Disruptive Technologies in the Construction Sector and their Relevance to Pakistan

WEBINAR

14th JULY, 2021

INTRODUCTION TO IQBAL INSTITUTE OF POLICY STUDIES (IIPS)

To develop into a center of excellence for research, policy studies and constructive dialogue with a view to facilitating policy formulation for sustainable national development

Undertake quality research and policy analyses for sustainable national development

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Build capacity and competence to respond to research and policy needs at national level

Develop viable connectivity between academia and industry for applied R&D

Conduct research on emerging technologies for industrial application

Support endeavours for socio -economic development through research and analyses

Undertake critical impact studies of policies and recommend solutions

Several disruptive technologies like modular construction, 3D printing buildings, and building information modelling software (BMIS) are steadily transforming the construction industry. In order to remain competitive, construction companies must quickly adopt these technological developments. The construction sector of Pakistan has tremendous potential for growth and development. However, teething problems related to a lack of funds and government facilitation limit the industry's ability to grow and remain competitive.

SESSION OBJECTIVES

1. What is the significance of progressive technologies in the construction industry?

2. How are smart and immersive technologies applied in construction projects?

3. What is the relevance of disruptive technologies to real estate development?

4. What is the application of energy dissipation technology in the construction industry?

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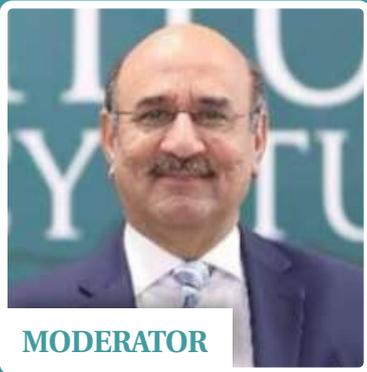
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DR SAROSH LODHI

Vice-Chancellor NED University

Significance of Progressive Technologies in the Construction Industry

Technological advancements are accelerating the pace of change in the world. Computers have come a long way since the 1980s, and are now considered the second biggest invention in human history. Computers have taught businesses to do things better, with less cost and greater efficiency. Eventually, the internet added connectivity to the world. Today, technology has taken root deeply in human societies, and things like Wi-Fi and smartphones are considered essential tools of the modern world. The construction sector also sits at the forefront of the changing nature of society and human life as a result of computation and technology. A key objective of the construction industry is to guarantee quality, standardize procedures, and reduce time. All three of these areas can be affected massively by emerging technologies in construction. Moreover, construction is one of the most powerful catalysts of reviving economic activity globally. However, its productivity can be considerably increased by

introducing technologies like artificial intelligence that are capable of analysing past trends and mistakes. It can also be used to calculate building designs, estimate different costs, and monitor inventory and workers using image recognition technology. Adding to the list is another major disruptive technology. Building Information Modelling (BIM) allows all stakeholders involved in a construction project to collaborate on a single platform. It has enhanced decision-making processes and reduced construction errors by a large margin, making construction more efficient and cost-effective.

Construction firms have also taken to prefabricated housing and commercial units in recent years. The concept is common in Western countries, but it requires a high level of mechanisation, standard frameworks, and standard materials, making it difficult for developing countries to adopt. Moreover, the methodology requires a robust transportation network, logistics, and durability standards. Today, things are changing due to the advent of 3D printers, which can print standalone buildings. In order to adopt technology in the future, developing countries should begin by teaching their youth technology skills. Additionally, smart cities and safe cities have also emerged, which use sensors and internet of things (IoT) devices to capture large amounts of data, thus ensuring better services and efficient resource allocation. High-speed connectivity is needed to transmit data from each device to large databases that store performance

information, temperature, traffic conditions, safety details, and security features. With the advent of 5G, it has now become possible to do so. In addition, virtual reality and augmented reality have allowed a wider audience to see the finished product before laying a single brick on the construction site. Construction industry standards are challenged by many technologies; however, investing in human capital is a crucial aspect of implementation and adoption of such technologies.

Human capital must not only be in quantity, but also of high quality. Despite its large population, China has been able to achieve fast economic growth and accelerate the adoption of disruptive technologies in the construction sector by investing in human capital. To help the young generation learn these technologies, the government must introduce programs and develop plans to get the construction sector regulated.

