International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 03 | March - 2023 Impact Factor: 7.185 ISSN: 2582-3930

Identify Critical Factors for Adopting Modern Technology: A Case Study of Gujrat

Vidhi S Patel[1], Dr.J.R.Pitroda[2], A.N. Bhavsar, Maulik Patel

[1]2nd Year Student M.Tech (Civil) Construction Engineering & Management, BVM Engineering College, Vallabh Vidyanagar

[2]Associate Professor P.G. Coordinator Construction Engineering & Management,

Civil Engineering Department, BVM Engineering College, Vallabh Vidyanagar

[3]Associate Professor, Construction Engineering & Management,

Civil Engineering Department, BVM Engineering College, Vallabh Vidyanagar, Gujarat

Abstract:

Modern methods of construction (MMC) are advised in order to address the incertitude that construction frequently presents to clients and contractors. For instance, consider time, faults, safety, environmental impact, costs, income, and lifecycle performance. But does MMC really make these doubts lessen? Additionally, MMC include intrinsic hazards from the previous century, such as substandard quality and social marginalization, and alter the frames of reference of stakeholders. Instead of reducing ambiguity, MMC can make it worse. In addition to institutional reports from India and the UK and recent research from the best construction management periodicals, these problems are explored in this thesis. The properties of MMC are assessed in terms of their ability to reduce the inherent uncertainties of traditional construction. uncertainty, affecting both clients and contractors. Conclusions drawn from the review indicate that, when completely implemented, the industrialized construction process does reduce uncertainty by being more predictable in terms of time schedules, prices, and working conditions.

Keywords: Barriers, Construction Method, Highrise building, innovation, Modern method

Introduction:

1. General:

Many individuals favour houses that are constructed the old-fashioned way, close to the construction site, board by board, nail by nail. However, they are no longer made the same way as they formerly were [1]. "The development of an Extensive range of modern methods of construction (MMC) techniques and goods has radically altered how the construction sector behaves now". This great change will undoubtedly lead to further advancements in this industry. Many advantages of employing MMC for housing have not yet been established or are debatable. However, according to the government and manufacturers, MMC's key benefits are:

• Economic – "MMC houses typically have fewer defects and can be built more quickly".

• Environmental – "the houses can be more energy efficient, may involve less transport of materials, and produce less waste".

• Social – "there may be fewer accidents and less impact on local residents during construction" [2][3].

2. Defining Modern Methods of Construction:

MMC is a colloquial word for both onsite and offsite construction processes that has its roots in the United Kingdom. Offsite MMC describes prefabricated parts of buildings that are manufactured at a factory, transported, and then assembled on-site. MMC is used to assemble structural elements and building pieces on-site.[4]

Authors Chen (Chen, 2010) claims that MMC has improved productivity and quality in the construction industry, as well as a number of other advantages, including shorter construction times, lower overall construction costs, improved quality, improved durability, better architectural appearance, improved occupational health and safety, material conservation, reduced waste on construction sites, decreased environmental emissions, and decreased energy and water use. 'Better products and procedures are important to MMC'. They seek to increase operational effectiveness, superior client satisfaction, environmental performance, sustainability, and the predictability of delivery schedules. MMC are consequently built on a broader perspective than a specific product focus [5][6].

2.1 Classification of Modern Method of Construction

Off-site production: 'the production process takes place in a factory, off site'.

Systems of prefabricated houses: consist of prefabricated panels for the walls, floors, and roofs that are built where they would eventually form a structure, requiring varying degrees of editing. 'The most popular open panels or frames are those that are simply skeletons and require finishing work, including insulation and outer casing, to be put immediately'. Closed is a different technique that also utilized panels. This more complicated system, which can include isolation and cladding material, is harder to construct in a factory.

Modular system (volume / volumetric): The building's structure is made up of modules put together as a whole. This technology enables the instantaneous connecting of a greater number of compatible modules, which is why it is frequently applied to larger, more uniform structures. 'Prefabricated modules, also known as cells, are sometimes described as being 80 to 95% finished inside the plant, including the mechanical and electrical services, before being transported to the final assembly location'. They are mainly seen in specialized spaces that require repetitive typing, including kitchens and toilets. [11]

3. Barriers of MMC:

According to a review of the literature, there are eight main categories under which common obstacles, drawbacks, and problematic problems (henceforth referred to as obstacles) of MMCs can be categorized. "These categories are cost, skills and experience, motivation and culture, tools and standards, the market for MMCs, industry, interface and flexibility, and projects". They are covered in the subsections that follow [7].

