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Achieving a green AI architecture using BIM in architecture and smart cities

Fariba Kaviani*

Bachelor's degree of Architecture, Department of Architecture, Faculty of Architecture, Kousar Non-profit University, Qazvin, Iran
Faribaa.kaviani@gmail.com

Bahareh Mohammad Seyed Abadi

Bachelor's degree of Architecture, Department of Architecture a, Faculty of Architecture, University of Science and Application of Parse design and drawing company, Tehran, Iran

ABSTRACT

The growth of urbanization in developing cities in recent decades can bring innovative methods in various areas of urbanization and architecture design and thus improve the urban living environment. Smart city is one of the most important topics in the area of smartening of urban spaces in smart urban and green design. The generation of smart cities can be addressed in this regard. The got to pay thought to the think about of human needs and it alter over time based on analysing of human and environmental characteristics makes it necessary to address the components of technology to make the lives of future generations productive. The method of the present study is based on previous studies and the qualitative and quantitative method for development of futuristic cities from the perspective of smartening. The main aim of this study is to examine the weaknesses of the case study and provide a solution for optimization based on the creation of an improved sustainable area based on environmental quality and environmental smartening in terms of smart tourism services. The results of studies suggest that based on the sustainability criteria of developed cities, urban infrastructure can be upgraded to an attractive and sustainable environment by smartening and using artificial intelligence, and with the aim of green AI by BIM.

Keywords: Smart City, Human needs, Sustainable design, Artificial intelligence, green design, BIM

INTRODUCTION

In today's world, cities need development for the future and through new technologies goals such as: sustainability can improve the quality of environment and life, environment, climate change and meet changing human needs. Cities are thus on the verge of population increase; hence it is crucial to consider the municipal authorities and desires of the city dwellers so that the need to take care of the environment and improve life in urban communities entail the structure of futuristic cities can sustainability.(Fokaifes and et al, 2018, pp. 1-8) Energy shortages and environmental degradation have moved to the top of the global agenda in recent years. The construction industry is currently responsible for most of the world's energy consumption of various types of resources such as ores and wood, as well as the main source of environmental pollution. (S. Lu, 2019, p. 118151) Since the rapid development of the construction industry, the development of the construction industry has driven the economy, but also caused environmental pollution, soaring consumption of resources and other problems. Architecture has relatively complex design features (liu, 2021, pp. 1-12). Regardless of the construction connection, a lot of resources are consumed. Green building advocates the use of



new materials and processes that can ensure the harmony and unity of people and society. The core of BIM technology lies in informatization, which can create a core database based on green buildings, build an evaluation system, eliminate the information island effect and ensure the quality of building construction. The core value of evaluation is dynamic (Sun, 2021, p. 8). So, only on the basis of BIM technology can we achieve an accurate assessment and maximize the use of BIM technology in the building assessment system. In general, future countries upgraded with intelligent intelligence can use technology to meet human needs. One of the most important cases in this area is the use of new technologies and sustainable development. (Grassl & Groß, 2019, p. 27) Related to the development of future cities with artificial intelligence and futuristic elements. In fact, holistic stability can encompass futuristic regions. (Adunadepo & Sunday, 2018, p. 10) For example, the quality and development of the environment can be displayed using intelligence and artificial intelligence. Although developing cities can use artificial intelligence to prevent population growth and environmental degradation and climate change. Therefore, with the use of robots and cutting-edge technology, optimal urban services as well as meeting human needs in cities can be called the intelligent age. (Boenig-Liptsin, 2018, pp. 16-21)

The vision of future cities can be presented using the technology process and the use of fake intelligence. Therefore, the objectives of this research are the following:

- To define the overall framework and technology of the Smart and its services
- To apply smart technology in futuristic cities
- To study the changing human needs using Maslow's theory
- To provide solutions tailored to changing human needs as technology advances BIM

Research assumptions

- It seems that the use of green artificial intelligence in intelligent environments allows us to respond to architectural design productivity and performance.
- It is believed that by studying human needs theory, we can provide an optimal response to the changes in human needs in smart cities and architectural design.

