

Original Article

A Study on Social Integration and Work Environment Improvement for Migrant Construction Workers Using Social Big Data Analysis

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ABSTRACT

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Objectives: As the number of migrant construction workers (MCWs) increases, various socioeconomic problems are arising. This study aims to analyze key issues and trends related to MCWs using social big data and to derive policy and educational implications for improving their working environment and social integration. **Methods:** Data from Naver and Daum, collected between 2021 and 2024, were analyzed using text mining, and network analysis. **Results:** The results identified key terms such as employment, wages, safety, and education, with network analysis revealing strong interconnections among these terms, underscoring their significance in shaping major discourses. **Conclusions:** This study proposes policy development and institutional support strategies to improve the working environment of foreign laborers and offers practical insights for ensuring sustainability in the construction industry and fostering social integration.

Keywords: Labor policy, Migrant construction workers, Social big data analysis, Social integration, Work environment improvement

1. Introduction

South Korea has been experiencing a rapid decline in its working-age population due to low birth rates and an aging society, resulting in a critical labor shortage that is affecting various sectors. Particularly in the construction industry, which is characterized by high labor intensity and elevated risk of accidents, the participation rate of domestic workers has been steadily decreasing [1]. To address this issue, reliance on foreign workers has been increasing. Foreign labor has become an essential component of the Korean construction industry [2], contributing not only to filling labor gaps but also playing a vital role

in the maintenance and development of the sector.

However, the growing number of foreign workers has brought to light a range of socio-economic challenges. Migrant construction workers (MCWs) often find themselves in disadvantaged positions, facing low wages, hazardous working conditions, and unstable employment terms. Language and cultural barriers further hinder their social integration, leading to reduced effectiveness in safety education, higher accident rates, and inadequate protection of their rights [3]. These issues do not merely affect individual MCWs but also pose significant risks to the productivity and stability of the construction industry [4] and potentially have far-reaching consequences for the

national economy.

Previous studies on foreign labor have primarily focused on employment stability, improvement of working conditions, and strengthening legal and institutional protections [5]. However, these studies are often limited to specific cases or isolated aspects [6,7], falling short of providing a comprehensive and multidimensional understanding of the issues surrounding foreign workers. Moreover, there is a lack of research leveraging large-scale data such as social big data, and the analysis of public opinion trends and social discourse on this topic remains in its nascent stages.

Social big data has emerged as a crucial tool for identifying and understanding contemporary societal issues. Through big data analysis, it is possible to examine the key issues and societal perceptions related to MCWs in depth. This enables the development of more effective policies and systemic improvements. Advanced data analysis techniques such as text mining, and network analysis offer intuitive and empirical insights into complex social phenomena.

This study aims to analyze the major issues and trends surrounding MCWs using a data-driven approach and to derive policy and educational implications for improving their working conditions and social integration. By utilizing social big data, this research seeks to uncover public opinion and discourse on MCWs and explore ways to establish a symbiotic relationship between the construction industry and foreign labor. Ultimately, this study aspires to enhance the sustainability of the construction sector and foster an environment where MCWs can play a stable and positive role within Korean society.

2. Literature Review

Research on MCWs has primarily focused on topics such as safety education, industrial accidents, employment stability, and productivity. Noh et al. [8] developed virtual reality (VR)-based safety education content for MCWs, highlighting the potential of VR technology to enhance the effectiveness of safety training. However, their study lacked an in-depth analysis of the workers' participation and tangible outcomes. Similarly, Noh and Jang [9] analyzed the impact of safety culture and awareness on the safety participation behaviors of MCWs, incorporating moderating variables such as age. While their research underscored the significance of safety consciousness, it did not address how these findings might evolve in dynamic industrial settings.

Numerous studies have also examined industrial accidents involving MCWs. Ju et al. [4] analyzed trends in

industrial accidents among MCWs and proposed policy implications, while Kim [10] explored methods to predict and prevent safety accidents on construction sites. Although these studies offered specific strategies for reducing industrial accidents, they did not integrate real-time analysis of accident data or account for long-term trends. Cho et al. [11] introduced a Living-Lab project aimed at providing first aid and CPR training to MCWs, emphasizing the practical need for safety education. However, the study fell short of quantitatively validating the effectiveness of such training programs.