3.1. Barriers of modern methods of construction are:

Absence of resources.

Deficiency of co-ordination between the engineers and the labors.

Far distance from the factory to site.

Great lack of skilled labors.

Heavy equipment.

High initial cost.

High taxation problems

Increase in duration of project.

Lack of market demand.

Need of capital.

Quality.

3.2. Advantages by the use of modern methods of construction are:

Due to the MMC the site disturbance is less.

Easy construction.

Gives better workability.

It improves the quality.

It increases the strength.

It reduces the cost of the project.

It make less of the waste products.

It saves the construction time.

Less quantity of labors are required.

Reduce health and safety risk.

Simple construction [8][9][10].

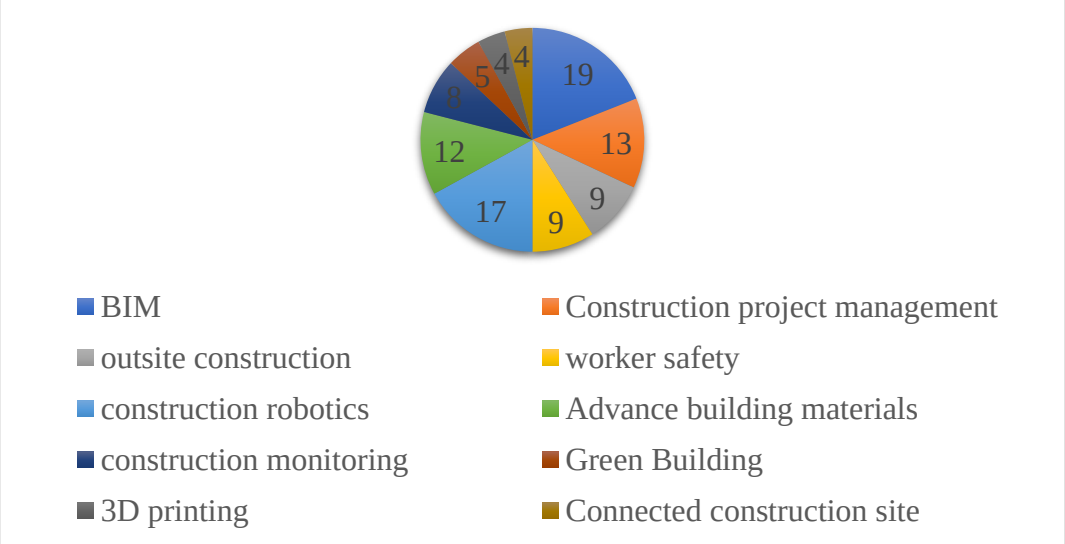


Fig.1 Impact of Construction industry Trends & Innovations in 2022

4. History of high-rise building:

4.1.General introduction:

With the rate of population growth, the needs of the population are expanding quickly. People are looking for additional space to accommodate their growing way of life. “Accommodation is obviously one of the fundamental needs for every sector of the economy or for an individual The land is being

covered in bituminous and concrete. [29] High rise structures are the main, both aesthetically and technically, answer in this scenario to meet the needs of the populace". For a better quality of life, better health, and greater prosperity for the occupants, as well as for the stability and strength of the structures, I will discuss the needs for high rise buildings, their demand, and the construction techniques with sophisticated technologies and ideas of green concepts in this paper [12].

4.2. The high-rise building is still made of the solid brick masonry up until the end of the last century. "The newer technologies are being applied and some are still being explored". High rise buildings are providing the better living facilities for the people with better facility [13].

4.3. The ancient Egyptians were the first to use scientific knowledge in building construction. When designing a large building with large rooms, engineers use natural science technologies to understand the qualities of the material. "The first high rise office building, which now has twelve floors after initially having ten, was constructed in Chicago in 1885. It took around sixteen months to complete". First, it's important to comprehend what a high building and a high-rise building are [14].

"High building means the building which are having no more floors". According to bible it has been written that the tower of babel has to reach unto the heaven. The early equitable life building in Network which was completed in 1872 also contribute toward the development of the high-rise building [15].

