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Study of Public Perception of Intelligent Construction Technology Topics

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Abstract

Intelligent construction technology is an important means to realise the transformation and development of the construction industry. With the growing demand for the transformation and upgrading of the industry, the public discussion on intelligent construction technology is becoming increasingly intense. This study uses crawler software to capture the discussion text related to intelligent construction technology from 2020-2025 on the Zhihu platform, and conducts a quantitative study through text analysis methods such as TF-IDF keyword extraction, LDA topic modelling, and machine learning sentiment analysis (scikit-learn), to examine the social public's concerns, attitudes, and perceptions of intelligent construction technology, and to analyse the public's perspective on the problems in the application of smart construction technology. The results of the study show that the public's concerns about intelligent construction technology are diversified, mainly focusing on five aspects, namely, industry development, talent cultivation, technology application, intelligent transformation, and employment and development direction; the public's attitudes towards intelligent construction technology are polarised; and the public's understanding of intelligent construction technology is diversified. Finally, suggestions for the promotion of intelligent construction technology and the development of intelligent construction are put forward from four perspectives, namely, individuals, schools, industries and society, with a view to providing a reference basis for policy formulation and technology promotion by the government and relevant industries.

Keywords

Social Public; Intelligent Construction Technology; Intelligent Construction; Textual Analysis Method.

1. Introduction

In recent years, with the development of a new generation of information technology such as big data, Internet of Things, artificial intelligence and cloud computing, intelligent construction technology has gradually become an important hand in promoting the development of intelligent construction and the transformation and upgrading of the construction industry. For example, the collaborative design and whole-process management platform for engineering projects developed by China Construction Digital Technology Co., Ltd. reduces the time invested by professional designers in non-design tasks, and greatly improves the management efficiency of project managers; the steel structure construction management platform established by China Railway Construction Engineering Group realises the information-based control and management of the whole life cycle of steel structure, saving 1,900t of steel for the project; and the China Construction Science and Technology Group used construction robots to increase the measurement efficiency of the building space by 2-3

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times; by introducing BIM technology and assembly building process, China Construction Group achieved the goal of increasing the construction efficiency of the project by 20% and lowering the cost by 15%.The application of intelligent construction technology realises the goal of cost reduction and efficiency increase in the construction industry, but of course, its promotion and application cannot be achieved without national and industry policies. Its application cannot be separated from the policy support of the state and the industry [1], [2], but the public, as the applicators and beneficiaries of intelligent construction technology, if the cognition, acceptance and support of intelligent construction technology are insufficient, it will inevitably affect the promotion process and social adaptability of the intelligent construction technology, and even hinder the development of intelligent construction [3] [4]. The results of a survey on the promotion and application of BIM technology in China's construction industry show that the decline in work efficiency and project performance due to personnel's biased perception of and insufficient familiarity with BIM technology hinders the promotion and popularisation of BIM technology to a certain extent.

There are two main types of views on the Internet about intelligent construction technology, one of which believes that the application of the technology can bring positive effects to the industry, not only to improve construction efficiency, but also to reduce construction costs and safety risks; the other is concerned that the popularisation of the technology will exacerbate the problems of unemployment, building quality, information security, etc. These views are gradually piled up in the online platform to form social opinion. Zhihu is a highly comprehensive knowledge Q&A and social network platform, which gathers professionals, students, working people and other diversified groups, combining professionalism and popularity, and is an ideal data source for analysing public perceptions. In this study, the Zhihu platform, which has more discussion and comment data, is selected as the data source, and text analysis methods such as TF-IDF keyword extraction, LDA topic modelling and machine learning sentiment analysis (scikit-learn) are applied to quantitatively analyse the text data, to reveal the public's concerns, attitudes and perceptions of intelligent construction technology, and to analyse the problems of the development of intelligent construction technology, so as to provide guidance for policy formulation and technology promotion. It provides reference basis for policy formulation and technology promotion.

2. Literature Review

The current research on intelligent construction technology focuses on four aspects: basic technology application, intelligent scenario application, cross-field research and talent training.

