International Journal of Communication Networks and Information Security
ISSN: 2073-607X, 2076-0930
Volume 15 Issue 02 Year 2023

Revolutionizing the Industrialization of Buildings with BIM and AI: Factors Influencing Adoption and Development and Building Planning

Hongjuan Yang*
Lecturer,Weinan Vocational and Technical College, Weinan City, Shanxi Province, 714026, China
y616300337@163.com
Ningning Wang
Lecturer,Weinan Vocational and Technical College, Weinan City, Shanxi Province, 714026, China
wangning05251985@163.com
Yadi Zheng
Lecturer,Weinan Vocational and Technical College, Weinan City, Shanxi Province, 714026, China
zhengyadi19870417@163.com

Article History

Received: 28 May 2023
Revised: 18 July 2023
Accepted: 31 August 2023

Abstract

The continuous development of BIM and AI has made the analysis of building industrialization a hot spot in research and made the issue of industrial reform the focus of computer and construction research. The traditional architectural planning method cannot solve the problem of building industrialization reform under AI technology, and the accuracy of architectural planning is low. Therefore, this paper proposes a model based on BIM and AI technology to analyze the development mode and planning of building reform. First, BIM and AI technology are used to analyze the building data, and the irrelevant construction industrialization data is deleted according to the development mode and planning of the data characteristics. Then, according to the judgment results of construction data, compared with the traditional architectural planning method, the content of different construction industries is deeply excavated, and the influencing factors with higher possibilities are output. After simulation test and analysis, BIM and AI technology can improve the judgment accuracy, integrity, and rationality of the influencing factors of building industrialization planning, with an accuracy rate of 96.4%, and make the correct choice of development mode to meet the judgment needs of influencing factors of architectural planning.

Keywords: BIM, AI Technology, Development Modalities,Data, Architectural Planning

1. Introduction

The advent of BIM (Building Information Modeling) technology and AI platforms has significantly transformed the construction industry's development and traditional building planning methods [1]. Major design organizations globally place a high emphasis on analyzing factors influencing the construction industry's development planning to foster its growth [2]. Survey data from 2021 to 2022 indicates that the adoption rate of intelligent technology in the architectural planning sector is 45.6% [3], a fourfold increase from 2010. However, the planning satisfaction rate of

intelligent technology is low, indicating that intelligent technology is not accurate in planning the construction industry [4], so it is necessary to find an effective planning method to solve the problem of influencing factors in the planning of the construction industry [5]. At present, although the construction industry planning has its own database and also realizes cluster analysis of building data, there are problems of high complexity and long planning time in architectural planning [6].Moreover, architectural planning and design mathematics, policy, environment, market, computer, mechanics, and other fields, and the analysis process are dynamic and quantified. Therefore, under the conditions of industry requirements, complex data, and random markets, BIM and AI technology should be used to carry out data clustering, data elimination, and planning value analysis, and the specific results are shown in Figure 1.

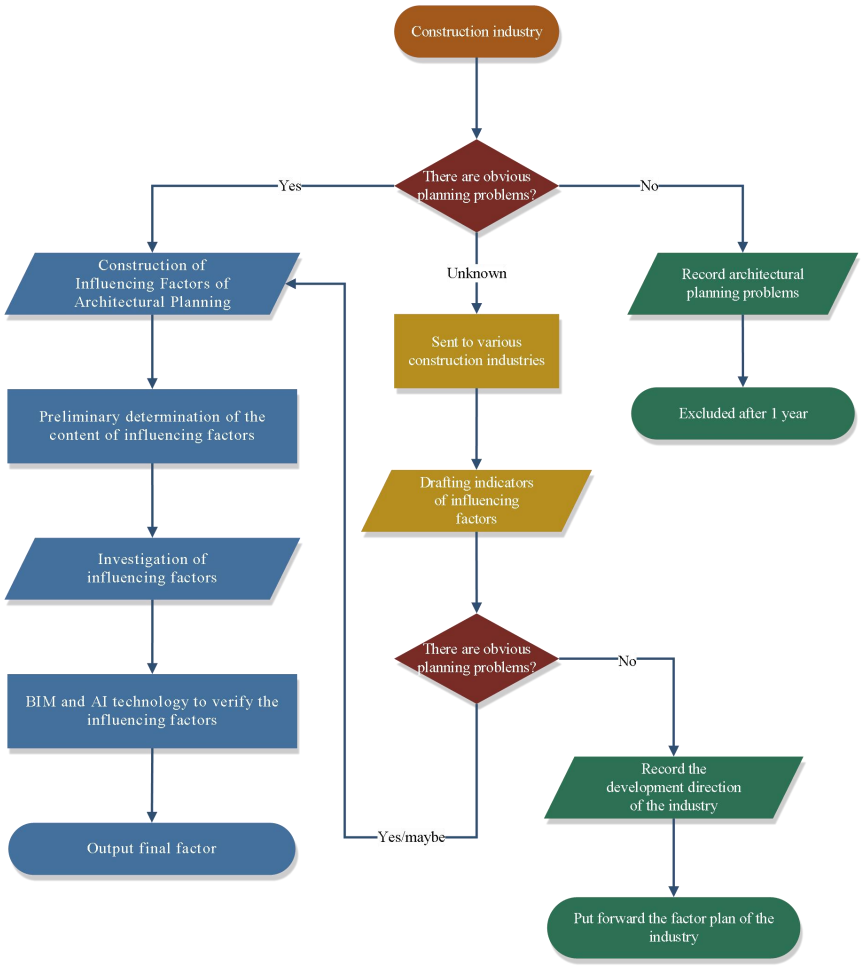

Figure 1 Application of BIM and AI Technology in Architectural Planning

BIM and AI technology has better dynamic data processing capabilities, realize the comprehensive mining of building information and building data [7], and integrate the corresponding algorithms into the data module to realize the comprehensive judgment of data. At the same time, in-depth excavation of the architectural planning results is carried out to verify it's influencing factors [8], the influencing value of the factors, and the judgment accuracy of the influencing factors [9]. Some scholars apply BIM and AI technology to the reform of the construction industry and try to analyze architectural planning [10]. The results show that BIM and AI technology have an auxiliary role in the planning of the construction industry and can determine the influencing factors in the planning [11]. BIM and AI technology belongs to the category of computers, widely used in management, computers, and other fields, and the technology has a wide range of applications, low error of calculation results, and can realize complex unstructured data calculation [12]. At the same time, BIM and AI technology can deal with the relationship between different factors and the structure of sub-factors and realize the fuzzy analysis of calculation results. In addition, BIM and AI technologies are also combined with other auxiliary databases to integrate theories such as statistics and mechanics into analysis [13], which is a comprehensive cloud computing. BIM and AI technology can realize the fitting analysis of