Regarding employment stability, Park [12] examined the employment conditions of MCWs and proposed improvement measures, while Cho [13] suggested institutional reforms to enhance employment stability. These studies primarily focused on macro-level policy recommendations and failed to reflect the lived experiences of workers and the evolving social environment. Lee et al. [14] proposed improvements to safety education systems for MCWs on construction sites, but their approach was limited to case studies, lacking comprehensive, data-driven analyses.

Studies on productivity and job stress have also been conducted. Jung et al. [6] analyzed the impact of job stress on managing construction accidents among domestic and MCWs, while Choi et al. [15] investigated factors hindering the productivity of MCWs on construction sites. While these studies highlighted the need to improve working conditions, they did not incorporate dynamic trend analyses or real-time evaluations using big data.

Existing research has primarily relied on traditional methodologies, such as surveys or case studies, to address specific issues related to MCWs. However, these approaches often depend on limited data or are confined to specific timeframes, thereby failing to capture dynamic changes and long-term trends comprehensively.

To address these limitations, this study employs big data analysis to provide a multidimensional understanding of trends and issues related to MCWs. Big data analysis enables the tracking of real-time changes in policies, social discourse, and accident patterns, offering a timely and integrated perspective. Additionally, the trends identified through data-driven methods can inform practical and actionable policy recommendations aimed at improving the safety, employment conditions, and accident prevention measures for MCWs. By leveraging diverse data formats, including text, images, and videos, this study seeks to uncover overlooked factors and establish a foundation for tailored policies that consider the cultural characteristics and needs of workers from different countries of origin. Ultimately, this research aims to expand upon the findings of prior studies and contribute concrete, data-driven solutions to enhance the safety and welfare of MCWs.

3. Research Design and Methodology

3.1. Research process and content

This study aimed to analyze the multidimensional changes related to MCWs and derive policy and educational implications. First, prior studies and existing literature on MCWs were systematically reviewed to establish a theoretical foundation. Subsequently, data from major digital platforms, including Naver and Daum, were collected for the period between 2021 and 2024. Text mining techniques were then employed to conduct word frequency analysis and TF-IDF analysis, enabling the extraction of key keywords related to MCWs. A 2-mode matrix analysis was further performed to gain an in-depth understanding of the trends in this domain. In addition, CONCOR analysis were utilized to examine major discourses and societal perceptions. Based on the results of these analyses, the

discussion was advanced, and conclusions were proposed from a policy and educational perspective.

3.2. Data analysis method

This study analyzed trends related to MCWs using Naver and Daum as data collection channels. The primary search keywords were "foreign construction workers" and "foreign construction laborers," and the analysis period spanned from January 1, 2021, to December 31, 2024.

Using the TEXTOM tool, data were collected from blogs, news, cafes, and KnowledgeIN. The analysis employed text mining, matrix analysis. Key keywords were identified through word frequency and TF-IDF analysis. Additionally, N-gram analysis and named entity recognition were conducted to examine keyword relationships and themes. A 2-mode matrix analysis was applied to identify activity networks.