In the application of basic technology, Guo Juanli et al developed a tool for the preliminary design of the overall bathroom based on BIM, which meets the actual needs while realising the user's free design [5]; Zhang Lixia proposed an effective data management model based on 3D BIM and covering the whole life cycle of the project to achieve a unified and integrated management of the whole life cycle of the project [6]; Huang Guangqiu et al relied on the Internet , big data, BIM and other intelligent technologies, constructed the development mode of building industrialisation based on intelligent construction (DCCO) [7]; Xiong Hao et al sorted out the key intelligent construction technologies of assembled buildings, and constructed the intelligent construction technology system based on the whole life cycle [8].

In the application of intelligent scenarios, Li Qiangnian and Fan Jinyu sort out the constraints of intelligent construction site in Gansu Province, clarify the hierarchical relationship between the constraints, build a model to determine the key constraints, and thus put forward suggestions to promote the development of intelligent construction sites [9]; Yu Junqi et al summarise the application of classical local path planning algorithms and local path planning algorithms of AI and their limitations, and discuss future development trend of intelligent construction robots [10]; Pan and Zhang comprehensively investigated and summarised the potential value and practical utility of BIM-AI integration, and deeply analysed the current status and future trend of utilising AI throughout the life cycle of a BIM project [11]; Yevu et al demonstrated the use of digital twins to monitor the

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intelligent construction process and real-time carbon emissions by using digital twins to show that the prefabrication supply chain in the the overall effect of applying digital twin technology [12]; Asif et al developed a sensor-based smart construction glove that classifies different tower crane signalling gestures used on construction sites and improves the overall accuracy of gesture recognition [13].

In terms of cross-field research, Huang Shuyi and Xu Weiguo explored the potential of cooperation between architecture and three disciplines, namely aerospace engineering, civil engineering, and materials science, by combing with 3D printed concrete technology [14]; Farham et al proposed that the combination of smart materials and 4D printing technology be applied to the hygrothermal restoration of building facades [15].

In terms of talent cultivation, Wu Yue and Guan Hanbo proposed that by increasing the number of intelligent construction professional point settings, creating a "dual-teacher, dual-capable" teacher team, improving professional teaching materials and curriculum resources, and strengthening the internship and practical training links, etc., to open up the career development channels of talents, and to expand the space for the growth of intelligent construction technology and skill talents [16]; Li Dongxia et al. proposed that the cultivation of intelligent construction talents should adopt the mode of organic combination of "teaching and doing", and cultivate intelligent construction technology professionals through the joint role of theoretical courses and practical teaching [17].

In summary, the existing research is to study the intelligent construction technology from the level of technology application and talent cultivation, while this study explores the problems of the development of intelligent construction technology from the perspective of the public, which enriches the theoretical research on intelligent construction technology and helps to formulate a more effective promotion strategy. In addition, traditional survey methods with high sample size and high cost are difficult to capture the dynamic perception of the public on intelligent construction technology in a more comprehensive way, and text analysis methods can achieve dynamic capture and real-time quantification of the public's concerns, attitudes and perceptions.

3. A Study on Topic Perception of Intelligent Construction Technology based on Textual Analysis Approach

In order to comprehensively understand the public's concern and awareness of intelligent construction technology, this study obtains the discussion and comment texts related to "intelligent construction technology" from the Zhihu platform, takes them as the object of analysis, quantitatively analyses the textual data using text analysis methods, and deeply analyzes the public's views on intelligent construction technology, as well as analyses the problems in the development of intelligent construction technology. It also analyses the problems in the development of intelligent construction technology.

3.1 Data Sources and Pre-processing

This study uses "intelligent construction" and "intelligent construction technology" as keywords with the help of crawler software, and selects the Zhihu platform as the data source. Considering the authenticity and representativeness of the text, the time of publishing the content is selected in the hotspot of the intelligent construction research, that is, from May 2020 to May 2025, considering the authenticity and representativeness of the text. After that, the text data collection work was carried out, and 236 comment data were crawled. The number of text data is not very large, and the reason for the low number may be that the popularity of the topic is not high, and the public's participation in smart construction is also limited. Finally, these text quantities were preprocessed and manually screened to eliminate irrelevant and repetitive content, and finally 156 data were retained.