influencing factors and the development of the construction industry and fit influencing factors with essential factors [14]. The influencing factors of BIM and AI technology on architectural planning are mainly as follows: 1) Clarify the influencing parameters in architectural planning and change the direction of architectural planning. Some scholars used BIM technology for research and compared three different architectural analysis methods, and the results showed that: BIM and AI technology have a wider range of applications, can realize the analysis of massive planning data, and realize the comprehensive judgment of architectural planning factors [15]; 2) Comparison of results with other means. Some scholars have proposed a traditional architectural planning method, which uses the traditional architectural planning method to judge the architectural planning factors and analyzes the factors of the planning data according to the probability of the influencing factors to improve the calculation speed. However, market randomness greatly affects this method, and a comprehensive analysis of influencing factors cannot be realized [16]. From the complexity of planning data, BIM and AI technology are used to analyze semi-structured and structural data and compare the judgment results of semi-structural and non-structural factors[17], which proves that BIM and AI technologies have high accuracy in calculating influencing factors; 3) The factor analysis of planning data with ant colony algorithm and Bayesian algorithm shows that the accuracy and rationality of previous intelligent algorithms are poor, while the calculation accuracy of BIM and AI technology is high. In summary, although the intelligent algorithm can comprehensively calculate the planning data in the past, the calculation results are not satisfactory, and it cannot meet the requirements of massive and complex planning data calculation [18]. This paper attempts to apply BIM and AI technology to the calculation of influencing factors of architectural planning, analyzes the key points, elasticity points, and circular points of buildings, and forms a planning and planning set to verify the calculation accuracy of influencing factors, aiming to promote the development of architectural planning.

2. Related Concepts

2.1 BIM and AI Technology

BIM digital building information model can realize the visualization of building information and reproduce the building realistically, ensuring that the information is complete and consistent, and has the characteristics of coordination, correlation, and simulation. AI technology belongs to an intelligent analysis algorithm, which realizes the selection and planning of building information models through the simulation, analysis, and expansion of human brain intelligence. BIM and AI technologies can judge the unstructured information in buildings, structured information, and the influencing factors of architectural planning. At present, BIM and AI technologies are widely used in the design field of buildings, but they are less widely used in the planning of the construction industry.

Several key studies have focused on integrating AI and BIM into building planning. Rui He and colleagues conducted an in-depth review of cutting-edge technologies for automated design and prefabrication in industrialized construction, including detailed discussions on recent advancements like digital twins and 3D printing [19]. Fredrik Wikberg and team introduced an innovative approach for managing the needs and limitations of industrialized buildings through the creation of architectural objects [20]. This method is enhanced by a hierarchical structure that supports the objects' development and configuration processes.Yue Pan et al. contributed a comprehensive investigation and summarised the potential value and utility of deploying automation in the construction industry [21]. The work presents much deeper insights into the status quo as well as future trends in applying AI technologies in BIM. Another important review on the state-of-the-art application of symbolic AI methods like rule inferencing is done by Sacks et al. [22]. A framework is also proposed in this work that focuses on research and development which extends the inclusion of machine learning methods for semantic enrichment as well as in the model review.

Yusheng Xiang and colleagues developed an algorithm based on multi-pathfinding techniques, enabling extensive machine collaboration and suggesting modifications to impractical elements [23]. This algorithm can utilize logistic information from BIM, such as loading and unloading points, by incorporating pathfinding solutions. Cesson and team explored the challenges in freeing designers from laborious tasks in building design, focusing on best practices [24]. Their research delves into the functions, objectives, and roles of designers in this evolving technological landscape.

In order to perform planning data analysis more accurately, the implementation conditions of BIM and AI technologies are described, and the results are as follows.

AI technology calculation: The implementation conditions of AI technology is x_{ij}, the building planning is y_{ij}, the association function of building data is $K(x_i \cdot x_j)$, and the key point of AI technology is ζ_{ii}, then the calculation of AI technology is shown in Equation (1).

$$\varphi(k) = \begin{cases} x_{ij} \div y_{ij} \\ a \cdot x_{ij} \\ b \cdot x_{ij} \end{cases} \quad (1)$$

The terms a and b denotes the random variability of AI technical analysis; $\overline{x_{ij}} \geq b$ is a constraint which must be satisfied.

2.2 Synthesis of Architectural Planning

Influencing factors of architectural planning: The factor analysis function is given by the term $\varphi(x \cdot b)$ where $\varphi(x \cdot b) \in \sum x_{ij}$ belongs to the selection function of the influencing factors, and the synthesis of planning data is shown in Equation (2):

$$\varphi(x \cdot b) \left| a \ll \overline{\sum_{j=1}^{n} \varphi(y \cdot b)} \right. \quad (2)$$

Calculation of the degree of influence of factors: Let the building planning data be x_{it} and the function of uncertainty factors is $D(x)$. The calculation of the degree of influence of factors is shown in Equation (3).

$$d(x, f(x) \left| a) \triangleq b \cdot lin(a \cdot \frac{1}{\sqrt{x_{ij}}} \right.) \quad (3)$$

3. Methodology

3.1 Initialization of Building Planning Data

The initialization of architectural planning data is more complicated, and the development mode and architectural planning show iterative changes, so it is necessary to initialize the data to determine the critical data values and the location of the key data. In addition, random changes can impact construction industry planning, so it is necessary to map the building data to a two-dimensional list and realize the standard mapping of the data, as shown in Figure 2.