5. Construction techniques for high rise building:

When designing a tall building, there are some essential technological guidelines. In India, a lot of high-rise buildings are being built using the most recent technology, and the idea of green technology is also being updated [16]. "When building a high tower, steel technology and reinforced cement concrete are typically used". As opposed to regular cement, high strength cement is employed in the construction of high-rise buildings. Cement blocks are typically utilized in high-rise buildings to make their walls. For the quick and easy construction of high-rise buildings, many machines are used [17].

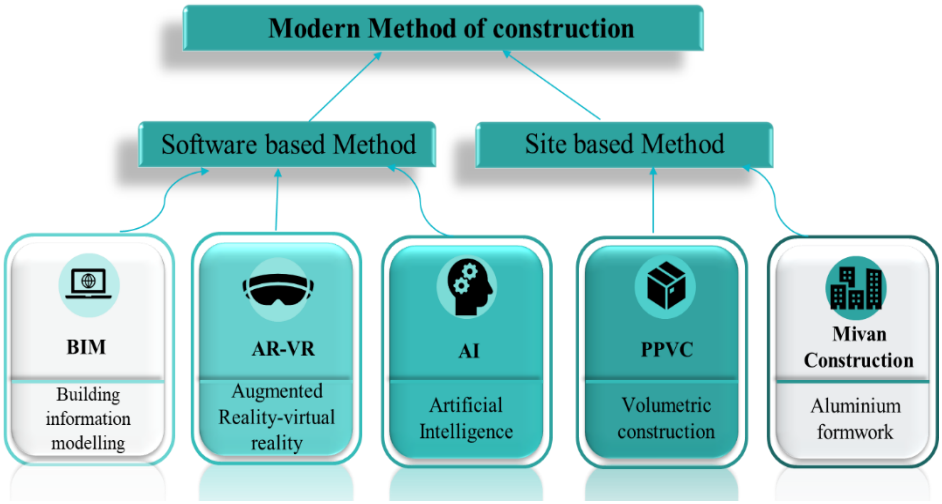


Fig: 2 Modern Method for highrise building

6. Liteature review:

The critical succes factor identify based on case study in Gujrat and the second based on survey based after this finding factors for adopting modern technology in special gujrat for highrise building .

This study indicate the critical success factors, among many other factors. Depending on these factors, stakeholders can establish best practices for successful project management.

Technique and the requiremnt for the high rise building is most important for the proper managemnt and for the strength of building. It is not a good building if there is not a good structure. The structure correspond to the material that are used for the construction.

6.1 Survey based identify factors:

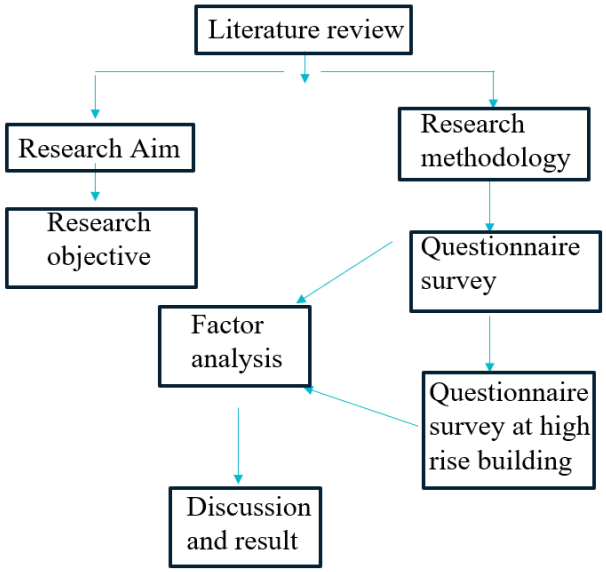
"Construction technologies (CT) have become useful tools that can be utilised in architectural, engineering, and construction (AEC) applications to operate more effectively. According to reports, advanced technology like artificial intelligence (AI) tools can significantly aid in the solution of challenging issues". [18]**.**

Factors; High set up cost, Legal and Contractual Constraints on adopting technology, High training and running costs

"The environmental effect of modern construction technology is reduced as a result of more production, better quality, quicker completion, and less waste. With the help of modern construction technology, more homes of higher quality can be built faster". [19].