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DR FARRUKH ARIF

Associate Professor NED University

Application of Smart and Immersive Technologies for Construction Projects

The term disruptive technology refers to any innovation that disrupts the normal functioning of an organisation. This term is not negative; rather, it refers to technologies that have the potential to positively impact any field. The key to a disruptive technology's positive impact is its adoption and adaptation to the industry. Consumers and allied sectors can benefit from innovation in the construction sector. To prepare human resources, equipment, and technical requirements for disruptive technologies, an educated and research-based approach is needed. New technologies are often perceived to be very expensive to adopt, but computers have become more powerful and efficient over the past few years, making it possible for even small startups with limited resources to adopt disruptive technologies. Disruptive technologies in construction include 3D printing, virtual reality, robotics, automation, artificial intelligence, drones, 5G technology, cybersecurity, augmented reality, and IoT applications. SMART (self-monitoring and analysis reporting technologies) are also making a significant impact on the construction industry. The idea is that devices embedded with sensors can collect information and transmit it back to databases, where artificial intelligence algorithms can analyze it. As a result of the sheer volume of information being collected, Big Data analytics play a critical role in the process.

In the construction industry, smart monitoring and control frameworks are classic examples of disruptive technologies. Smart monitoring systems use a variety of technologies, such as drones, photogrammetry, and laser scanning. Some of these systems are very expensive, so small companies and developers cannot afford them. In addition, there is a lack of human capital that can operate and manage such devices. A revolutionary advance in this field is the integration of videography-MATLAB-BIM for smart progress monitoring of construction sites. In this method, video cameras are installed at pre-designated locations that can record high-quality video while transmitting it over the Internet to a MATLAB-based service. Image recognition software can be used to identify multiple aspects from a video and analyze it based on the use case. Following that, information is incorporated into business information modelling (BIM) systems for multiple stakeholders to collaborate. By using the technology, processes can be identified and compared to planned strategies. It is also possible to generate and share progress reports with

clients and allied sectors. As opposed to other monitoring methods and human intervention, video cameras are cost-effective and offer reduced errors. You can also integrate administrative tasks with fieldwork to improve resource management. Lastly, the system can also reduce conflicts due to the fact that everything is recorded on several levels and stages.

The lack of human resources is a major hindrance to many projects. On-site monitoring of progress and human resource utilization is another application of technology. Surveys and data-driven models can be developed using the collected data. Using cloud-based data collected from construction sites, AI can be used to predict future outcomes and prevent disasters. Moreover, simulation is insufficient to determine all the risks and opportunities involved in construction. During a set period, Internet of Things (IoT) devices can be installed in buildings to collect data for planning and forecasting purposes. An additional technology that has the potential to disrupt the construction industry is immersive visualization. This segment includes communication using graphs, images, mixed reality, augmented reality, and virtual reality. Immersive visualisation technology can be applied in many fields, such as construction planning, architecture design, cross planning, and structure optimization. Therefore, disruptive technologies in the construction sector can bring cost-effectiveness, efficiency, and higher productivity.

What Needs to be Done for Inclusion of Disruptive Technologies in the Construction Industry

Technology adoption is a rewarding yet difficult task for any organization. Historically, the construction sector has been slow to adopt new technologies due to the large stakes involved in the process and the small margin for error. To increase awareness in the industry and develop human resources, capacity building and enhancement initiatives are essential. A lack of effective strategies can make it very challenging for different agencies. Additionally, rather than copying models from other countries, Pakistan should develop indigenous solutions for adopting technology, as the factors that influence technology adoption differ considerably from developed countries.

Industry-academia linkages are also an important step towards adopting new technologies where the industry assumes the role of solution seeker and academia becomes the solution provider. As well as anticipating disruptive technologies, the industry must also assess its readiness for adoption. Finally, professionals with strong technical skills, open minds, and a passion for innovation must play active roles in policy-making forums and regulatory agencies.

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MR ARSLAN JAVED

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Relevance of Disruptive Technologies to Real Estate Development

Defying the status quo and bringing about positive changes are the goals of disruptive technologies. In recent years, businesses such as Uber and Airbnb have disrupted the taxi and hotel industries in numerous places around the globe. Moore's law dictates that every two years the number of transistors in computer chips will double. As a result of the massive increase in computational power, technology is advancing rapidly. There are two technologies disrupting real estate: virtual reality and artificial intelligence. A significant amount of waste is generated during construction. Research has shown that 35 percent of every dollar spent on construction is wasted. This is mainly due to a lack of collaboration between multiple stakeholders. Virtual reality can help solve that problem. Projects can be viewed and experienced in virtual space even before construction begins, providing engineers with a better sense of what changes may be needed and if a design performs as expected under certain conditions. Real estate

marketing is also being revolutionized by technology. By showing clients the finished product they are investing in, they can get a better picture and experience it beforehand. Moreover, the technology is becoming smaller and more portable, which allows stakeholders in a construction project and clients of the completed product to utilize it in a more mainstream manner. In the real estate sector, artificial intelligence also has a vast application. One of the most significant aspects of its use is termed generative design. The technology has the potential to completely disrupt the construction industry by revolutionising building design and planning. The software has the capability to generate thousands of alternate designs according to different parameters set by the engineer or the architect. Depending on the requirements and constraints, multiple designs can be considered. As a result, an architect can collaborate with other team members to shortlist the best options to speed up the process. Currently, companies and government organizations use generative design to create master plans that can be tested on multiple parameters. In Pakistan, less than 0.5 percent of areas have been planned, making designing and planning a major concern for the real estate sector.