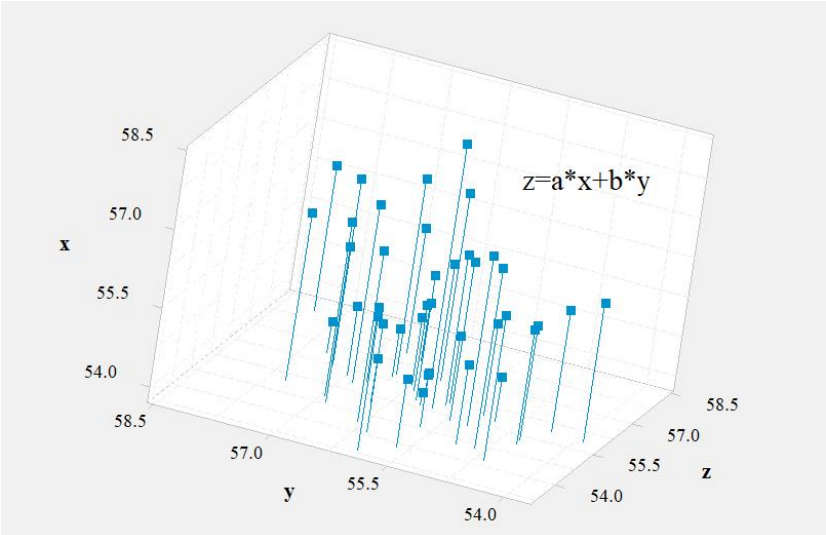

Figure 2. Mapping of Building Planning Data

It can be seen from Figure 2 that the projection of the building planning data is uniform and non-directional, which meets the overall distribution requirements of the data. Among them, the spatial distribution of architectural planning data is iterative, indicating that the architectural planning data obtained in the early stage is relatively comprehensive, and the spatial projection can obtain a better data distribution, and the resulting error is shown in Figure 3.

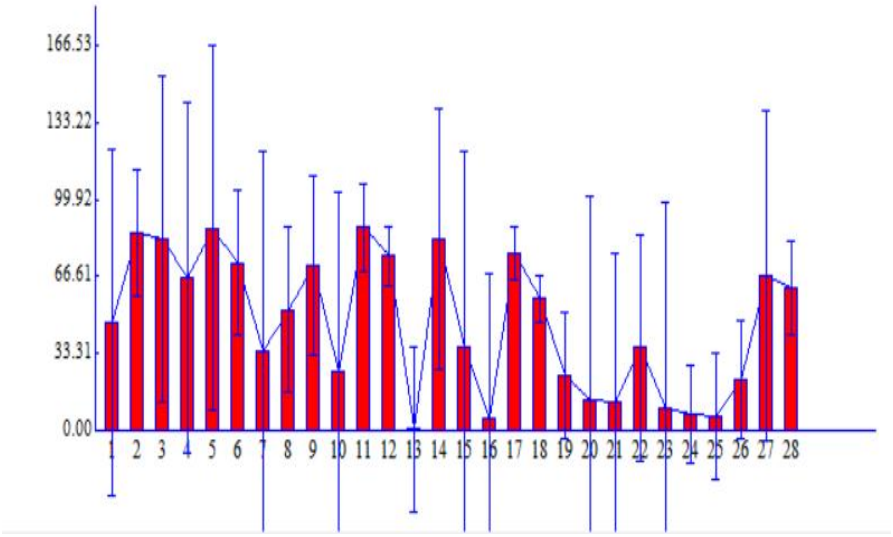

Figure 3. Errors in Building Planning Data Processing

The standard conversion results of the building planning data are shown in Table 1.

Table 1. Numerical Standardization of Architectural Planning

Planning Values		**Planning Values**		**Error**
Before Conversion	After Conversion	Before Conversion	After Conversion	0.74
46.33	4	57.09	3	0.54
85.83	8	23.89	8	0.68
82.60	8	13.05	6	0.66
66.01	6	11.97	0	0.08
87.62	8	35.82	6	0.68
72.61	7	9.86	6	0.04
34.78	3	7.22	7	0.75
52.14	5	6.10	1	0.67
71.35	7	22.29	3	0.64
25.83	2	66.90	8	0.65
87.87	8	61.50	.	0.79
75.44	7	67.04	.	0.58
0.70	0	3.19	7	0.77

It can be seen from the architectural planning in Table 1 that all the building planning data are standardized, and the processed result is less than 10, indicating that the value of the entire building plan meets the requirements. In addition, the numerical error of architectural planning is small, less than 0.8, further indicating the effectiveness of architectural planning data processing.

3.2 Calculation of Uncertainties Factor

There are three main uncertainties in architectural planning, namely policy factors, market factors, and irrational factors. The mathematical description of the above three factors is as follows.

BIM and AI technologies are used to analyze uncertainties, and policy factors are calculated as shown in Equation (4). The factors are denoted as x and n represents the number of factors that are considered. A(x) denotes the AI technology pertaining to the factors.

$$A(x) = \frac{\sum_{i=1}^{n} [x_i^2 \cdot y]}{n} \quad (4)$$

Market factors denoted as F_2 (x) influence building planning through cost, supply, and demand, etc., which are calculated as shown in Equation (5).

$$F_2(x) = \sum_{i=1}^{n} [x_i^2 \div \sin(2\pi x_i)] \quad (5)$$

Irrational factors signified as F_3 (x) are other unpredictable factors, and the development mode and architectural planning are integrated to achieve the mining of uncertain factors, and their calculation is shown in Equation (6).

$$F_3(x) = \frac{1}{n} \sum_{i=1}^{n} \sqrt{x}_i^2 \quad (6)$$

After calculating the above formula, the following uncertainty values can be obtained, and the results are shown in Table 2.

Table 2. Uncertainty Standardization of Building Planning Data

Uncertainty (%)	For Number (%)	AI Technology Standardization	BIM Technology Standardization
1,1	2	6	3
46,1	75	5	8
86,1	27	2	6
83,1	71	6	0
66,1	76	7	6
88,1	79	2	6
73,1	31	4	7
35,1	86	2	1

As can be seen from Table 2, BIM and AI technologies can standardize uncertainty and map the corresponding values into two-dimensional space. At the same time, the uncertainty values were less than 10, which further indicated that the standardization of uncertainty data was effective.