3.2 Keyword Extraction

The preprocessed text data is subjected to word frequency statistics, and the jieba library in Python is both accurate and efficient in Chinese word segmentation, and the jieba library is used for Chinese word segmentation. Next, the word frequency-inverse document frequency (TF-IDF) algorithm [18]

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is used to calculate the keyword weights and extract the high-frequency keywords in the text data, and the calculation formula is shown below:

$$TF\text{-}IDF_{ij}=TF_{ij} \text{ x } IDF_{ij} \quad (1)$$

$$TF_{ij}=\frac{n_{ij}}{\sum_{n=0}^{j} n_{ij}} \quad (2)$$

$$IDF_{ij}=\lg\frac{|D|}{|d_i|+1} \quad (3)$$

Table 1. Top50 High-frequency keywords and frequency

No.	keyword	weights	No.	keyword	weights
1	BIM	0.3240	26	technology	0.0195
2	intelligent construction	0.1276	27	automation	0.0195
3	geotechnical	0.0929	28	management	0.0192
4	civil engineering	0.0713	33	student	0.0192
5	now	0.0544	30	demand	0.0189
6	intellectualise	0.0497	31	Intelligent construction robots	0.0187
7	developmental	0.0486	32	trend	0.0162
8	prospect	0.0423	33	name	0.0158
9	employment	0.0403	34	issue	0.0157
10	construct	0.0385	35	design	0.0152
11	artificial intelligence	0.0300	36	intelligent building	0.0147
12	calculator	0.0290	37	realization	0.0132
13	future	0.0273	38	intelligent construction technology	0.0129
14	direction	0.0262	39	smart construction site	0.0127
15	talent	0.0256	40	prefabricated	0.0124
16	demand	0.0255	41	position	0.0122
17	present	0.0248	42	infrastructure	0.0118
18	construct	0.0234	43	big data	0.0114
19	construction	0.0228	44	production	0.0114
20	Integration	0.0222	45	comparison	0.0114
21	school	0.0219	46	intelligent	0.0112
22	appliance	0.0211	47	after	0.0104
23	digitalisation	0.0211	48	research	0.0103
24	option	0.0210	49	concept	0.0090
25	curriculum	0.0205	50	relation	0.0090

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Where TFij and IDFij are the keyword frequency and inverse document frequency of word i, respectively,nij is the number of times word i occurs in text j. D refers to the size of the dataset, and di denotes the number of texts in the dataset that contain word i. The high-frequency keywords extracted by the jieba participle database and the keyword weights calculated by the TF-IDF algorithm are shown in Table 1.

The high-frequency keywords show that the public discussion and comments mainly focus on three aspects: technology application, talent training and future development. To expand,The emergence of terms such as "intelligent", "artificial intelligence", "BIM", "digitalisation", "automation", "intelligent construction technology", "big data" and "smart construction site" reflects the public's greater concern about the prospects for the technological application of smart construction technologies;The emergence of words such as "employment", "talent", "curriculum", "design", "position", "student" and "knowledge" reveal the public's emphasis on talent cultivation and personal development;The emergence of words such as "development", "future", "direction", "prospect", "demand", "trend" and so on express the public's expectation for the future development of intelligent construction technology.

3.3 LDA Topic Modelling

Latent Dirichlet Allocation (LDA) is one of the most popular methods in the field of topic modelling [19][20], LDA topic modeling is an unsupervised machine learning technique that is able to automatically mine potential topics from large amounts of textual data. Before performing LDA topic modelling the first step is to determine the number of topics, about the determination of the number of topics this study uses two methods, Bayesian statistical method [21] and observation method [22]. Firstly, the optimal number of topics is calculated using LatentDirichletAllocation of scikit-learn in Python and the result is shown in Figure 1. According to Griffiths' conclusion, it can be seen that the BIC value increases with the number of topics, the optimal number of topics is the number of topics corresponding to the occurrence of fluctuation values (red box) and the smaller the BIC value, the better, then the optimal number of topics ranges from 4 to 6.