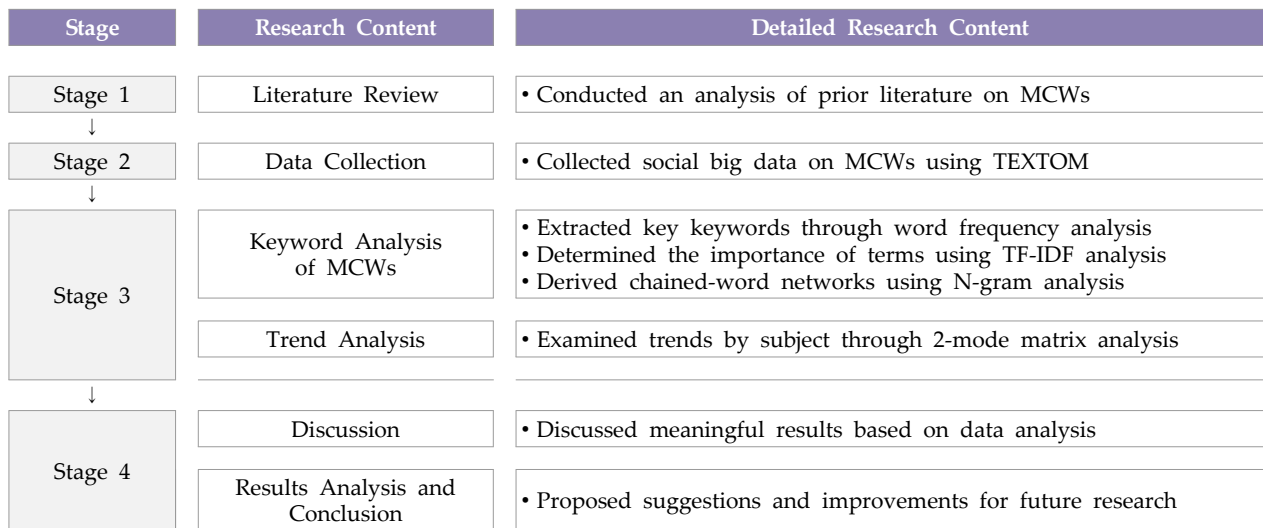


Fig. 1. Research Content and procedure

Table 1. Analysis data information

Category	Details
Collection Tool	TEXTOM
Collection Scope	Naver (Blogs, News, Cafes, KnowledgeIN, Web Documents), Daum (Blogs, News, Cafes, Web Documents)
Collection Period	January 1, 2021 - December 31, 2024
Search Keywords	MCWs, Literacy

Table 2. Data analysis structure

Category	Analysis methods	Description
Text Mining Analysis	Word Frequency Analysis	Identification of core keywords within MCWs data
	TF-IDF Analysis	Extraction of significant keywords
	N-gram Analysis	Derivation of chained keyword networks
	Named Entity Recognition	Identification of academic terms, organizations, regions, and keywords
Matrix Analysis	2-mode Matrix Analysis	Network extraction for MCWsstakeholders
Discourse Analysis	CONCOR Analysis	Grouping of MCWsdiscourse

3.3. Research questions

This study addresses the following research questions and seeks to discuss them based on the analysis results:

- RQ 1. What are the main issues related to MCWs, and what are the characteristics of the topics brought into focus?
- RQ 2. How are the key keywords and their networks within the context of MCWs structured?
- RQ 3. What should be the directions for policies and support systems regarding MCWs?

4. Research Results

4.1. Results of keyword analysis on MCWs using text mining

4.1.1. Identification of major keywords related to MCWs through word frequency analysis

This study conducted a word frequency analysis to understand trends related to MCWs, resulting in the identification of 50 key keywords. During the analysis, dependent

Table 3. Top 50 keywords related to MCWs identified through word frequency analysis and word cloud

no.	Keywords	N	%	no.	Keywords	N	%
1	Minority	4647	3.889	26	Work	336	0.281
2	Construction	3670	3.071	27	Business	330	0.276
3	Worker	3526	2.951	28	Region	330	0.276
4	Site	1720	1.439	29	Enterprise	328	0.275
5	Laborer	1630	1.364	30	Accident	309	0.259
6	Job	1554	1.301	31	Manufacturing	305	0.255
7	Employment	1166	0.976	32	Law	298	0.249
8	Safety	729	0.61	33	Domestic	291	0.244
9	Construction Industry	698	0.584	34	Management	291	0.244
10	Workforce	656	0.549	35	Time	290	0.243
11	Industry	644	0.539	36	Project	277	0.232
12	Korea	560	0.469	37	Above	277	0.232
13	Support	558	0.467	38	Increase	269	0.225
14	Visa	524	0.439	39	Application	268	0.224
15	Education	487	0.408	40	Field	266	0.223
16	Feasibility	441	0.369	41	Industrial Accident	260	0.218
17	Labor	435	0.364	42	Recruitment	255	0.213
18	Wage	435	0.364	43	Society	254	0.213
19	Economy	429	0.359	44	People	253	0.212
20	Foreign	423	0.354	45	Professional	247	0.207
21	Labor	420	0.352	46	Safety Training	245	0.205
22	Government	400	0.335	47	Center	243	0.203
23	Employment	354	0.296	48	Shortage	238	0.199
24	Policy	347	0.29	49	Word	236	0.198
25	Problem	340	0.285	50	Job Opportunity	234	0.196



to the improved integration, welfare, and productivity of MCWs in the industry.