Factors: Time, Quality, Sustainability, Commercial risk, Maintenance

"The study's findings highlight numerous other elements as well as the crucial success criteria. Stakeholders can build best practices for effective project management based on these variables".[20]. **Factors: Quality-related factors, cost-related factors, time-related factors, contract-related factors, and external-related factor.**



6Fig:3 Process of literature review findings

Conclusion:

Modern construction techniques have too many advantages to be disregarded. In a short amount of time, modern building techniques can produce a significant number of sustainably constructed, beautifully designed homes. Modern construction methods also give the possibility to use factory manufacturing to fill the skills gap in the building industry. Modern construction methods will be a key tool in tackling this challenge and should be considered as an opportunity for the housing industry to increase capacity and choice. Modern construction technology has largely taken the place of more conventional approaches.

The environmental effect of modern construction technology is reduced as a result of more production, better quality, quicker completion, and less waste. With the help of modern construction technology, more homes of higher quality can be built faster.

The benefits of using MMC are undeniable. Numerous studies claim a financial benefit and speed up the construction process. The sustainability of building is positively impacted by the use of modern materials. For a number of reasons, it is crucial to define these advantages. One of them is the interdependence of the crucial elements in the application of MMC and cutting-edge materials in the construction with their benefits. These are described by a variety of authors. The development of talents is a crucial aspect, along with the solution's economic viability. Their usage is justified by the need for education and the spread of information.

Architectural, engineering, and construction (AEC) applications can make better use of the sophisticated tools known as construction technologies (CT). According to reports, technologies like artificial intelligence (AI) tools can significantly aid in the solution of challenging issues. By utilizing CT in AEC, it can help to cut down on time, people, and materials, which lowers the cost of the completed work.

Sustainable building practices aim to satisfy housing, infrastructure, and favourable working conditions without jeopardizing the ability of future generations to meet their own demands when the time comes. The economic effectiveness, social responsibility, and environmental performances that support architectural quality and technical innovation are all part of sustainable construction. Traditional building materials are cheap, readily accessible, and sustainable. Utilizing these materials in innovative construction methods will improve sustainability and energy efficiency while lowering construction costs.

References:

[1] H. Khan, “MODERN METHODS OF CONSTRUCTION,” no. 4, pp. 203–230, 2019.

[2] A. H. Mission and U. Development, “Emerging and Innovative Technology for construction of Housing used in Gujarat.”

[3] “The Open Construction & Building Challenges and Barriers of Building Information Modeling Adoption in the Abstract :,” pp. 98–106, 2020, doi: 10.2174/1874836802014010098.

[4] M. M. Rahman, “Barriers of Implementing Modern Methods of Construction,” *J. Manag. Eng.*, vol. 30, no. 1, pp. 69–77, 2014, doi: 10.1061/(asce)me.1943-5479.0000173.

[5] "Building and Environment, Vol. 16, No. 3, p. 233, 1981. Pergamon Press Ltd. Printed in Great Britain.," vol. 16, no. 3, p. 926726, 1981.

[6] R. M. Noor, A. Musir, and M. Nasir, "Critical success factors for construction project Critical Success Factors For Construction Project," vol. 030011, no. October 2016, 2017, doi: 10.1063/1.4965067.

[7] A. M. F. Albtoush, S. I. D. R. A. Rahman, and A. H. Al Momani, "Critical success factors of construction projects in Jordan : an empirical investigation," *Asian J. Civ. Eng.*, vol. 23, no. 7, pp. 1087–1099, 2022, doi: 10.1007/s42107-022-00470-8.

[8] M. Wang and X. Yin, "Automation in Construction Construction and maintenance of urban underground infrastructure with digital technologies," *Autom. Constr.*, vol. 141, no. July, p. 104464, 2022, doi: 10.1016/j.autcon.2022.104464.

[9] C. Thapa, D. R. Dhakal, and K. Neupane, "Construction Techniques And Demand Of High Rise Building In India," *Int. J. Emerg. Trends Eng. Dev.*, vol. 2, no. 3, pp. 46–51, 2013.

[10] Y. Yu, D. Murat, V. Junjan, and M. Iacob, "Circular economy in the construction industry : A review of decision support tools based on Information & Communication Technologies," *J. Clean. Prod.*, vol. 349, no. July 2021, p. 131335, 2022, doi: 10.1016/j.jclepro.2022.131335.