Sustainability and human needs, as described in the literature, focus on the full human potential throughout the process. Balancing the ecological vitality in urban areas will have a positive impact on sustainable urban development and meet the needs and requirements. However, without reducing production resources (Ben-Eli, 2018, pp. 1337–1343).

The implementation of the framework therefore requires sufficient knowledge of green artificial intelligence, the model of human needs, the perspective of forward-thinking communities, and the design of urban infrastructure and architecture. Finally, using the qualitative method in the first phase of research, we can show the limitations and theoretical foundations by looking at examples such as smart and green architectural design examples to understand the creation of a sustainable future for humanity. Then, with the method of quantitative research, it is possible to measure the degree of satisfaction of the citizens of one of the specific cities, using a



questionnaire and its numerical analysis with computer software (Spss), and how to achieve optimal and practical results in this area through intelligent technology and use to present green artificial intelligence and finally to measure the change in human needs in the future.

Research literature

Human needs

In fact, the relationship between smart city design and changing human needs in the future should be studied and its functional components identified. The famous psychologist Abraham Maslow established his hierarchy of human needs in 1943 (Maslow., 2020, pp. 358-379). Human needs are shown at five levels. (Figure 1)

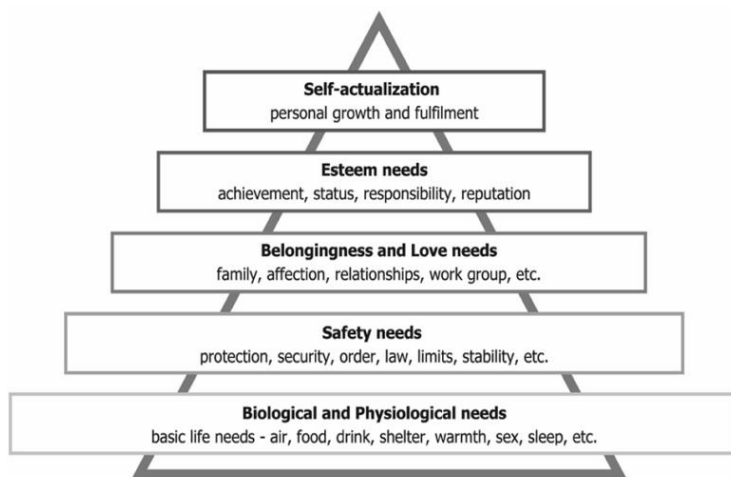


Figure1: Hierarchy of human needs (Maslow., 2020, pp. 358-379)

How do we design for the physical, physiological and psychological needs of residents and users in Smart Cities and Green Lands? Norman (Norman, 2018).

Smart city

Cities or smart areas are based on a productive and safe environment that has achieved sustained improvement in the economy and sustainable lifestyle of the method of technology deployment (Hall.R.E, 2019, pp. 1-7). Theorists claim that creating variable urban environments is required to build sustainable planning and establish smart cities (Giffinger.R, 2018, pp. 7-26).

City architects use smart devices, including smart applications and electronic means, to discover the relationships between smart parts of the city and design smart networks (Ismagilova, 2019, pp. 88-100) (Singhand et al, 2019, pp. 1-23) (Barletta, 2020).

Using an intelligent urban model and a theoretical approach of this system, intelligent plans and models in intelligent urban spaces can be provided (Caivano, 2020, pp. 2-23). In fact, the use of artificial intelligence in cities can help improve technology and human lifestyle. It is as if human beings do less hard work and experience a more flexible life and a different and optimal style. (Everitt & Hutter, 2018, pp. 15-46) Nowadays, the use of artificial cognition technology has expressed a different style of urban life. In fact, the use of intelligence can bring human life



from home to urban areas to a futuristic stability in terms of comfort and convenience. (lin.et, 2018, pp. 441-465)(Figure 2)