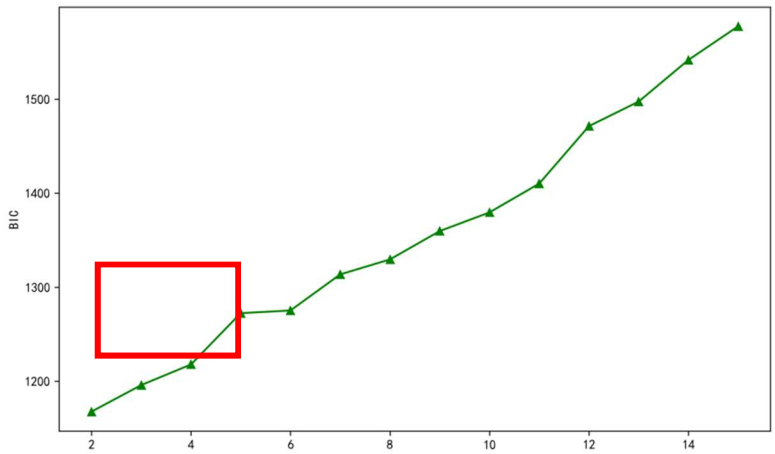

Figure 1. Two or more references

In order to further determine the number of themes, the analysis was carried out using the LDA model from the Gensim library in Python and the results were visualised using pyLDAvis. The visualisation results from running the code with the number of themes set to 6, 5 and 4 respectively are shown in Figure 2, 3 and 4. It can be seen from the figure below that when the number of themes is set to 5, the distance between bubbles is the largest and there is no overlap of bubbles, which indicates that there is a greater degree of differentiation between the themes and that there is a high degree of independence of each theme.

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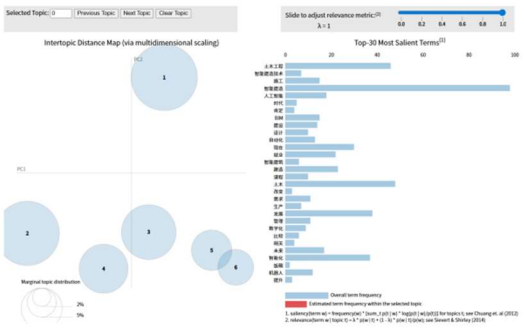

Figure 2. LDA topic model analysis results for num_topics=6

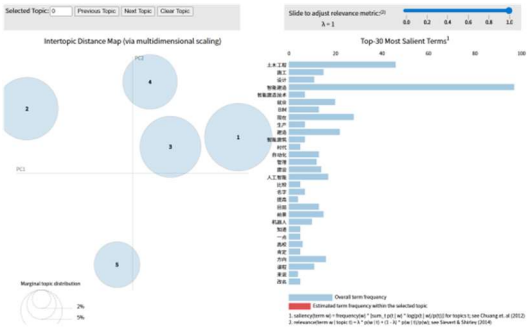

Figure 3. LDA topic model analysis results for num_topics=5

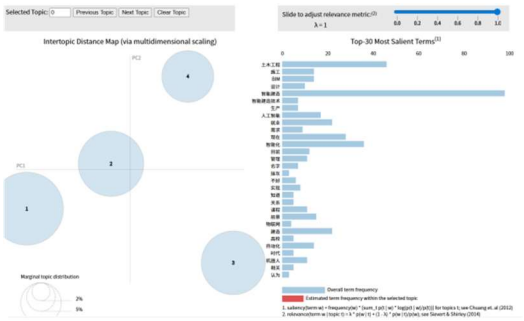

Figure 4. LDA topic model analysis results for num_topics=4

The corresponding high-frequency words of the five themes are shown in Table 2, which shows that the public's concerns about intelligent construction technology are mainly in the five aspects of industry development, talent training, technology application, intelligent transformation and employment and development direction. The keywords of theme 1 "industry development" include "intelligent construction technology" "now" "era" "intelligent construction" "development" "improve" "intellectualise", etc. indicating that the public recognises the background of the era in which intelligent construction was created and calls on the industry to improve its intelligent construction capabilities; The keywords for theme 2 "talent cultivation" include " intelligent construction" "civil engineering" "curriculum" "university " "construction" "building", etc. reflecting the public's recognition of the cross-development of intelligent construction and civil engineering, and emphasising the parallel development of education and industry practice; The keywords of theme 3 "Technology Application" include "intellectualise" "construction" "design" "BIM" "intelligent construction" "automation" "production" and "artificial intelligence", etc. indicating that the public is concerned about the application of BIM, artificial intelligence and other information technology and intelligent technology in engineering construction, design and production, which reflects the necessity of intelligent transformation of the construction industry from the side; The keywords of theme 4 "Intelligent Transformation" include "civil Engineering" "Intelligent construction" "development" "artificial intelligence" "talent", etc., the public affirmed the importance of intelligent technology in realising the transformation of the industry, reflecting the impact of intelligent transformation on talents and employment; The keywords of theme 5 "employment and development direction" include "intelligent construction" "employment" "development" "direction" "future" "intelligent building" "robotics", etc., indicate that the public will fully consider the future prospects and direction of the construction industry when choosing a profession or career.