3.3 Calculation of Influencing Factors of Architectural Planning

BIM and AI technology to calculate the influencing factors of planning data need to be relevant, interfere with judgment, and analysis content includes BIM data validity, data timeliness, and data independence and other factors, as well as AI technology processing accuracy, etc., the specific calculation is as follows.

1) The influencing factors of BIM design are calculated as shown in Equation (7).

$$y_{ij}(\Delta t) = \omega \bullet y_{ij}(\Delta t) \bigcup f(P_j[x(t)]) \quad (7)$$

2) The influencing factors of architectural planning are calculated as shown in Equation (8).

$$y_{ij}(t+1) = \omega \bullet y_{ij}(t) \cdot g_{ij}^{\ k}[x(t)] \quad (8)$$

3) The influencing factors of the development of the construction industry are calculated as shown in Equation (9).

$$y_{ij}(t+1) = \delta \cdot \sum_{i,j,k=1}^{n} g_{ij}^{\ k}\{x(t) \cdot \overrightarrow{f(P_j[x(t)]} \quad (9)$$

4) The judgment factors of AI technology on building planning are calculated as shown in Equation (10).

$$y_{ij}(t+1) = g_{ij}^{\ k} \cdot \omega \div y_{ij}(t) \quad (10)$$

The judgment of BIM and AI technology on the influencing factors of architectural planning is mainly divided into two aspects: on the one hand, the analysis of the development mode of construction is carried out to determine the impact of the development mode on the construction industry; On the other hand, the factors of architectural planning are analyzed to determine the influencing factors affecting the development of the construction industry. Finally, the architectural planning collection is formed through BIM and AI technology, and the accuracy of the analysis results is compared.

3.4 The process of Judging the Influencing Factors of Architectural Development and Planning

BIM and AI technology uses qualitative methods to plan data and planning through probabilistic calculation, and the specific selection process is shown in Figure 4.

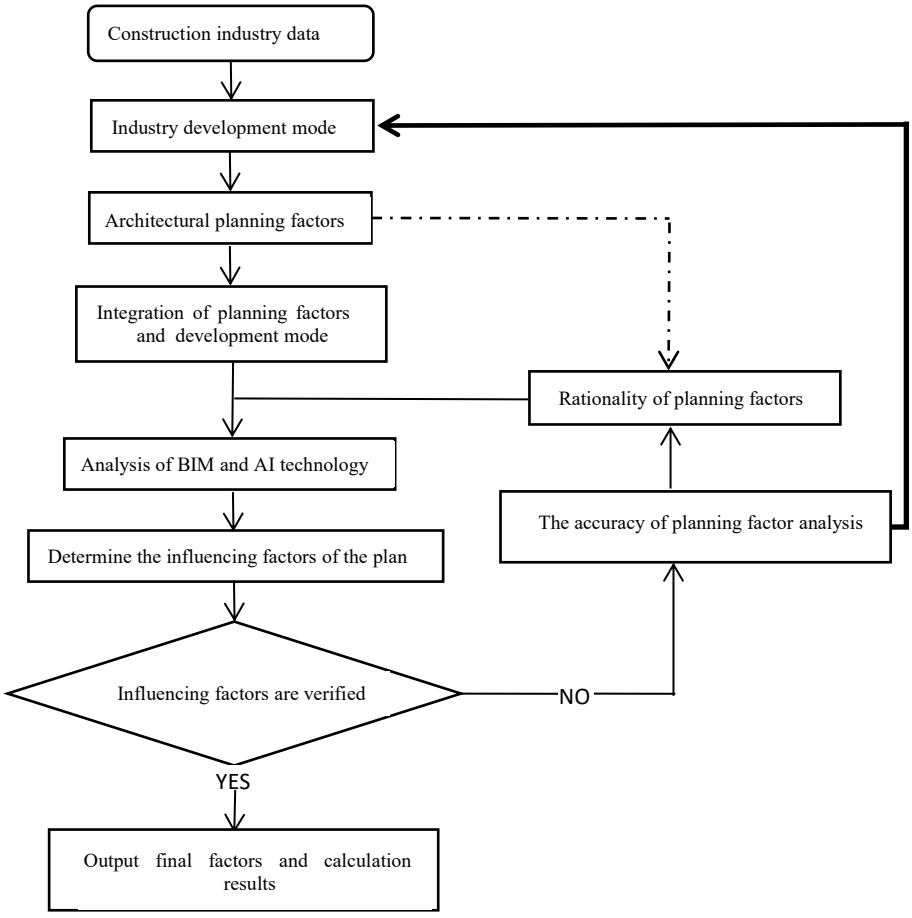

Figure 4. Analysis Process of BIM and AI Technology on Planning Influencing Factors

Step 1: Determine the set of influencing factor data and planning data, analyze the planning data problems according to the characteristics of influencing factors, and determine the collection of

planning data. At the same time, the initialization data and constraints of the planning data are transformed and mapped to the list of influencing factors.

Step 2: Plan the processing of data processing. Standardize planning data. Vectors replace the direction of the influencing factors.

Step 3: Generate the planning function. BIM and AI technology is used to calculate market portrait data, BIM and AI technology servers, and plan by setting initial weights and constraints. Data mining is carried out by formulas (1) ~ (7) and the planning coefficients of different plans.

Step 4: Plan the maximum probability of the data and reform the sub-planning results. According to the amount of planning data and data structure, select the building influencing factors with the highest probability.

Step 5: Constraints of BIM and AI technologies. Obtain subjective planning, objective planning, comprehensive planning, and verification of planning results.

Step 6: Plan a comprehensive plan for the amount of data. After determining the set of influencing factors, select the influencing factors with the highest probability, and mine the plan with the artist database to verify the accuracy of the sub-plans and the compliance of BIM and AI technology constraints.

Step 7: Plan the data collection of influencing factors and whether all the data sets are analyzed. If all data sets are analyzed, repeat steps 2~6, otherwise, output the best planning and constraints.