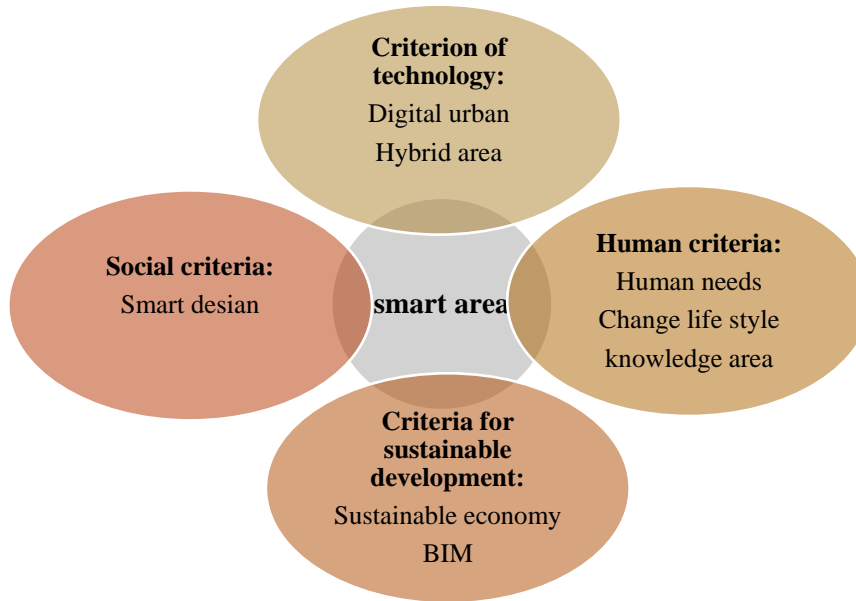


Figure2: The main criteria of the smart area(author)

Intelligence in developing cities can meet human and environmental needs, although it can also accompany innovative strategies in the fields of economy, environment and the creation of areas with green attitudes and modern technology. (Fermentia-Serra, Beuhofer, & Ivars Baidal, 2019, pp. 109–133)

Urban AI

Applied intelligence to intelligently design urban areas can be applied to urban productivity and technology. (Cugurullo, 2020, pp. 2-38) In fact, applied intelligence in smart areas becomes a strength and can turn weaknesses and threats into positive points. (D'Amico, 2020) (Macrorie, 2020)

Application of BIM in architecture

Wireless sensor networks (WSNs) are a group of self-configured and infrastructure-less communication models used to monitor physical and environmental conditions. Monitoring conditions include temperature, sound intensity, wind direction, vibration, pressure, movement of objects, lighting intensity, pollution levels, line voltage, environmental chemicals, and more. It is necessary to transfer their data collectively to the central point where they can be observed and analysed. Building Information Modelling (BIM) is a collaborative process that uses advanced technologies to create data models of the building. The improved indoor air quality can be achieved by designing adequate ventilation. The use of solar energy as a renewable energy source is an essential model for greenhouse designs. The building materials used are ethical and

non-toxic to protect the health of residents. The better air quality of the building is ensured by the right ventilation design and non-toxic materials used in the BIM modelling phase.

- (i) The main objective of green building design is to provide reasonable waste management that can be achieved during the construction phase. Landfilling of rubble should be reduced and controlled. The well-designed green buildings help reduce the waste generated by residents by providing compost pits/bins and separate bins for recyclable plastic waste.
- (ii) The WSN plays an important role in energy saving. The motion detection technology saves unwanted energy consumption. The WSN-powered home automation (smart home) system saves energy by turning off lights if occupants forget to turn them off while leaving the home. The motion sensors play a crucial role by checking room occupancy and deciding whether to turn the lights on or off. By checking air conditioning and heating, the home automation system saves energy to a large extent. Consistent savings can be achieved with the programmable mode for the temperature and lighting of the house. This automation can be integrated into any organizational building concept.
- (iii) Green buildings focus on reducing environmental impact by reducing energy and water consumption, resulting in minimized environmental disturbances from the building. The main aspect of green buildings is their design to improve human health by creating a healthy indoor environment. From the recent studies, it is clear that the health of the human occupants is more reasonable than the non-green buildings. Building ventilation and indoor air quality play a crucial role when it comes to human health. Proper ventilation is provided in the BIM models at the design stage.
- (iv) Green building should also focus on significantly reducing waste to landfill. The waste water from washing machines and dishwashers can be treated in an in-house water treatment plant and used for gardens, car washes and toilet flushing.
- (v) Implementing efficiency in material design and eliminating material waste in the design phase could reduce greenhouse gas (GHG) emissions. Recycling and reuse of building materials also lead to a reduction in greenhouse gas emissions. Scrapping of the building before the end of its useful life should be avoided. Switching from high-emission materials to natural materials like wood is a healthy practice in the fight against greenhouse gas emissions.