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Table 2. The matic model analysis results

Subject	Subject name	high frequency word
1	Industry development	"intelligent construction technology" "now" "era" "intelligent construction" "development" "improve" "demand" "intellectualise" "employment" "think"
2	talent cultivation	"intelligent construction""civil engineering" "construction" "building" "prospect" "now" "civil engineering" "development" "curriculum" "university"
3	Technology Application	"intellectualise" "construction" "design" "BIM" "intelligent construction" "automation" "management" "civil engineering" "production""artificial intelligence"
4	Intelligent Transformation	"civil Engineering" "Intelligent construction" "civil Engineering" "now" "development" "intellectualise" "artificial intelligence" "name" "talent" "employment"
5	employment and development direction	"intelligent construction" "employment" "development" "construction" "direction" "civil Engineering" "future" "intelligent building" "robots" "comparison"

3.4 Sentiment Analysis

Machine learning and deep learning algorithms are the most commonly used and accurate methods to perform sentiment analysis, but considering the small amount of text data extracted in this study and deep learning algorithms often require more data support, this study uses the scikit-learn model, a machine learning algorithm in Python, to perform sentiment analysis. Firstly, the collected comment data are manually classified, lebal=1 for positive comments and lebal=0 for negative comments, and the collated comment data are shown in Table 3.

Table 3. Part of the comments

No.	comment	lebal
1	Building intelligence engineering technology professional employment prospects are good, intelligent building industry by the social media known as the potential of the sunrise industry, the demand for talent is large, the number of practitioners in short supply. However, this specialty is more difficult to learn than the costing profession, the novice is even worse.	0
2	Intelligent construction or intelligent manufacturing, the focus is on the latter two words, the first two words are just a vest, a decoration. In fact, this specialty is still in the Civil Engineering College, teaching you the same wave of teachers.	0
3	Regarding the future of intelligent construction, leaving aside the item of intelligent construction site, there is also the current sensational robotics research and development, as well as intelligent industrial parks in the context of the popularization of the assembly type, all to solve the construction of the high cost of manpower as well as the lack of manpower, the construction of the model of the rough and so on, can be said to be a lot of companies betting on the future, but in fact, there is still a very long way to go.	1
4	The Intelligent Construction Program cultivates social pillars and professional elites who are oriented to the needs of future national construction and adapted to the needs of future social development, with solid basic theories, broad professional knowledge, outstanding practical ability, profound scientific and humanistic literacy, and with innovative ability, international vision and leadership consciousness.	1
5	Digital building, intelligent building are the future development trend, you can learn it systematically.	1

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Accuracy, precision, recall and F1 value are important metrics for evaluating sentiment analysis models [23]. The four metrics of Accuracy, Precision, Recall and F1 Score are used as evaluation criteria to measure the sentiment analysis results and the formulae used are as follows:

$$\text{Accuracy}=\frac{TP+TN}{TP+FP+FN+TN} \tag{4}$$

$$\text{Precision}=\frac{TP}{TP+FP} \tag{5}$$

$$\text{Recall}=\frac{TP}{TP+FN} \tag{6}$$

$$\text{F1 Score}=2 \text{ x } \frac{\text{precision x recall}}{\text{precision+recall}} \tag{7}$$

Where TP (True Positive) is the number of correct predictions where the model prediction is 1 and the actual is also 1; FP (False Positive) is the number of incorrect predictions where the model prediction is 1 and the actual is 0; FN (False Negative) is the number of incorrect predictions where the model prediction is 0 and the actual is 1; TN (True Negative) is the number of correct predictions where the model prediction is 0 and the actual is also 0.

