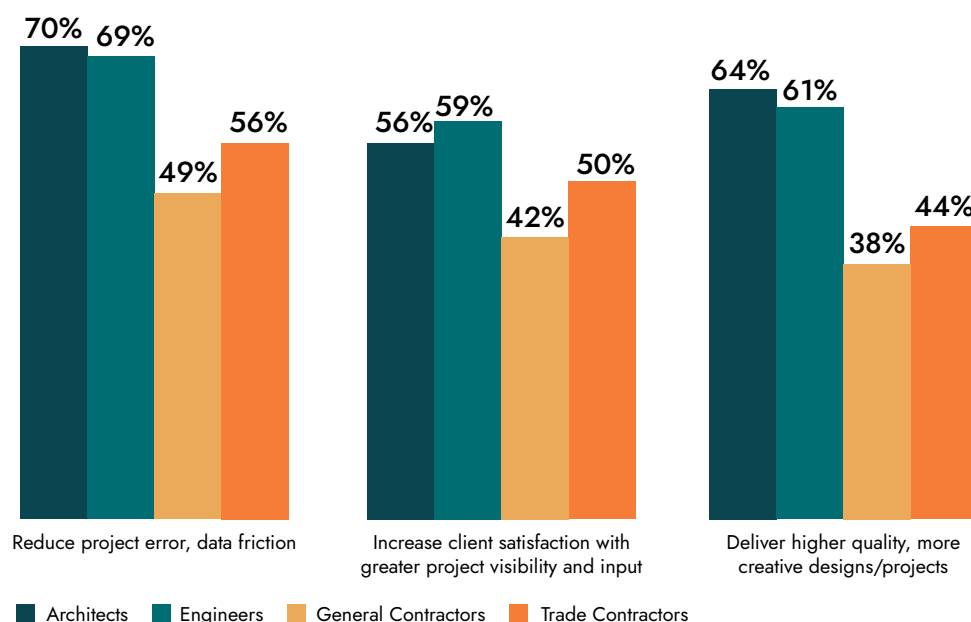


Legend: Architects ■ Engineers ■ General Contractors ■ Trade Contractors ■

**Fig 11: Advantage of BIM to the AEC market (Source: projectdelivery.autodesk.com)**

Transparency Market Research reports that in many countries like UK, the U.S., Korea, Hong Kong, Singapore, Russia, and Finland, the post-pandemic regulations and many favorable policies have boosted the market of BIM software and services. However, some other countries like Germany, Japan, Canada, China, Netherlands, Spain, and Portugal have already been successfully using BIM for improving construction productivity while other regions have recorded upsurge in BIM adoption like Belgium, Switzerland, Italy, Brazil, Czech Republic, and New Zealand.Due to the increase in construction activities in APAC region, countries like Japan, China, Singapore, and the Indian subcontinent is predicted to have the growth of highest CAGR over the forecast period. BIM has reported 60% reduction in cost in construction field as reported by Hitech. PRNewswire reports an overall growth of 28.71% of BIM market in the year 2021 and predicts that 33% of growth by 2021 will be registered from the APAC region. Transparency Market Research predicts the raise of global BIM market to reach $11,542.3 million by 2022 and 2031 the market value is projected to reach US$ 42.9 billion registering a CAGR of approximately 15%. Many startups have therefore emerged in the field of BIM especially in the last few years.

# Key Insights of the Report

❯ There is an increased liberalization in adoption of technology in construction industry in the year 2021 owing to the post-pandemic restrictions, safety mandates and remote working situations.

❯ There is an expected upsurge of construction technology adoption globally. However, Asia Pacific (APAC) construction market is expected to project the highest growth in terms of technology adoption especially due to increased construction projects and government initiatives.

❯ Out of all the technological advancements, both market reports and research publications projects that AI, IoT, Robotics and BIM are most trending technology in construction ecosystem.

❯ Most of the technological adaptation is linked to promoting a safer construction ecosystem with a more productive jobsite by automating documentation, safety surveillance and efficient remote management.

❯ The Artificial Intelligence market is projected to rise with the application of "Risk Management" for safety surveillance while the major utility area for IoT and BIM market is predicted to real-time remote operations and improved planning respectively. Moreover, demolition contribute the highest CAGR with automation via. Robotics.

❯ The overall trends predict a positive market growth in the construction technology with rise of ConTech startups updating the current construction scenario.

# Bibliography

1. Amer, F., Jung, Y., &Golparvar-Fard, M. (2021). Transformer machine learning language model for auto-alignment of long-term and short-term plans in construction. Automation in Construction, 132 doi:10.1016/j.autcon.2021.103929

2. Jawad, R., Anikesh, R., &Gayathri, G. (2021). Autonomous mobile robot for visual inspection of MEP provisions. Paper presented at the Journal of Physics: Conference Series, , 2070(1) doi:10.1088/1742-6596/2070/1/012199

3. Kuhar, P., Sharma, K., Hooda, Y., &Verma, N. K. (2021). Internet of things (IoT) based smart helmet for construction. Paper presented at the Journal of Physics: Conference Series, , 1950(1) doi:10.1088/1742-6596/1950/1/012075

4. Li, J., & Tang, F. (2021). Construction technology safety management under the background of BIM and information system modeling. Paper presented at the Proceedings - 5th International Conference on Intelligent Computing and Control Systems, ICICCS 2021, 59-63. doi:10.1109/ICICCS51141.2021.9432239

5. Liu, Z., Lu, Y., Nath, T., Wang, Q., Tiong, R. L. K., &Peh, L. L. C. (2021). Critical success factors for BIM adoption during construction phase: A singapore case study. Engineering, Construction and Architectural Management, doi:10.1108/ECAM-12-2020-1072