Technologies implemented in these processes include the following: Building Information modelling (BIM) is a digital transformation technology in architecture, engineering, and construction that involves the modelling and management of the digital representation of all forms of structural construction. An artificial neural network (ANN) is a system representing the human brain and used in this research to perform continuous training of the system to predict possible inconveniences in the system. The Genetic Algorithm (GA) with ANN provides a Genetic Artificial Neural Network (GANN) that is used to train multiple building-mounted sensor networks to provide optimized results. In this GANN it is assumed that each sensor type works together with different functionalities.

Green Building and BIM



Green building is characterized by large amounts of information and complex types. (Bhagi, 2021, pp. 64-73) As an interactive platform for the efficient transmission of information and management data BIM technology ensures the unity of information in the phases of building planning, design and construction using digital technology. The application of BIM in green building can effectively eliminate the information island problem between different stages, and establish the balance between green management and green technology. It is embodied in the seamless connection of space dimension and time dimension. In terms of the temporal dimension, the collection, sorting, summary and analysis of green building design information can be realized through the parametric model of BIM. At the same time, it provides an intelligent data platform for later project post-evaluation and even operational evaluation to provide strong data support for green building performance simulation and to be used in green building environmental performance analysis (P. Wang, 2020, pp. 21–36)

As shown in Figure 3, it can realize the effective connection between technology and building rating system. (Figure 3)

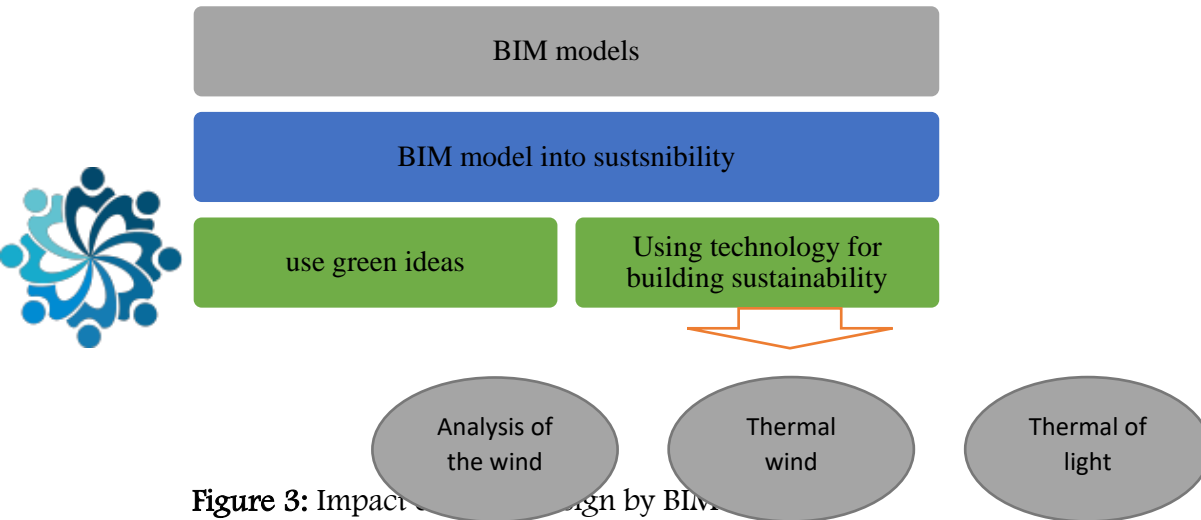


Figure 3: Impact of Design by BIM
Methodology

The question of the strategy of a case study based on the introduction of the given criteria. which are developed and checked according to the research criteria. (Roth.S., 1999)

The research method based on these cases is step by step:

1. Problem statement
2. Formulation of research hypotheses
3. Collection of research theories and components
4. Analysis of research results using quantitative and coding methods. (Figure 4)