DR ASAD NAEEM

Associate professor at BUITEMS

Application of Energy Dissipation Technology in the Construction industry

Technology is being ignored in Pakistan on a national level with a huge economic and social impact on the country. Trillions of dollars' worth of infrastructure has collapsed over the years during many bouts of floods and earthquakes experienced in Pakistan over the years. In order to tackle this challenge, Pakistan needs to introduce energy dissipation devices in its buildings that greatly reduce the effects of an earthquake on a building. Energy dissipation devices can be installed to an existing or new buildings, bridges, or any other structure that may improve energy distribution of the whole structure and decrease energy demand on main structural elements in case of an earthquake. The process is called seismic retrofitting and it is the modification of existing structures to make them more resistant to seismic activity, ground motion, or soil failure due to earthquakes. The process has three parts namely, increasing the strength of the building, increasing the deformation capacity of the building, and installing an energy dissipation device or base isolator. It is generally believed that making a building stiffer will allow it to become greater in strength; however, stiffer buildings are more prone to collapse under heavy earthquakes. Therefore, there is a maximum level of stiffness a building can achieve after which a damping device can be added to maximise energy dissipation. The device used for this purpose is called a damper, and there are various types that can be used. They can be added to buildings with non-intrusive construction methods and retain building operations to the maximum. In terms of their performance, dampers reduce story drift and non-floor accelerations in high rise buildings to protect non-structural components with little to no damage during a major seismic event, retaining the operations of the building.

Conventional damping technology includes slit dampers, viscous dampers, buckling restraint base (BRB), ADAS dampers, and base isolation technologies. However, a new

stream of hybrid dampers has recently emerged which combine conventional energy dissipation devices along with use of smart materials and construction. This offers enhanced seismic performance and operation under different levels of seismic activity. They are also self-centering in the aftermath of an earthquake and have significantly less repair and maintenance costs. Living in an area that is prone to earthquakes requires extensive measures to preserve the structural integrity of the infrastructure present there. Although many developed and developing countries have adopted the technology, Pakistan continues to remain behind in its adoption, and continues to suffer heavy losses in the event of an earthquake or strong winds. The technology can change the construction landscape in Pakistan by making it safer and providing structural integrity to buildings for many years.
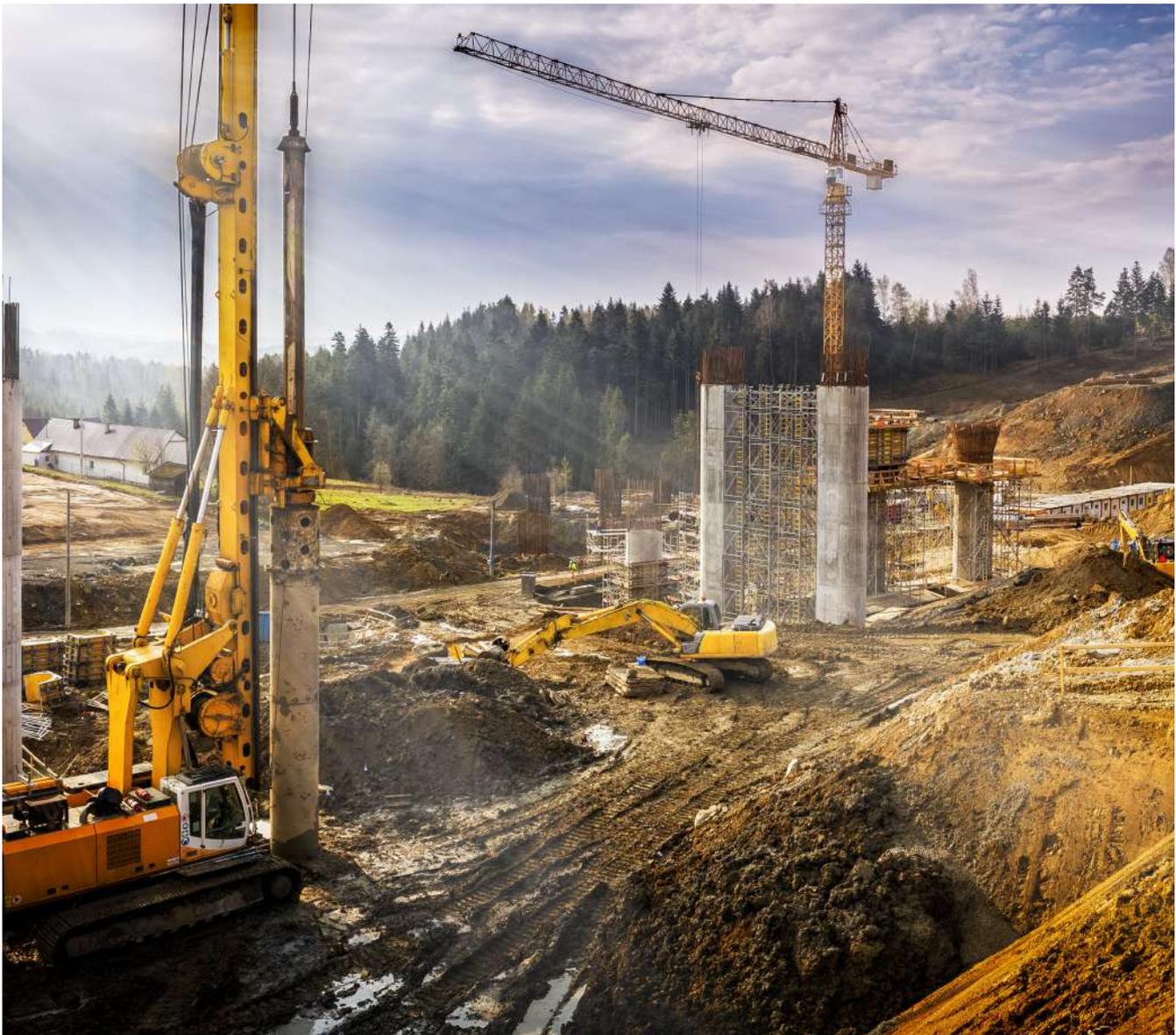
KEY TAKEAWAYS