The results of the evaluation of the sentiment analysis model are shown in Table 4, the accuracy of this sentiment analysis model on the whole data set is 0.79; the precision rate of positive sentiment is 0.79, and the precision rate of negative sentiment is 0.80, both precision rates are greater than 75%, which indicates that the number of positive and negative misclassifications is low; the recall rate of positive sentiment is 0.85, and the recall rate of negative sentiment is 0.73, both recall rates are greater than 70% which indicates that the model has a stronger ability to identify positive and negative samples; the F1 value of positive sentiment is 0.81, and the F1 value of negative sentiment is 0.76, which overall reflects that the model's comprehensive classification ability is better than that of negative samples on positive samples; the macro-averaging shows that the model has a more balanced classification performance on positive and negative samples; and the weighted average is consistent with the precision rate (both 0.79), which indicates that the model has a stable overall data performance is stable. In summary, the results of this model analysis are acceptable.

Table 4. Sentiment analysis model assessment results

	accuracy	recall	F1 score
positive	0.80	0.73	0.76
negative	0.79	0.85	0.81
accuracy			0.79
macro-averaging	0.79	0.79	0.79
Weighted average	0.79	0.79	0.79

The word clouds of positive and negative feature words from the sentiment analysis are shown in Figure 5 and 6. It can be observed from the word cloud diagram of positive feature words that words such as "development", "tradition", "trend", "future", "development trend", etc. are of larger size;

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"development trend", etc. are of larger size; "development trend", etc. are of larger size. "development trend" and other words have a large font size, these words show the positive and good side of the development of intelligent construction technology; "choice" "transformation" The appearance of words such as "need" and "personnel management" demonstrates the necessity of the transformation and development of the construction industry; "although", "and ", "because", "in fact", "not that it is not good" and other conjunctions may appear because these words connect positive points or elaborate positive reasons. From the word cloud diagram of negative feature words, it can be seen that the words "nothing", "change", "at all", "not ", "original", "still" and other words have a strong tendency of negative emotions, and "change the soup but not the medicine" directly expresses the negative sentiment towards the change of the name of civil engineering to "intelligent construction" without any change in the substance. The words "change the soup but not the medicine" directly express the negative sentiment towards the change of the name of civil engineering to IEC without any change in the substance; "nothing" and "not" negate the positive aspects of IEC and convey a negative message; "still" and "original" are the same. "still" and "originally" appear in the negative feature words, probably because they emphasise the negative situation or express negative emotions in the text.

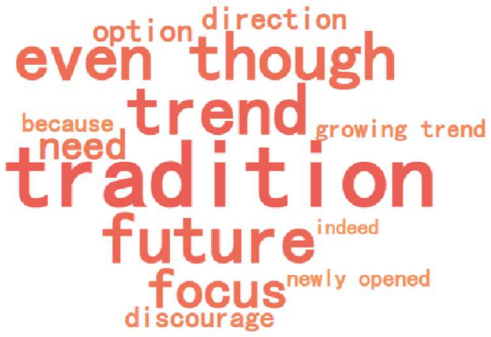

Figure 5. Positive feature word cloud map

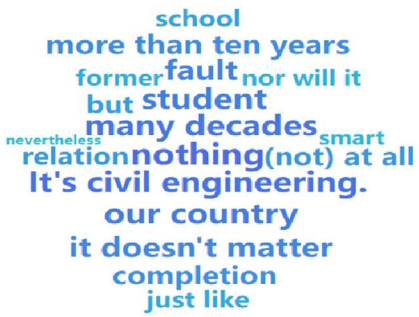

Figure 6. Negative feature word cloud map

4. Conclusion and Recommendations

4.1 Findings

In the increasingly competitive construction industry, intelligent construction technology has injected fresh blood into it, reducing costs and work intensity and improving the overall image of project management while continuously improving project quality. The following conclusions can be drawn from this study:

(1) From the results of LDA theme model analysis, it can be seen that the public's concerns about intelligent construction technology are diversified, mainly focusing on five aspects: industry development, talent training, technology application, intelligent transformation, employment and development direction. The public believes that intelligent construction is the current development direction of the construction industry, and the industry demand drives the development of intelligent construction technology, but the actual application of intelligent construction technology is not good; intelligent transformation has brought a considerable impact on the traditional civil engineering and construction industry, and the advantages of intelligent construction careers are not prominent compared with other careers.