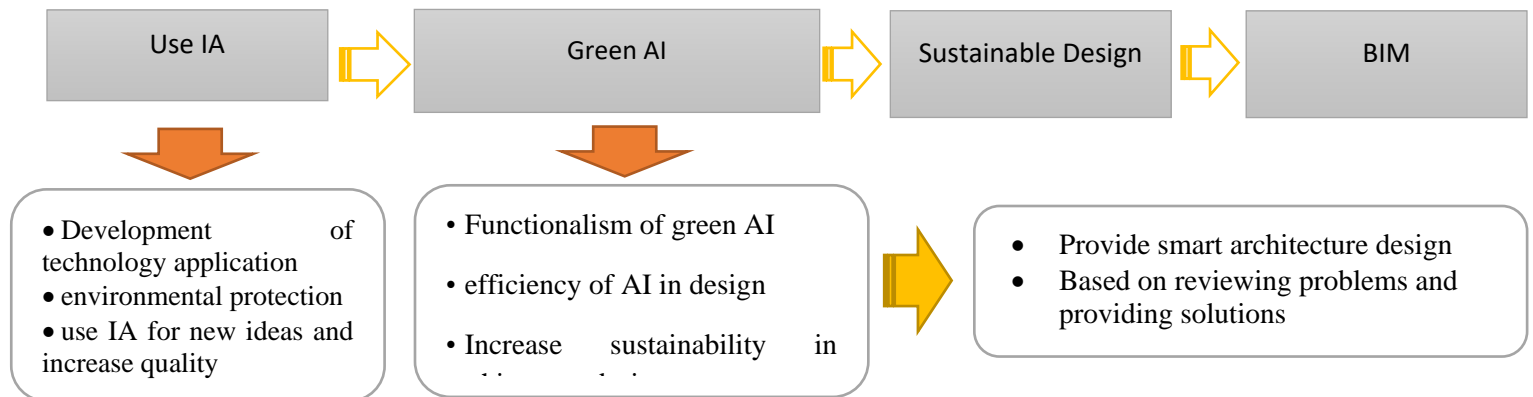


Figure 4: The research model. (author)

The method of the present research is qualitative and quantitative

The qualitative method of the present study was analysed using the findings and literature sources to examine the theoretical foundations and identify and recognize the theories and fundamental components of the research in the research background of artificial intelligence BIM in architectural planning. In fact, the sources of academic articles and texts in Researchgate.net, Academia.edu and Google Scholar were used to achieve the basic research criteria. In the second stage, the use of quantitative research methods was used to prove the hypotheses and provide solutions for the purposes. In fact, this research was based on a quantitative methodology (questionnaire) for accuracy, ideological compatibility, validity, reliability and presentation of objective data according to theoretical bases. In fact, the three characteristics of numerical measurement are reliability and credibility, measurements are based on the examined characteristics and qualitative components, and the instrument's reliability is stable and coherent, and the numerical and coding methods can be used many times in other cases. The show Consider is based on the collection of quantitative information through questionnaires from people in developing countries or cities for the next generation of Smart Cities using an online questionnaire. The aim is to establish a theoretical process, criteria and validity to maximize research conclusions...



Steps of the quantitative research model: (respectively):

- Questionnaire design (using components, theories, criteria and theoretical foundations) (Determination of the Likert spectrum) (Coding and evaluation of the components and questions separately)
- Determination of the statistical community
- Validity and reliability of the questionnaire
- Collect questionnaire data and import it into the software
- Analysis of the data by variance, criterion weighting coefficient, t-test and Pearson
- Determination of the qualitative and quantitative model based on results and data analysis
- Finally, review of the final criteria and presentation of the green AI model and its application in architectural design

Note: The questionnaire is open and closed in two ways.

Open questionnaire of some questions from professors of urban planning and architecture (in person), open-ended questions to identify and examine strengths and weaknesses in smart cities. Closed questionnaire including 12 questions from citizens living in developing cities (online), Closed questions for descriptive statistical analysis (mean, standard deviation), for readability

and logical method of comparisons with numerical data, the questionnaire followed a three-part design:

- Components
- theories
- Criteria

In fact, the components are considered to be AI projects and design by BIM.

Theories emphasize the effectiveness and updating of theories for cities and future generations.