4.2. Analysis of relationships in activities of MCWs

A 2-mode matrix analysis was conducted to generate a co-occurrence matrix of words from rows and columns containing different terms. The cosine similarity analysis revealed that key terms such as foreigner, construction, and worker exhibited high frequencies and strong

associations. For instance, the cosine similarity between foreigner and worker was calculated as 0.1688, while the similarity between foreigner and construction was determined to be 0.1737. These results are instrumental in understanding the relational structure of major concepts associated with MCWs, providing a clear visualization of how these key terms interact. Notably, the high correlations with policy-driven or socially significant topics such as employment, safety, and education highlight the primary focus areas of the discourse surrounding MCWs.

Table 5. Top 20 Word sequences identified through N-gram analysis

Bigram(2)			Trigram(3)			Tetragram(4)					
Term1	Term2	Frequency	Term1	Term2	Term3	Frequency	Term1	Term2	Term3	Term4	Frequency
Minority	Worker	1862	Construction	Site	Minority	192	Construction	Site	Minority	Worker	125
Construction	Site	1169	Site	Minority	Worker	155	Construction	Basics	Safety/Training	Certificate	41
Minority	Employee	777	Construction	Basics	Safety Training	122	Construction	Site	Minority	Worker	40
Construction	Worker	418	Minority	Construction	Worker	90	Construction	Worker	Self	Assembly	39
Site	Minority	250	Construction	Site	Work	84	Construction	Site	Minority	Employee	34
Construction	Employee	192	Minority	Seasonal	Employee	78	Minority	Worker	Support	Center	34
Safety	Health	186	Construction	Site	Minority	77	Press	Release	Briefing	Room	31
Employment	Ministry	165	Apartment	Construction	Site	73	Major	Accident	Punishment	Act	29
Employment	Permit System	162	Industry	Safety	Health	72	Basics	Safety	Health	Training	28
Migrant Worker	Worker	161	Minority	Employee	Employment	68	Apartment	Construction	Site	Foreign	27
Minority	Construction	157	Minority	Worker	Employment	64	Industry	Safety	Health	Corporation	27
Construction	Basics	139	Safety	Health	Training	58	Occupation	Manufacturing	Processing	Assembly	26
Foreign	Workforce	133	Construction	Site	Safety	55	Work	Time	Rest	Time	25
Basic	Safety Training	130	Site	Minority	Employee	49	Time	Rest	Time	Occupation	25
Seasonal	Worker	114	Work	Minority	Worker	47	Time	Occupation	Manufacturing	Processing	25
Minority	Employment	111	Construction	Site	Worker	44	Korea	Industry	Safety	Health	24
Wages	Arrears	109	Safety	Health	Corporation	44	Packaging	Quality	Inspection	Production	24
Site	Work	108	Site	Minority	Worker	42	Quality	Inspection	Production	Construction	24
Manufacturing	Construction	104	Minority	Worker	Construction	41	Inspection	Production	Construction	Labor	24
Work	Minority	104	Minority	Worker	Support	41	Construction	Site	Work	Foreign	23