4. Results and Discussion

4.1 Architectural Development and Planning

This paper takes the BIM database of the construction industry as an example to analyze the building planning data. Among them, the data collection period is June 2022 ~ December 2022, and the data types include text, annotation, voice, video, and other complex data. MATLAB software, excel, and BIM2.0 software were used for analysis, and the specific analysis results are shown in Table 3.

Table 3. BIM Data in the Construction Industry

Data Structure	Data Content	Amount of Data	Percentage Error	Normality
Semi-structured	Mail	46.33	1.96	9.69
	Text	285.83	1.30	1.25
Non-structured	Video	6582.60	2.60	4.85
	Audio	5266.01	1.07	0.91
	PPT	2387.62	2.91	9.80
	Image	1272.61	1.29	3.63
Structure	CAD Drawings	2334.78	0.97	9.50
	BIM Files	23252.14	0.83	7.78
	Excel Data	71.35	0.45	3.15

4.2 Integrity of Architectural Planning Data Processing

Integrity is an important part of architectural planning, so the results of the overall analysis of planning data by BIM and AI technology are shown in Table 4.

Table 4. Planning Data Integrity

Analysis Method	Content	Index	Wholeness	Correlation

BIM Technology	Architectural Development	Short-Term Development	46.33	0.68
		Long-Term Development	85.83	0.72
		Development Potential	82.60	0.72
	Architectural Planning	Industry Planning	66.01	0.74
		Cross-Industry Planning	87.62	0.65
		Industry Mining	72.61	0.72
	Planning Factors	Political Factors	34.78	0.70
		Market Factors	52.14	0.68
		Technical Factors	71.35	0.71
		Environmental Factors	25.83	0.69
		Uncertainties	87.87	0.69
AI Platform	Architectural Development	Short-Term Development	75.44	0.70
		Long-Term Development	0.70	0.71
		Development Potential	82.60	0.66
	Architectural Planning	Industry Planning	35.91	0.71
		Cross-Industry Planning	5.18	0.68
		Industry Mining	76.60	0.69
	Planning Factors	Political Factors	57.09	0.66
		Market Factors	23.89	0.76
		Technical Factors	13.05	0.70
		Environmental Factors	11.97	0.69
		Uncertainties	35.82	0.70
BIM and AI technology	Architectural Development	Short-Term Development	9.86	0.72
		Long-Term Development	7.22	0.71
		Development Potential	6.10	0.69
	Architectural Planning	Industry Planning	22.29	0.71
		Cross-Industry Planning	66.90	0.69

		Industry Mining	61.50	0.69
	Planning Factors	Political Factors	67.04	0.67
		Market Factors	3.19	0.69
		Technical Factors	68.51	0.71
		Environmental Factors	72.28	0.72
		Uncertainties	16.19	0.67

The calculation process of the different building planning contents is shown in Figure 5.

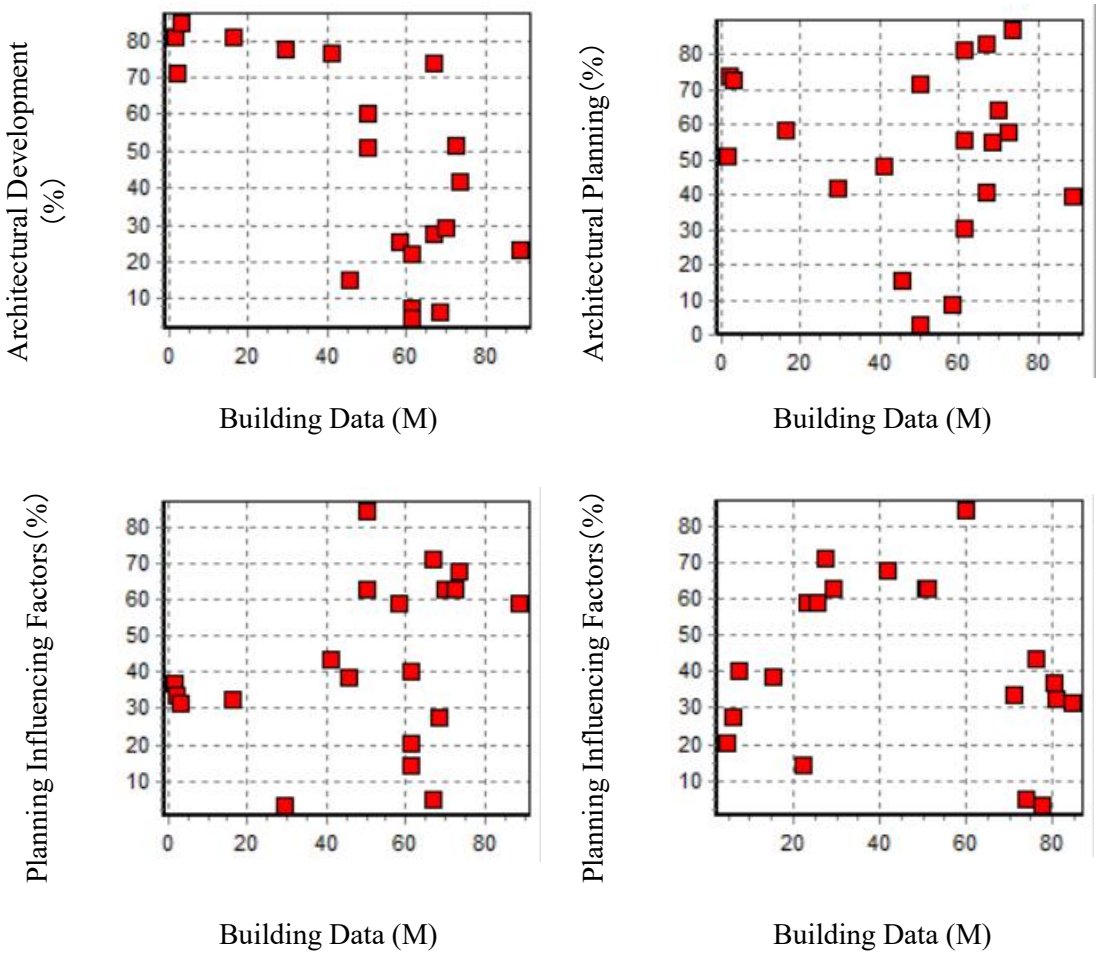

Figure 5. Integrity of Building Data

It can be seen from Figure 5 that the integrity of architectural planning is better, indicating that BIM and AI technology can improve the integrity of building data, and later planning factor analysis can be carried out. The above problems occur because AI technology and BIM technology map-building data, simplifying the complexity of data analysis and improving the effectiveness of data analysis.