6. Locatelli, M., Seghezzi, E., Pellegrini, L., Tagliabue, L. C., & Di Giuda, G. M. (2021). Exploring natural language processing in construction and integration with building information modeling: A scientometric analysis. Buildings, 11(12)  doi:10.3390/buildings11120583

7. Lu, Y. (2021). The use of artificial intelligence in the construction of operation safety early warning management system of urban rail transit. Paper presented at the Journal of Physics: Conference Series, , 1972(1) doi:10.1088/1742-6596/1972/1/012093

8. Martínez-Rojas, M., Gacto, M. J., Vitiello, A., Acampora, G., & Soto-Hidalgo, J. M. (2021). An internet of things and fuzzy markup language based approach to prevent the risk of falling object accidents in the execution phase of construction projects. Sensors, 21(19) doi:10.3390/s21196461

9. Rey-Merchán, M. C., Gómez-De-gabriel, J. M., López-Arquillos, A., &Fernández-Madrigal, J. A. (2021). Virtual fence system based on IoT paradigm to prevent occupational accidents in the construction sector. International Journal of Environmental Research and Public Health, 18(13) doi:10.3390/ijerph18136839

10. Wang, X., Liang, C. -.,Menassa, C. C., &Kamat, V. R. (2021). Interactive and immersive process-level digital twin for collaborative human-robot construction work. Journal of Computing in Civil Engineering, 35(6) doi:10.1061/(ASCE)CP.1943-5487.0000988

11. https://assets.kpmg/content/dam/kpmg/xx/pdf/2021/08/global-construction-survey1.pdf

12. https://business.libertymutual.com/wp-content/uploads/2021/04/WSI_1002.pdf

13. https://formworkdokauk.com/2019/01/25/artificial-intelligence-in-construction-what-are-the-advantages/

14. https://ifr.org/

15. https://midwestepi.files.wordpress.com/2017/05/mepi-construction-fatalities-nationwide-final.pdf

16. https://omdia.tech.informa.com/topic-pages/artificial-intelligence

17. https://projectdelivery.autodesk.com/blog/aec-industry-trends-bim-dodge-analytics/

18. https://www.alliedmarketresearch.com/bim-in-construction-market-A10290

19. https://www.alliedmarketresearch.com/iot-in-construction-market-A07565

20. https://www.automate.org/robotics

21. https://www.bls.gov/charts/census-of-fatal-occupational-injuries/number-and-rate-of-fatal-work-injuries-by-industry.htm

22. https://www.bls.gov/cps/cpsaat47.htm

23. https://www.constructconnect.com/blog/7-construction-technology-trends-to-watch-in-2021

24. https://www.constructiondive.com/news/12-contech-firms-raise-a-combined-396m-in-investor-funding/608151/

25. https://www.emergenresearch.com/industry-report/internet-of-things-in-construction-market

26. https://www.hitechcaddservices.com/news/the-positive-impact-of-bim-on-construction-projects/

27. https://www.marketsandmarkets.com/Market-Reports/construction-robot-market-266557111.html

28. https://www.marketsandmarkets.com/Market-Reports/iot-construction-market-214544022.html

29. https://www.maximizemarketresearch.com/market-report/global-construction-robots-market/36233/

30. https://www.mordorintelligence.com/industry-reports/construction-robots-market

31. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2491397/

32. https://www.osha.gov/sites/default/files/publications/construction_hazards_qc.pdf

33. https://www.prnewswire.com/news-releases/bim-market-size--bim--market-share-to-grow-substantially-by-2025--insights-on-emerging-trends-opportunities--risks-global-insights-301381916.html

34. https://www.reportsanddata.com/report-detail/artificial-intelligence-ai-in-construction-market

35. https://www.reportsanddata.com/report-detail/artificial-intelligence-ai-in-construction-market

36. https://www.researchandmarkets.com/reports/4845716/construction-robots-global-market-trajectory

37. https://www.researchandmarkets.com/reports/4845716/construction-robots-global-market-trajectory

38. https://www.transparencymarketresearch.com/building-information-modeling-market.html

39. https://www.transparencymarketresearch.com/construction-robot-market.html

40. https://www.transparencymarketresearch.com/iot-in-construction-market.html

41. https://www.transparencymarketresearch.com/pagenotfound

42. https://www.us.jll.com/en/trends-and-insights/research/the-state-of-construction-technology

# About viAcT

viAct is a top ConTech startup from Hong Kong backed by Alibaba Hong Kong Entrepreneurs Fund, Artesian Ventures and ParticleX. viAct provides "Scenario-based Vision Intelligence" solutions exclusively for construction industry all across Asia & Europe and have been successfully deployed around 30 sites. viAct have developed 30+ modules specified modules, hand-crafted to successfully provide extremely granular insights on safety prepositions, productivity forethoughts and environmental compliances in jobsites by not only tracking objects but by transforming vision to practical actions. viAct's Construction Management Software is trusted by many global construction giants such as AECOM and AutoDesk, to name a few due to its intuitive "No-Code AI".

Willing to leverage the power of digitization and adapt to contemporary construction technology trend to be a part of the changing construction ecosystem?

Try it for free with us!

https://www.viact.ai/freetrialsign-up

## CONTACT US

**Gary Ng**
CEO & Co-Founder
viAct
gary.ng@viact.ai

**Hugo Cheuk**
COO & Co-Founder
viAct
hc@viact.ai

**Surendra Singh**
Marketing & Public Relations Head
viAct
surendra.singh@viact.ai

## ACKNOWLEDGEMENTS