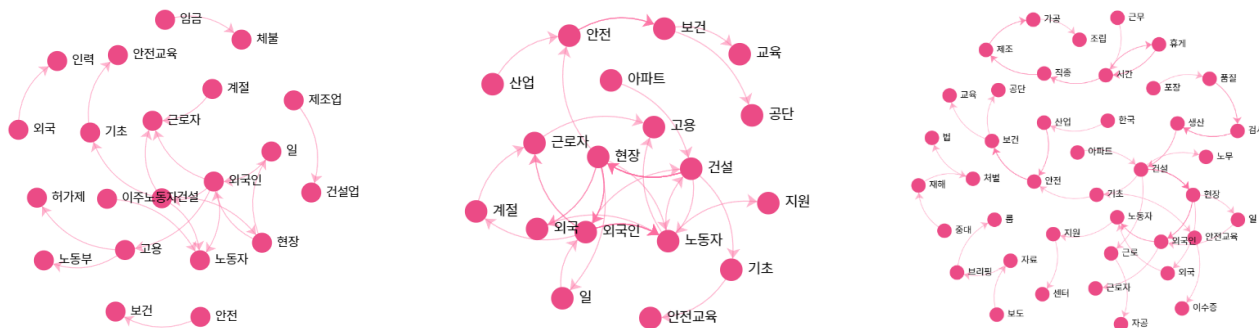


Table 6. Matrix analysis results

	Foreigner	Construction	Worker	Site	Employee	Work	Employment	Safety	Construction Industry	Workforce	Industry	Korea	Support	Visa	Education	Possible	Labor	Wages	Economy	Abroad
Minority	0.1688	5872	6910	3256	3699	2462	2292	1213	1410	1371	1004	971	925	1381	965	739	642	732	481	700
Construction	0.0237	0.1737	5266	3953	2276	1803	1350	1286	666	931	782	580	574	666	785	532	537	608	380	559
Worker	0.0286	0.0294	0.1947	2662	1349	2004	1293	912	883	839	647	712	534	598	507	314	290	737	314	469
Site	0.0193	0.0231	0.0244	0.1745	1183	1024	505	796	348	447	292	297	231	246	418	180	206	259	67	331
Employee	0.0153	0.0133	0.0147	0.0133	0.1665	867	845	674	442	432	428	309	485	321	519	224	563	257	142	325
Work	0.0225	0.0215	0.0257	0.0186	0.0147	0.2143	672	301	333	205	220	357	290	298	210	193	259	250	174	187
Employment	0.012	0.0111	0.0126	0.0077	0.0091	0.0122	0.1652	141	591	487	333	190	191	339	105	325	314	173	141	269
Safety	0.0098	0.0104	0.0119	0.0115	0.0092	0.0077	0.0031	0.1559	239	111	426	155	279	97	561	56	60	51	40	77
Construction Industry	0.018	0.0113	0.0203	0.0106	0.0124	0.0152	0.014	0.0088	0.203	306	234	142	126	218	154	95	57	147	86	137
Workforce	0.0118	0.0112	0.0135	0.0102	0.0078	0.0084	0.0078	0.0037	0.0137	0.1665	216	154	102	184	58	85	114	95	60	320
Industry	0.0133	0.012	0.015	0.0092	0.0103	0.0101	0.009	0.0108	0.0189	0.0101	0.2016	194	156	109	152	50	99	94	166	125
Korea	0.0128	0.0126	0.0149	0.0092	0.0074	0.0138	0.005	0.0058	0.0092	0.0074	0.0124	0.1955	116	95	114	57	37	51	142	67
Support	0.0108	0.0098	0.0108	0.0067	0.0088	0.0116	0.005	0.0086	0.0089	0.0039	0.0079	0.0068	0.1824	84	190	78	102	22	81	79
Visa	0.0085	0.0074	0.0095	0.0054	0.0052	0.0074	0.0051	0.0033	0.0093	0.0055	0.0051	0.0042	0.0036	0.1563	158	228	74	42	42	79
Education	0.008	0.0078	0.0083	0.0075	0.0078	0.006	0.0028	0.011	0.0076	0.0023	0.0068	0.0056	0.0078	0.004	0.1497	103	83	18	42	50
Possible	0.0101	0.0102	0.0096	0.0067	0.0066	0.0081	0.0076	0.003	0.008	0.0044	0.0041	0.0052	0.0047	0.0068	0.0042	0.1932	233	26	22	57
Labor	0.0095	0.0095	0.0084	0.0069	0.013	0.0094	0.0088	0.0032	0.006	0.0059	0.0059	0.0033	0.0054	0.0035	0.0048	0.0083	0.1959	113	25	100
Wages	0.0094	0.0094	0.0124	0.0074	0.0063	0.01	0.0062	0.0024	0.0071	0.0048	0.0054	0.0033	0.001	0.0019	0.001	0.0026	0.0061	0.1837	60	64
Economy	0.0106	0.0106	0.0112	0.0038	0.0056	0.0109	0.0055	0.0029	0.0081	0.0052	0.0118	0.0124	0.0057	0.0032	0.0032	0.0034	0.0032	0.0048	0.2525	62
Abroad	0.0125	0.0129	0.0145	0.0127	0.0109	0.0124	0.009	0.0049	0.013	0.0167	0.0103	0.0066	0.0064	0.0051	0.0035	0.0063	0.0084	0.0041	0.0084	0.2165