(2) The results of sentiment analysis show that the public's attitude towards intelligent construction technology is polarised. One part of the public believes that with the development of science and technology, intelligent construction has a brighter development prospect, while the other part of the public is not optimistic about the development of intelligent construction, they think that a lot of schools will change the name of civil engineering majors to intelligent construction, but its curriculum

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design and teaching methods have not changed significantly, which is not conducive to the development of students' personal development and the national training of talents.

(3) Comprehensive keyword extraction, LDA theme modelling, and sentiment analysis results can be summarized that the public's understanding of intelligent construction technology is diversified, and the public's understanding of intelligent construction technology mainly revolves around the aspects of career development, industry development, and education and teaching, etc. They believe that although the intelligent construction technology is in line with the development needs of the construction industry nowadays, there are also the problems of incomplete talent cultivation system, incomplete industry standard system, teaching quality and teaching method. They believe that although intelligent construction technology meets the development needs of the current construction industry, there are problems such as incomplete talent training system, imperfect industry standards, mismatch between teaching quality and employment standards, and insufficient understanding of intelligent construction technology.

4.2 Development Proposals

This study combines the findings and textual data to make the following recommendations from four aspects: individuals, industries, schools and society:

(1) Individuals should continue to improve their professional skills, take the initiative to learn and master key emerging technology skills such as BIM, artificial intelligence, big data, etc., so as to cope with the impact of industry changes and achieve sustainable career development. Only through continuous knowledge updating and skill iteration can we meet the higher and more complex demands for job competence in the era of intelligence. At the same time, individuals should establish correct career values and correctly view the bottlenecks of industry development.

(2) The industry should strengthen exchanges and cooperation with other related industries, such as the information industry, to promote the cross-border integration and development of the industry through industry cooperation and sharing of resources, so as to improve the overall competitiveness of intelligent construction technology. In addition, the industry should make efforts to improve the corresponding occupational classification and qualification system, and refine the job competence standards, so that professionals in the field of intelligent construction can be matched to suitable jobs with their professional skills and knowledge reserves.

(3) Schools should optimize talent cultivation programmes, and through systematic reform of curriculum design and education methods, add practical courses and cross-curricular courses such as "Intelligent Construction Management", "Construction Robotics", "Artificial Intelligence", and so on, while attaching importance to the study of basic disciplines. At the same time, we put emphasis on basic learning and add practical courses and interdisciplinary courses such as "intelligent construction management", "construction robotics", "artificial intelligence", etc., so as to cultivate composite talents who know both construction technology and information technology. In addition, schools should actively promote school-enterprise cooperation, strengthen the in-depth integration of industry, academia and research, and develop teaching modules based on actual engineering projects, so as to improve students' practical ability and employment competitiveness. In addition, schools should strengthen the construction of teachers, and actively introduce young and middle-aged teachers with outstanding teaching and research ability, as well as experienced experts and technical backbones in the industry, so as to broaden students' learning channels and enrich their learning resources.

(4) Improve public awareness of intelligent construction, so that more people can understand the development prospect of intelligent construction technology. Activities such as intelligent construction technology exhibitions and intelligent construction robot competitions can be organised to strengthen publicity and promotion and stimulate the enthusiasm and interest of people from all walks of life. At the same time, communication and co-operation with social mainstream media can be made to improve the social influence of intelligent construction technology.

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This study has the following shortcomings: the insufficient amount of data and a single source may lead to insufficient model training, and the insufficient integration and analysis of data may affect the comprehensiveness and representativeness of the research conclusions, and the subsequent study may expand the scope of data collection to enhance the diversity and representativeness of the data; the sentiment analysis only sets positive and negative labels and ignores the expression of neutral emotions, which may affect the sentiment analysis results' accuracy, and subsequent studies can consider introducing a more detailed sentiment analysis framework to more accurately capture the emotional tendencies in the text.

The promotion and popularisation of intelligent construction technology requires not only national policy support and industry promotion, but also the understanding and support of the public. This study reveals the social public's concerns, attitudes and perceptions of intelligent construction technology through textual analysis of online texts on the Zhihu platform, proposes problems in the development of intelligent construction technology from the public's point of view and puts forward development suggestions, with a view to providing a basis for policy formulation and technology promotion by the government and relevant enterprises.

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