[11] S. E. E. Profile and S. E. E. Profile, "Factors affecting the use of modern methods and materials in construction," no. January, 2015, doi: 10.1088/1757-899X/71/1/012053.

[12] M. Hamza, S. Durdyev, N. Van Tam, and S. Shahid, "Factors influencing construction technology adoption in residential projects at Vietnam," *Ain Shams Eng. J.*, no. xxxx, p. 101906, 2022, doi: 10.1016/j.asej.2022.101906.

[13] A. Toppinen, R. Toivonen, and H. Vihem, "Forest Policy and Economics Policy narratives on wooden multi-storey construction and implications for technology innovation system governance," vol. 125, 2021, doi: 10.1016/j.forpol.2021.102409.

[14] D. Li and Y. Gong, "ScienceDirect The design of power grid data management system based on blockchain technology and construction of system security evaluation model," *Energy Reports*, vol. 8, pp. 466–479, 2022, doi: 10.1016/j.egyr.2022.05.277.

[15] Y. Qingjuan, L. Bei, and L. Kui, "Procedia Engineering The Rural Landscape Research in Chengdu ' s Urban-rural Intergration Development," vol. 21, no. 1, pp. 780–788, 2011, doi:

10.1016/j.proeng.2011.11.2078.

[16] D. Lee and M. Kim, "Autonomous construction hoist system based on deep reinforcement learning in high-rise building construction," *Autom. Constr.*, vol. 128, no. April, p. 103737, 2021, doi: 10.1016/j.autcon.2021.103737.

[17] R. M. Lawson, R. G. Ogden, and R. Bergin, "Application of Modular Construction in High-Rise Buildings," *J. Archit. Eng.*, vol. 18, no. 2, pp. 148–154, 2012, doi: 10.1061/(asce)ae.1943-5568.0000057.

[18] D. Xinjie, K. Mingming, and Y. Yin, "A Multiple Survey Network for Super High-Rise Building," *J. Phys. Conf. Ser.*, vol. 2202, no. 1, 2022, doi: 10.1088/1742-6596/2202/1/012035.

[19] S. Pourzeynali, H. H. Lavasani, and A. H. Modarayi, "Active control of high rise building structures using fuzzy logic and genetic algorithms," *Eng. Struct.*, vol. 29, no. 3, pp. 346–357, 2007, doi: 10.1016/j.engstruct.2006.04.015.

[20] L. Jaillon and C. S. Poon, "Advantages and Limitations of Precast Concrete Construction in High-rise Buildings: Hong Kong Case Studies," *CIB World Build. Congr.*, pp. 2504–2514, 2007.

[21] S. Sukathong, P. Suksawang, and T. Naenna, "Analyzing the importance of critical success factors for the adoption of advanced manufacturing technologies," *Int. J. Eng. Bus. Manag.*, vol. 13, pp. 1–16, 2021, doi: 10.1177/18479790211055057.

[22] B. Manzoor, I. Othman, J. C. Pomares, and H. Y. Chong, "A research framework of mitigating construction accidents in high-rise building projects via integrating building information modeling with emerging digital technologies," *Appl. Sci.*, vol. 11, no. 18, 2021, doi: 10.3390/app11188359.

[23] C. Thapa, D. R. Dhakal, and K. Neupane, "Construction Techniques And Demand Of High Rise Building In India," no. June 2014, 2013.

[24] G. Xu and X. Shi, "Characteristics and applications of fly ash as a sustainable construction material: A state-of-the-art review," *Resour. Conserv. Recycl.*, vol. 136, no. August 2017, pp. 95–109, 2018, doi: 10.1016/j.resconrec.2018.04.010.

[25] F. Parkar, "COMPARATIVE ANALYSIS OF FORMWORK IN MULTISTORY BUILDINGv Related papers COMPARAT IVE ANALYSIS OF FORMWORK IN MULT IST ORY BUILDING eSAT Journals Analysis of Formwork in Mult ist ory Building Naveed Akht ar COMPARAT IVE ST UDY

AND DECISION MAKING FOR A FOR," [Online]. Available: http://www.ijret.org.