1. Technology has now taken deep roots in human societies, and things like Wi-Fi and cellphones are being considered a necessity in the modern age.

2. As computation and technology bring change in every part of human life and society, the construction sector also stands primarily affected by this change.

3. Quality assurance, standardisation, and time-saving mechanism are key objectives of the construction industry.

4. The construction industry is the most prominent catalyst of reviving economic activity in a country. Its productivity can be increased manifold by introducing technologies like artificial intelligence and virtual reality.

5. The technology can play a significant role in calculating building design, estimating different costs, and monitoring inventory and workers using image recognition.

6. Building Information Modelling (BIM) is a platform that lets all the stakeholders related to a construction project collaborate on a single platform.

7. In recent years, the idea of prefabricated housing and commercial units has also taken ground in the construction industry. However, it requires high levels of mechanisation, standard frameworks, and standard materials, making it a challenge for developing countries to adopt.

8. Things are now changing with the advent of 3D printers, which can print standalone buildings.

9. Smart cities and safe cities have also emerged that use sensors and internet of things (IoT) devices to capture large amounts of data related to several metrics, which can provide better services and efficient resource allocation.

10. Another technology called virtual reality and augmented reality have also opened opportunities for a wider audience to experience the final product before laying a single brick on the construction site.

11. China has a much larger population compared to Singapore; however, investing in human capital has allowed both countries to achieve strong economic growth and speedy adoption of disruptive technologies in the construction sector.

KEY TAKEAWAYS

12. As disruptive technologies try to sweep away past habits and methods that have sticked for a long time, a more educated and research-based effort is needed to prepare the human resource, equipment, and technical requirements.

13. 3D printing, virtual reality, robotics and automation, artificial intelligence, drones, 5G technology, cybersecurity development, augmented reality, and IoT applications are all examples of disruptive technologies that have the potential to revolutionize the construction industry.

14. Self-monitoring and analysis reporting technologies (SMART) are also making a significant impact in the construction industry.

15. There is a need for capacity building and enhancement initiatives for increasing industry awareness and human resource development.

16. Instead of taking models from other countries, Pakistan should focus on research and development of indigenous solutions for adoption of technology as the factors which influence technology adoption can vary significantly from developed countries.

17. Industry academia linkage is also an important step towards adoption of technology where the industry assumes the role of solution seeker and academia becomes solution provider.

18. The industry must also be gauged in terms of its readiness for adoption of disruptive technologies.

19. Professionals having strong technical knowledge, open minds, and hearts towards innovation are required to play explicit roles in policy making forums and regulatory agencies.

20. Artificial intelligence also has a massive application in the realm of real estate. One of the most significant aspect of its use is termed as generative design. The technology has the potential to completely disrupt the construction industry by revolutionizing building design and planning.