4.3. Network analysis results

4.3.1. Network properties

The structural statistics of the overall network were analyzed, and related indices were measured based on the interconnectivity of nodes, centering on the 1-Mode selected term "MCWs." The total number of nodes in the network was 20, with a total of 190 edges. All nodes were connected within a single component, forming a unified network. The centralization indices for Degree, Closeness, and Betweenness were all recorded as 0, indicating that no specific node prominently occupies the center of the network. The network diameter was 1, and the reciprocity was 0, signifying that all nodes in the network are connected at an equal level. Overall, the keyword network centered around MCWs demonstrated a balanced structure without any dominant themes, confirming an evenly distributed network configuration.

Table 7. Network analysis properties and values

Network Measures	Value
Nodes	20
Total Edges	190
Diameter	1
Degree Centralization	0
Closeness Centralization	0
Betweenness Centralization	0
Connected Components	1
Overall Reciprocity	0

Table 8. Results of centrality analysis

Term	Degree Centrality	Closeness Centrality	Betweenness Centrality	Eigenvector Centrality	PageRank	Clustering Coefficient
Minority	1	1	0	0.2236	0.1576	1
Construction	1	1	0	0.2236	0.1254	1
Worker	1	1	0	0.2236	0.1160	1
Site	1	1	0	0.2236	0.0729	1
Employee	1	1	0	0.2236	0.0692	1
Work	1	1	0	0.2236	0.0556	1
Employment	1	1	0	0.2236	0.0501	1
Safety	1	1	0	0.2236	0.0372	1
Construction Industry	1	1	0	0.2236	0.0340	1
Workforce	1	1	0	0.2236	0.0335	1
Industry	1	1	0	0.2236	0.0307	1
Korea	1	1	0	0.2236	0.0264	1
Support	1	1	0	0.2236	0.0261	1
Visa	1	1	0	0.2236	0.0284	1
Education	1	1	0	0.2236	0.0282	1
Feasibility	1	1	0	0.2236	0.0220	1
Labor	1	1	0	0.2236	0.0233	1
Wage	1	1	0	0.2236	0.0223	1
Economy	1	1	0	0.2236	0.0177	1
Foreign	1	1	0	0.2236	0.0237	1

1. Degree Centrality: Indicates how many connections a particular word (node) has with other words. It measures the direct connectivity of a node within the network.
2. Closeness Centrality: Reflects how closely a word is connected to all other words in the network. This metric evaluates the efficiency of a node's accessibility to others through the shortest path.
3. Betweenness Centrality: Measures the extent to which a word acts as a bridge between other words, facilitating the flow of information or resources within the network.
4. Eigenvector Centrality: Also known as influence centrality, considers not only the number of connections a node has but also the importance of the nodes it is connected to.
5. Pagerank: A centrality metric designed to minimize the influence of neighboring nodes with high centrality values. It measures the relative importance of a node within the network.
6. Clustering Coefficient: Quantifies the network's cohesiveness by calculating the probability that a node's neighbors are also connected to each other. It reflects the degree of local connectivity around a node.

4.3.2. Centrality analysis

To quantify the relative importance of specific words (nodes) within the network and evaluate their influence and meaning based on structural positions, centrality analysis was conducted. The analysis revealed that all words exhibited identical values for degree centrality, closeness centrality, and betweenness centrality, indicating a network structure where all nodes maintain equal connectivity. The eigenvector centrality for all words was consistently measured at 0.2236, demonstrating no differences in mutual influence among the central nodes of the network. In terms of PageRank values, words such as foreigner, construction, and worker displayed relatively higher scores, suggesting that these terms possess comparatively greater importance and connectivity within the network. The clustering coefficient was recorded as 1 for all words, signifying a fully connected network structure. These results highlight that terms like foreigner, construction, worker, and site play a significant role in the network and collectively form the core structure. This finding underscores the balanced and interconnected nature of the network, with key terms contributing equally to its stability and coherence.