4.3 Rationality of analysis of architectural planning factors

The rationality of the building planning factors should be verified, the processing results of BIM and AI technologies should be verified, the application effects of the two technologies should be calculated, and the specific results are shown in Table 5.

Table 5. Rationality of Architectural Planning Factors

Factor	Political Factors	Market Factors	Technical Factors	Environmental Factors
Political Factors	1	0.9586	0.9204	0.7445
Market Factors	0.8191	1	0.7971	0.6761
Technical Factors	0.6969	0.1569	1	0.9043
Environmental Factors	0.9756	0.9969	0.8888	1
Winsorized Average = 41.1931				
Standard Error Of Mean =2.3846				
95% Reasonable Interval=35.7846~ 46.6016				
99% Reasonable Interval=34.3814~ 48.0048				

For the rational analysis in Table 5, the rationality distribution results of the building data are obtained, as shown in Figure 6.

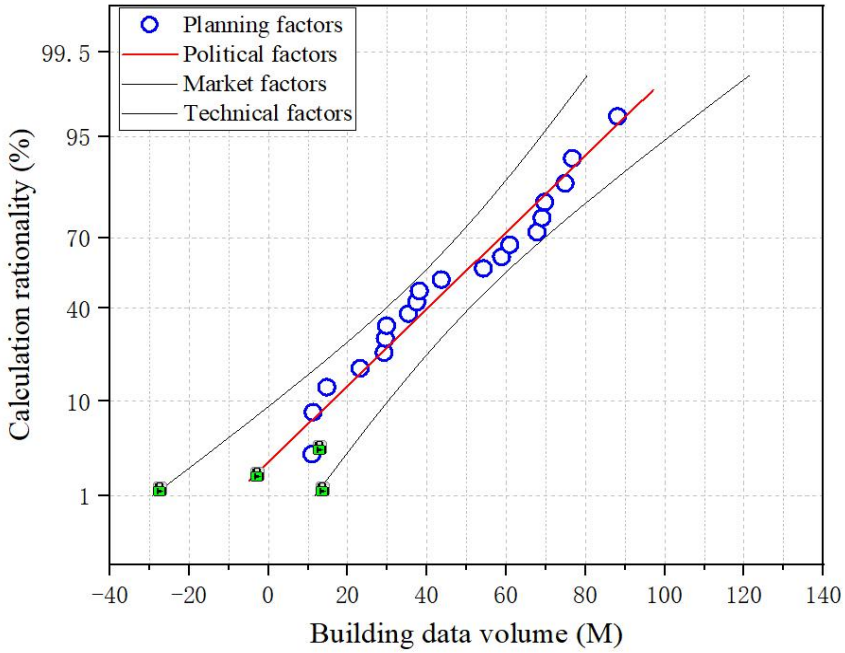

Figure 6. AI Technology Analysis of Planning Data

It can be seen from Figure 6 that the influence of BIM and AI technology on buildings is affected by BIM and AI technology by about 41%, which is significantly higher than that of traditional architectural planning methods AI technology simplifies calculations and minimizes the impact of planning data to ensure accurate analysis of building influencing factors. The main reason for the above problems is that qualitative analysis of BIM and AI technology can achieve abnormal data exclusion and reduce the influence of natural language on planning factors.

4.4 Architectural Development Methods

The development method is also an essential part of architectural planning, and the architectural development method should be calculated and compared with the traditional architectural planning method, and the specific results are shown in Figure 7.

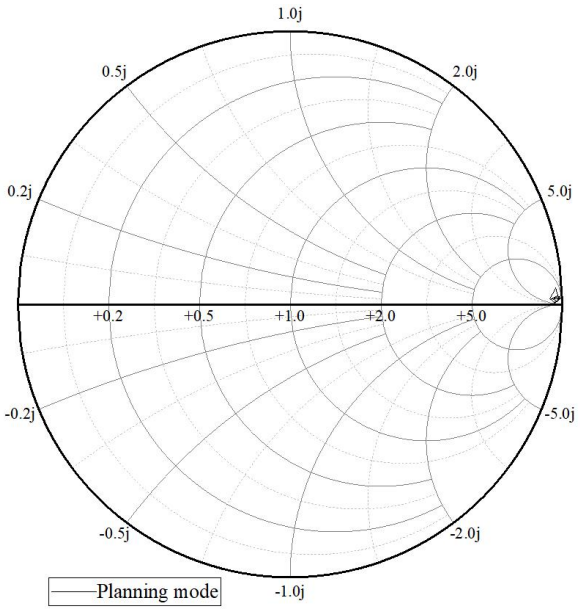

Figure 7. Building Data Developing

It can be seen from Figure 7 that the negative coordinates in the figure are the original development data of the building, and the central point is the development mode of the future building. The transformation from any point to the central point and the data of the central point is relatively concentrated, indicating that BIM and AI technology can effectively adopt the development method of construction data and make the development direction of the construction industry consistent. A comparison of different methods is performed on the data in Figure 7, and the results are shown in Table 6.

Table 6. Comparison of Architectural Development Methods by Different Methods

Method	Content	Effectiveness	Change Direction
BIM Technology	Short-Term Development	86.49	+
	Long-Term Development	81.45	+
	Development Potential	89.86	+
AI Platform	Short-Term Development	89.84	+
	Long-Term Development	82.72	+
	Development Potential	80.37	+
BIM and AI Technology	Short-Term Development	92.37	+
	Long-Term Development	91.21	+
	Development Potential	93.09	+
Traditional Architectural Planning	Short-Term	70.94	+

Law	Development		
	Long-Term Development	73.15	+
	Development Potential	70.61	+
T Value		9.386	

Compared with traditional building planning methods, BIM and AI technologies are more effective in analyzing the planning methods of building data, and in BIM databases, BIM and AI technologies are more effective The architectural planning method is in line with the actual requirements. The reason is that BIM and AI technologies map the non-structural data in the building data, iteratively analyze the abnormal data, and reduce the initial amount of data in the building design.