Criteria challenge productivity and pragmatism in the implementation of ideology. (Figure 5)

(Table 1)

Table 1: Review of components (author)

Theme	Attribute	Component	infrastructure
efficiency	<ul style="list-style-type: none"> – High Quality – High efficiency – High flexibility 	Quality	Urban Development
Sustainable environment	<ul style="list-style-type: none"> – Low energy consumption – Low maintenance – Protection of natural resources 	Stability	Global development
Human needs	<ul style="list-style-type: none"> – Foresight – Mental comfort – Turning mentality into objectivity 	Vitality	Individual development

Findings

The research method is based on quantitative and numerical data, the steps of the research are as follows:

The first step is to design the questionnaire questions

The second step is the permissibility and fluency of the questionnaire questions

The third step of determining the statistical population of the research (statistical population is random and questionnaires are filled in online)

The number of statistical populations is 120 people according to Cochran's formula

The four step the data were analysed using software Spss 21

The fifth step is to review the data and analyse them based on the answers to the research hypotheses

Figure 5: The main reasons for selecting all three movies as case studies. (author)

The First Step

The present study uses the SPSS statistical software to analyse this and to verify the results of the questionnaire, and all the results of this research were extracted from the SPSS-16 software.

Likert Scale

The spectroscopy performed according to the Likert method can be used as a unit of measurement in the questionnaire, which is evaluated according to the answers and the number of items. The Likert scale in this study is classified on the basis of 5 and on the basis of 1 to 5 in order of the very low rating of the questionnaire responses.

The Second Step

Validity and reliability of the questionnaire - Cronbach's alpha.

One of the most common methods for assessing the reliability of questionnaires is to determine the internal correlation of the questionnaire questions, which is done using the Cronbach's alpha coefficient. Cronbach's alpha coefficient is closely related to the internal tuning of the questions and its value is theoretically between zero and one; In general, however, the Cronbach's alpha value of a comparison should be at least 0.7. (Table 2)



Table 2: Check the Cronbach's alpha (author)

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.7	0.7	230

For Cronbach's alpha, the number 0.7 is extracted. Therefore, the validity and reliability of the above questionnaire can be extracted that the present questionnaire has validity and reliability.

The Third Step

Statistical Society

In the scientific definitions of a statistical society, people from a society who live in a society with one or two similar characteristics are called a statistical society. In fact, the researcher asks the statistical population about the characteristics of the variables and research criteria.

The target population is people in different cities and questionnaires have been filled in randomly and online for sampling.

The volume of the statistical population is 230 people, calculated based on the Cochran's formula: The sample size is equal to: 230

5% error rate

Therefore, 230 people should be questioned in this research.

In fact, the current statistical community of citizens in different cities is online.

The Four Step

Evaluation of the proof of the three main research factors in the questionnaire (human needs, sustainability of historic cities and smart cities) has been done with a lot of homogeneity and also using research tools.

The following table is based on three main factors of research and emphasis on questionnaires and statistical analysis, as the mean and standard deviation show that:

In the first stage of the test, there is no difference between the relationship between the components of the research and the number **P is equal to 0.001** and based on these three main areas of research, they can have a clear and meaningful relationship with each other. (Table 3)

Table 3: Evaluation of Analysis Characteristics of Questionnaire Factors Based on Model (CCBQ). (author)

Factors	X ²	df	P	GFL	AGFI	CFI	RMSEA
The three main factors of research	675/465	4/567	0/002	0/78	0/841	0/875	0/089

The correlation matrix was examined in order to make green AI for BIM design. Accordingly, the numerical relationship between coding to make green AI by BIM, obtaining the number 1 in all cases indicates the establishment of a numerical significant relationship between variables. (Table 4)

Table 4: Examining correlation coefficient matrix of the secondary and main factors of the questionnaire and the total score. (author)

Criteria	Artificial intelligence and productivity	Human needs	Economy	tourism development	Preserve the environment	Total score CCBQ
AI	-0/01					
Human needs	0/23	1				
Economy	0/32	0/36	1			
Architecture design	0/45	0/22	0/44	1		
Sustainability design	0/78	0/46	0/32	0/56	1	
Total score CCBQ	0/97	0/78	0/59	0/69	1	0/79