[26] S. Goubran, T. Masson, and T. Walker, "Diagnosing the local suitability of high-rise timber construction," *Build. Res. Inf.*, vol. 48, no. 1, pp. 101–123, 2020, doi: 10.1080/09613218.2019.1631700.

[27] Y. Zhao, X. Ma, C. Zhang, H. Wang, and Y. Zhang, "3D real-time volumetric particle tracking velocimetry – A promising tool for studies of airflow around high-rise buildings," *Build. Environ.*, vol. 178, no. April, p. 106930, 2020, doi: 10.1016/j.buildenv.2020.106930.

[28] W. Pan, Y. Yang, and L. Yang, "High-Rise Modular Building: Ten-Year Journey and Future Development," *Constr. Res. Congr. 2018 Sustain. Des. Constr. Educ. - Sel. Pap. from Constr. Res. Congr. 2018*, vol. 2018-April, no. March, pp. 523–532, 2018, doi: 10.1061/9780784481301.052.

[29] H. Stopps, C. Thorneycroft, M. F. Touchie, N. Zimmermann, I. Hamilton, and T. Kesik, "High-rise residential building makeovers: Improving renovation quality in the United Kingdom and Canada through systemic analysis," *Energy Res. Soc. Sci.*, vol. 77, 2021, doi: 10.1016/j.erss.2021.102085.

[30] A. S. Hassan and N. T. Al-ashwal, "Impact of Building Envelope Modification on Energy Performance of High-Rise Apartments in Kuala Lumpur, Malaysia," *Int. Trans. J. Eng. Manag. Appl. Sci. Technol.*, vol. 6, no. 3, pp. 91–105, 2015.

[31] R. Congress, "Guidelines for Environmental Impact Assessment of Highway Projects the Indian Roads Congress," 1988.

[32] O. Gamayunova and D. Spitsov, "Technical features of the construction of highrise buildings," *E3S Web Conf.*, vol. 164, 2020, doi: 10.1051/e3sconf/202016408008.

[33] S. Y. Eroshkin, N. D. Koryagin, D. V. Kovkov, D. V. Panov, and A. I. Sukhorukov, "The Paradigm of the Integration of Different Types of Management Information Systems in Investment and Construction Company Implementing the Project Approach," *Procedia Comput. Sci.*, vol. 103, no. October 2016, pp. 605–608, 2017, doi: 10.1016/j.procs.2017.01.076.

[34] W. Ferdous, Y. Bai, T. D. Ngo, A. Manalo, and P. Mendis, "New advancements, challenges and opportunities of multi-storey modular buildings – A state-of-the-art review," *Eng. Struct.*, vol. 183, no. October 2018, pp. 883–893, 2019, doi: 10.1016/j.engstruct.2019.01.061.

[35] M. Siikonen, *Planning and Control Models for Elevators in High-Rise Buildings Planning and Control Models for Elevators in High-Rise Buildings KONE Corporation SF-00331 Helsinki , Finland Helsinki*

University of Technology Systems Analysis Laboratory Research Reports O, no. October 1998. 2016.

[36] A. Ranjbaran, "Planning And Control of High-Rise Building Construction." 2007, [Online]. Available: http://www.google.com/url?sa=t&rct=j&q=quasiparticle+high+tc&source=web&cd=24&ved=0CEcQFjADOBQ&url=http://thesis.library.caltech.edu/2523/3/Thesis_AB_main.pdf&ei=RIjJTp2pJcLg0QGb4bUH&usg=AFQjCNEQ3x7PBLDO6E_s4jnZ3jMZG5qO2Q.

[37] L. Dai and B. Liao, "Title : Innovative High Efficient Construction Technologies in Super High Rise Steel Structure Buildings The Research and Application of Innovative High Efficient Construction Technologies in Super High Rise Steel Structure Building," *Int. J. High-Rise Build.*, vol. 3, no. 3, pp. 205–214, 2014.

[38] L. Manukhina and N. Samosudova, "Specific features of modern multifunctional high-rise building construction," *E3S Web Conf.*, vol. 33, pp. 3–8, 2018, doi: 10.1051/e3sconf/20183301040.

[39] S. Navaratnam, "Selecting a Suitable Sustainable Construction Method for Australian High-Rise Building: A Multi-Criteria Analysis," *Sustain.*, vol. 14, no. 12, 2022, doi: 10.3390/su14127435.