4.5 Accuracy of the Judgment of Architectural Planning Factors

In order to verify the implementation effect of BIM and AI technology, the factors of building planning are judged, and the accuracy of a judgment is shown in Figure 8.

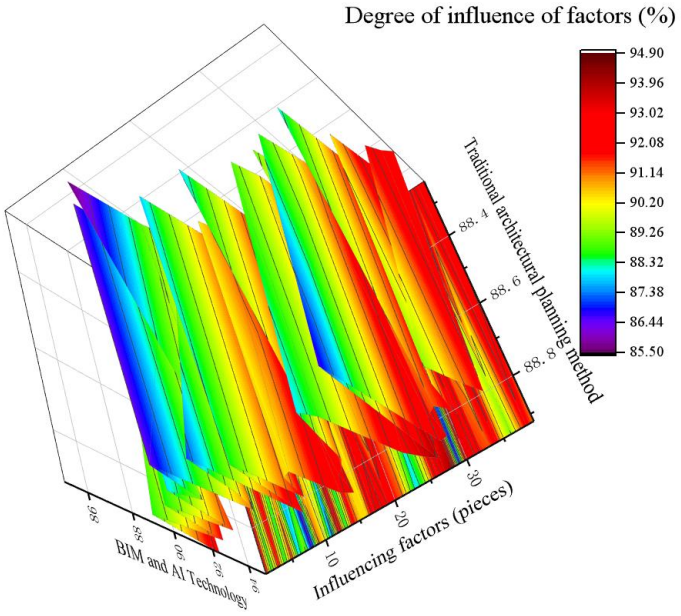

Figure 8. Judgment Results of Influencing Factors of Different Algorithms

Figure 8 illustrates that the accuracy of BIM and AI technology in calculating the influencing factors surpasses traditional architectural planning methods. Each factor shows a relatively high degree of influence, indicating BIM and AI's capability to precisely assess building data's influencing factors. The specific details of these results are presented in Table 7.

Table 7. Judgment Accuracy of Influencing Factors of Architectural Planning

Practical Accuracy Requirements			
Mean = 90.2297	Standard Deviation = 2.0286	Bilateral 95% Boundary:	86.2536~ 94.2058
Single Side 95% Lower Limit:			86.8926
One-Sided 95% Cap:			93.5668
The Traditional Architectural Planning Method			
Mean = 90.2297	Standard Deviation = 2.0286	Bilateral 99% Boundary:	75.0040~ 75.4554
Unilateral 99% Lower Limit:			75.5111

One-Sided 99% Cap:			84.9483
BIM and AI Technology			
Mean (Logarithm) = 4.5021	Standard Deviation (Logarithm) = 0.0225	Bilateral 95% Boundary:	86.3089~94.2808
Single Side 95% Lower Limit:			86.9238
One-Sided 95% Cap:			93.6138
Median=90.3736	Bilateral 95% Boundary:		86.4104~93.3054
Single Side 95% Lower Limit:			86.4104
One-Sided 95% Cap:			93.3054

It can be seen from Table 7 that BIM and AI technology have relatively good results for architectural planning, the calculation accuracy is consistent with the overall calculation requirements, and the calculation deviation is significantly smaller than that of traditional architectural planning methods. The reason is that BIM and AI technology can realize massive data analysis, provide a basis for accurate calculation of building planning, and further verify the accuracy of analysis of influencing factors in building planning. In order to further verify the accuracy of BIM and AI technology, the calculation process is analyzed, and the specific results are shown in Table 8.

Table 8. Comparison Of Process Accuracy Adjustment of Different Algorithms

Sample	**First Time**		**Second Time**		**Third Time**		**Fourth Time**	
	BIM and AI Technology	Traditional Architectural Planning Law	BIM and AI Technology	Traditional Architectural Planning Law	BIM and AI Technology	Traditional Architectural Planning Law	BIM and AI Technology	Traditional Architectural Planning Law
Sample 1	0.39	0.13	0.36	0.20	0.46	0.07	0.54	0.33
Sample 2	0.21	0.08	0.31	0.30	0.49	0.16	0.35	0.75
Sample 3	0.84	0.68	0.69	0.48	0.12	0.17	0.22	0.65
Sample 4	0.51	0.09	0.13	0.33	0.37	0.20	0.78	0.74
Sample 5	0.83	0.23	0.66	0.05	0.12	0.13	0.13	0.73
Sample 6	0.26	0.56	0.71	0.07	0.00	0.13	0.91	0.12
Sample 7	0.21	0.06	0.58	0.22	0.84	0.01	0.31	0.29
Sample 8	0.70	0.78	0.52	0.86	0.68	0.14	0.45	0.00
Sample 9	0.42	0.10	0.40	0.87	0.35	0.25	0.24	0.68

It can be seen from Table 8 that in terms of process accuracy comparison, the accuracy change of BIM and AI technology is significantly better than that of traditional building planning methods. In the 1~4th excavation, they are all better The reason for the traditional architectural planning method is

that BIM and AI technologies increase the synergy coefficient and planning weight of planning in different BIM and AI technology databases. Reduce the impact of local maximum probability programming on planning results.

The study presents a holistic view of the factors that influence of AI and BIM technology for planning. However, this work is confined to analyze the impact of a limited number of factors. The compliance policy, environmental policy, political conditions etc. have not been discussed in this work. This can be a future research direction.

5. Conclusion

This paper proposes planning based on BIM and AI technology for planning data problems. This method combines BIM, AI technology, and constraints to analyze the data of the construction industry, determine its development mode and the influencing factors of planning, and improve planning accuracy. The results show that compared with traditional building planning methods, the overall results of BIM and AI technology are better, which can improve the accuracy, integrity, and rationality of calculations and the way to develop. However, there are also certain limitations in the analysis of building data, mainly reflected in the development mode and the processing of indicators of architectural planning, and the relevant indicators will be comprehensively processed in the future.