4.3.3. Ego network analysis

To analyze the relationships among nodes directly

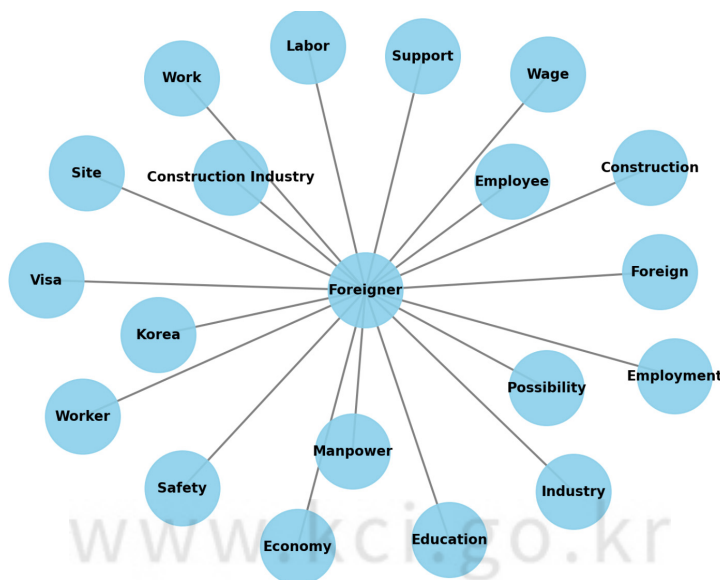
connected to a specific central node (ego), this study selected MCWs as the ego and extracted the corresponding ego network. The density of the ego network was 0.55555, indicating that the nodes within the network are relatively densely connected. The number of brokers was measured at 152; however, the betweenness centrality of the ego node was 0, indicating that MCWs do not act as intermediaries between connected nodes. An analysis of the connectivity characteristics of alter nodes within the ego network revealed that all alter nodes exhibited identical values for degree centrality, closeness centrality, and betweenness centrality, recorded as 1 and 0, respectively. The eigenvector centrality was consistently

measured at 0.224, suggesting that all nodes in the network maintain uniform connectivity. Regarding PageRank values, terms such as MCWs, construction, and laborer showed relatively higher values, highlighting their significance in maintaining connectivity within the ego network. Additionally, the clustering coefficient for all nodes was 1, confirming that the ego network forms a fully connected structure. In conclusion, the ego network centered around MCWs exhibited high density and balanced connectivity, with no single node dominating the network. This result indicates that discussions related to MCWs are evenly distributed across various topics and maintain a well-balanced structure.

Table 9. Results of ego network analysis

Ego	Size	Ties	Pairs	Ego-Density	Broker	Ego Between
Foreigner	19	190	342	0.55555	152	0

Alter	Ego			Eigenvector	Page Rank	Clustering coefficient
	Connection level	vicinity	medium			
Minority	1	1	0	0.224	0.158	1
Construction	1	1	0	0.224	0.125	1
Employee	1	1	0	0.224	0.116	1
Site	1	1	0	0.224	0.073	1
Worker	1	1	0	0.224	0.069	1
Work	1	1	0	0.224	0.056	1
Employment	1	1	0	0.224	0.05	1
Safety	1	1	0	0.224	0.037	1
Construction industry	1	1	0	0.224	0.034	1
Manpower	1	1	0	0.224	0.034	1
Industry	1	1	0	0.224	0.031	1
Korea	1	1	0	0.224	0.026	1
Support	1	1	0	0.224	0.026	1
Visa	1	1	0	0.224	0.028	1
Education	1	1	0	0.224	0.028	1
Possibility	1	1	0	0.224	0.022	1
Labor	1	1	0	0.224	0.023	1
Wage	1	1	0	0.224	0.022	1
Economy	1	1	0	0.224	0.018	1
Foreign	1	1	0	0.224	0.024	1