Friedman-test

In quantitative research, Friedman's test can be called a non-parametric test, which is examined using the analogy of several categories at the desired levels. In the present study, the Friedman test was based on the responses to the questions analysed in the variables panel. (Table 5)

Table 5: Friedman test to identify the level of important parameters of the questionnaire and use those parameters in the conclusion. (author)

	N	Mean	Std. Deviation	Minimum	Maximum	Variables
q1	230	4.5555	2.37069	2.00	4.00	Artificial intelligence and productivity
q2	230	4.3660	1.75378	3.00	5.00	
q3	230	3.7500	1.13818	1.00	5.00	
q4	230	3.6667	1.30268	1.00	5.00	Human needs
q5	230	2.2500	1.13818	1.00	5.00	
q6	230	2.3333	1.15470	1.00	5.00	
q7	230	3.4167	.90034	1.00	4.00	Economy
q8	230	3.8333	.93744	2.00	5.00	
q9	230	4.4167	.66856	3.00	5.00	
q10	230	3.0000	.73855	2.00	4.00	tourism development
q11	230	3.5000	1.24316	1.00	5.00	
q12	230	2.5000	1.08711	1.00	5.00	
q13	230	4.0000	.60302	3.00	5.00	Preserve the environment

(The criterion is based on the number of positive answers to each question)

Determining the criteria

The first column displays the names of the variables, the second column displays the number of observations, the third column the lowest value and the fourth the highest value. Mean and Std. Deviation Displays the standard deviation. The deviation from the criterion of this research is based on the collected answers between 1 and 0.5, which is not less than 0.5 and is acceptable and all hypotheses will be proved. (Table 6)

Table 6: The results according to the variables of the questionnaire and answering the questions. (author)

Descriptive Statistics							
Results	Variables	Question	N	Minimum	Maximum	Mean	Std. Deviation
Technology can be used to help sustainability design	AI	q1	230	1.00	5.00	3.5533	1.23
		q2	230	1.00	5.00	3.4477	1.14



		q3	23 0	1.00	5.00	3.4455	1.35
The human need for technology and green areas	Human needs	q4	23 0	1.00	5.00	3.8878	1.12
		q5	23 0	1.00	5.00	2.6389	1.22
		q6	23 0	1.00	5.00	2.5556	1.30
Sustainable design development using AI by BIM can have a positive effect on the economy of design.	Economy	q7	23 0	1.00	5.00	3.6944	1.16
		q8	23 0	1.00	5.00	3.7500	1.25
		q9	23 0	2.00	5.00	4.1389	1.03
Intelligent cities and building can have a significant impact on future life humans	Architecture design	q10	23 0	1.00	5.00	3.0833	1.18019
		q11	23 0	1.00	5.00	3.6667	1.30931
		q12	23 0	1.00	5.00	2.8889	1.34754
Smartening can be effective for preserving the environment and antiquities.	Sustainability design	q13	23 0	1.00	5.00	3.7500	1.10518
	Valid N (listwise)		23 0	230			

A review of the criteria stated by the present research, consistent with the quantitative analysis of the questionnaire, can be very useful to discuss research findings and the application of the research. Accordingly, staging research findings and criteria helps users have a better understanding of the results.

Discussion

This paper presents the viewpoint of using BIM technology in green building assessment, summarizes the shortcomings of the green building assessment system at this stage, and discusses the feasibility and necessity of BIM application in green building assessment. This paper compares and analyses the green building evaluation system at home and abroad from the aspects of the evaluation object, the evaluation process, the evaluation method and the determination of clauses, and proposes modification proposals for the integrated green building evaluation system around the world.

This paper comprehensively explains the application of BIM in green AI in building assessment, forms a complete research path, introduces the green building assessment process based on BIM,

takes the interaction of the assessment information in the BIM environment as a starting point, explains the necessity and specific methods to realize collaborative work and analyses the application of BIM in specific assessment provisions. Check the theoretical analysis with actual cases. Based on the BIM model and various analysis software as auxiliary tools, select representative green building regulations for statistical analysis and simulation analysis, test the impact of applying BIM on green building assessment, and complete the assessment of relevant regulations. From an application value perspective, the application of BIM in the assessment process shows that it plays an important role in improving building performance. However, as a new technology, it cannot guarantee the popularization and application of the technology in industry, and there are certain social challenges in the development process.