6. Acknowledgment

This work was supported by Application of BIM technology in prefabricated building (WNZY202012).

References

[1] D. Asmar, R. Daher, Y. Hawari, H. Khoury, and I. H. Elhajj, “Automated building and evaluation of 2D as-built floor plans,” *Machine Vision and Applications,* vol. 33, no. 3, 2022.

[2] A. T. I. R., Rismawaty Arunglabi, and M. R., Askar Taliang, “5G Technology in Smart Healthcare and Smart City Development Integration with Deep Learning Architectures,” *International Journal of Communication Networks and Information Security (IJCNIS)*, vol. 14, no. 3, pp. 99-109, 2022.

[3] C. Bradley, and J. Bitton, “Building a Longitudinal Workforce Plan for Nursing,” *Nurse Leader,* vol. 20, no. 5, pp. 451-456, 2022.

[4] S. Constantinou, A. Konstantinidis, P. K. Chrysanthis, and D. Zeinalipour-Yazti, “Green Planning of IoT Home AutomationWorkflows in Smart Buildings,” *Acm Transactions on Internet of Things,* vol. 3, no. 4, pp. 1-30, 2022.

[5] M. Herrando, A. Gomez, and N. Fueyo, “Supporting Local Authorities to Plan Energy Efficiency in Public Buildings: From Local Needs to Regional Planning,” *Energies,* vol. 15, no. 3, p. 907, 2022.

[6] D. Isobe, and R. M. Jiang, “Explosive demolition planning of building structures using key element index,” *Journal of Building Engineering,* vol. 59, p. 104935, 2022.

[7] Karmakar, A. R. Singh, and V. S. K. Delhi, “Automated route planning for construction site utilizing building information modeling,” *Journal of Information Technology in Construction,* vol. 27, pp. 827-844, 2022.

[8] K. Kim, and M. Peavy, “BIM-based semantic building world modeling for robot task planning and execution in built environments,” *Automation in Construction,* vol. 138, 2022.

[9] R. Trujillo-Cabezas, “Integrating Foresight, Artificial Intelligence and Data Science to Develop Dynamic Futures Analysis,” *Journal of Information Systems Engineering and Management*, vol. 5, no. 3, p. em0120, 2020.

[10] K. Muldoon-Smith, and L. Moreton, “Planning Adaptation: Accommodating Complexity in the Built Environment,” *Urban Planning,* vol. 7, no. 1, pp. 44-55, 2022.

[11] B. Nowogonska, and I. Nowogonski, “Method of Planning Repairs of the Installation including Building Waste,” *Applied Sciences-Basel,* vol. 12, no. 9, p. 4520, 2022.

[12] T. Roberton, and T. Sawadogo-Lewis, “Building coherent monitoring and evaluation plans with the Evaluation Planning Tool for global health,” *Global Health Action,* vol. 15, p. 2067396, 2022.

[13]J. Shelby, G. Lindsay, and C. Derr, "Contested identities, contested building: planning for a glocal future," *Archnet-Ijar International Journal of Architectural Research,* vol. 16, no. 3, pp. 671-687, 2022.

[14]S. A. Sherman, and A. Chakraborty, "Beyond Plans Scenario Planning as a Tool for Regional Capacity Building," *Journal of the American Planning Association,* vol. 88, no. 4, pp. 524-536, 2022.

[15]I. Viedma-Guiard, A. Rodriguez-Suarez, L. A. Hernandez-Aja, del Valle, and A. M. Solano, "The role of planning in building typology characterisation," *Vlc Arquitectura-Research Journal,* vol. 9, no. 2, pp. 333-357, 2022.

[16]M. Zandiyehvakili, B. Aminnejad, and A. Lork, "A Mathematical Optimization Model for Maintenance Planning of School Buildings," *Intelligent Automation and Soft Computing,* vol. 32, no. 1, pp. 499-512, 2022.

[17]T. C. Ouyang, M. L. Zhang, W. C. Wu, J. Q. Zhao, and H. Xu, "A day-ahead planning for multi-energy system in building community," *Energy,* vol. 267, p. 126399, 2023.

[18]A. S. Sharma, and D. H. Hota, "ECG Analysis-Based Cardiac Disease Prediction Using Signal Feature Selection with Extraction Based on AI Techniques," *International Journal of Communication Networks and Information Security (IJCNIS)*, vol. 14, no. 3, pp. 73-85, 2022.

[19]R. He,M. Li, V. J. Gan, and J. Ma, "BIM-enabled computerized design and digital fabrication of industrialized buildings: A case study," *Journal of Cleaner Production*, vol 278, p. 123505, 2021.

[20]F. Wikberg, T. Olofsson, and A. Ekholm, "Design configuration with architectural objects: Linking customer requirements with system capabilities in industrialized house-building platforms," *Construction management and economics*, vol. 32, no. 1-2, pp. 196-207, 2014.

[21]Y. Pan, and L. Zhang, "Integrating BIM and AI for smart construction management: Current status and future directions," *Archives of Computational Methods in Engineering*, vol. 30, no. 2, pp. 1081-1110, 2023.

[22]R. Sacks, T. Bloch, M. Katz, and R. Yosef, "Automating design review with artificial intelligence and BIM: State of the art and research framework," *In ASCE International Conference on Computing in Civil Engineering 2019* (pp. 353-360). 2019. Reston, VA: American Society of Civil Engineers.

[23]Y. Xiang, K. Liu, T. Su, J. Li, S. Ouyang, S. S. Mao, and M. Geimer, "An extension of BIM using AI: A multi working-machines pathfinding solution," *IEEE Access*, vol. 9, pp. 124583-124599, 2021.

[24]L. Ceccon and D. Villa "AI-BIM interdisciplinary spill-overs: prospected interplay of AI and BIM development paradigms," *In From Building Information Modelling to Mixed Reality* (pp. 195-217). 2021, Springer International Publishing.