The characteristics of the green building determine that it requires multi-level and multi-disciplinary building data information. In the future, a multidisciplinary collaborative work system can be established, covering all building information, to split the BIM model for green building assessment, to create a full-cycle assessment system, and to conduct various in-depth research on the construction of various disciplines of green building. The application of this paper should be limited in length, lack of building types and cannot perfect the green building rating system. However, we believe that with the high development of domestic informatization, various assessment methods and relevant regulations and standards for green building assessment standards will continue to improve. In the future, we can try to introduce artificial intelligence and other technologies into the green building rating to further improve the green building rating system.

By investigating the characteristics of a smart building and changing human needs in design, it is possible to address the sustainability indicators of design. In accordance with human needs regarding the creation of smart tools for building and high productivity, the positive effect on sustainable design and smart space were discussed in a case study. The use of smart tools in building design can support public and private institutions and can be expanded in terms of providing optimal sustainability and green areas.

Conclusion

The product lifecycle of building environments is being enhanced with the implementation of Building Information Modelling (BIM) and the recent emergence of AI applications. Due to the ability to link online sensors used in an environment in real-time, the green building energy saving optimization design using green AI has been described. The aim of the energy-saving optimization of green building designs is to bring together the physical reality and the digital environment in a way that makes it easy to manage and control the construction process, integrate systems, monitor the environment and take other steps towards a more energy-efficient future of life. Classification of various studies in a way that reflects the current state of the art in green AI forms and helps to identify new technologies that will help in the transformation from BIM to green AI. The study developed a classification framework for rankings based on the building life cycle. The results showed that the proposed model performs well in improving the energy assessment.

Another strong point of this project can be the promotion of walking in historical areas using technology, which leads to attracting the audience and preserving antiquities in the industrial



world. According to the qualitative and quantitative results of the study, the following recommendations can be presented to solve the problems of the research sample (Rome-Vatican historical and tourism area):

Recommendations in the area smart building and green AI:

- 1- use internet in design
- 2- Creating software specific to the area (definition of spaces, infrastructure, accesses, history of buildings, etc.)
- 3- Providing a smart platform to access by BIM
- 4- Using virtual displays

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Questionnaire

Q1- How much do you think the building you live in has given importance to smartening?

yes, very
yes, rather
no, rather not
no, not at all
Does not know

Q2- In your opinion, which of the 6 criteria for building to be smart is more important?

Sustainable city economy
Sustainable urban vitality
Smart urban spaces
Smart community
Smart lifestyle
Smart government

Q3- Which of the following do you think is applicable to your building?

Sustainable building economy
Sustainable building vitality
Smart building BIM
Smart community
Smart lifestyle
Smart government



Q4- Is it possible to make other building smart with new ideas by taking ideas from the innovation of building?

yes, very
yes, rather
no, rather not
no, not at all
Does not know

Q5- Do you think that smartening can be discussed globally?

yes, very
yes, rather
no, rather not
no, not at all
Does not know

Q6- Can evaluation in terms of quality and BIM services in smart areas help to improve people's lifestyles?

yes, very

yes, rather

no, rather not

no, not at all

Does not know

Q7- Do you think a building by BIM can be turned into an arena for the use of technology?

yes, very

yes, rather

no, rather not

no, not at all

Does not know

Q8- Can information about the smartening process in building smart be turned into a practical process by the government and the private sector?

yes, very

yes, rather

no, rather not

no, not at all

Does not know

Q9- Do you think that smart building can help in the field of green design?

yes, very

yes, rather

no, rather not

no, not at all

Does not know

Q10- Can today's building become futuristic space by making AI smarter?

yes, very

yes, rather

no, rather not

no, not at all

Does not know

Q11- Can digital platforms and software contribute to design development?

yes, very

yes, rather

no, rather not

no, not at all

Does not know

Q12- Which of the following do you think is important for the protection of building?

Use technology to preserve building



Preserving energy
Creating sustainability space
Use BIM in building

Q13- Is it possible to have a significant impact on the sustainability process for the next generation of human beings by using the intelligence of communities and building?

yes, very
yes, rather
no, rather not
no, not at all
Does not know