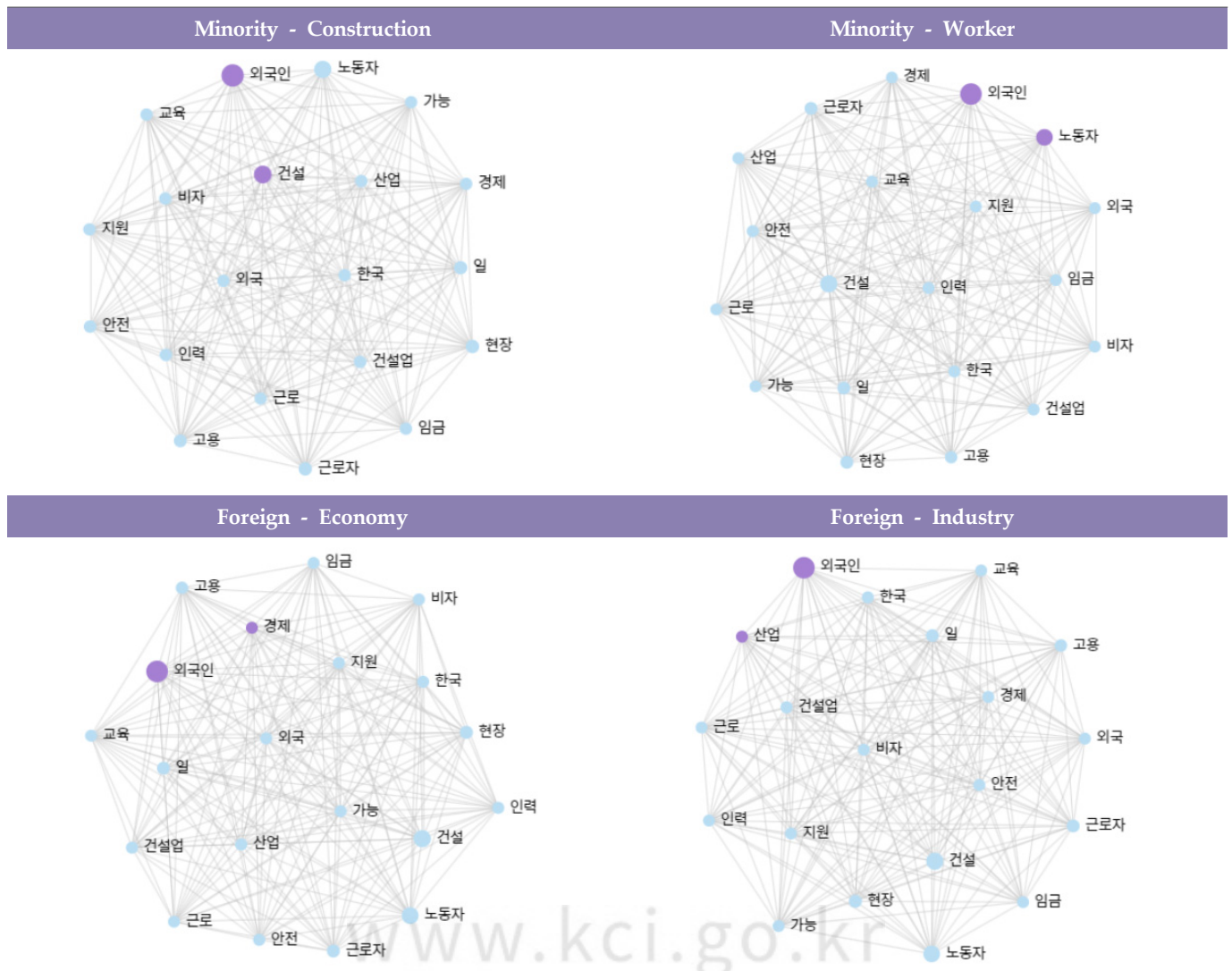
4.3.4. Shortest path analysis

To identify the shortest paths between the starting node (foreign workers) and key destination nodes in the network (construction, laborer, economy, industry), a shortest path analysis was conducted. The results indicated that all shortest path values between MCWs and the main keywords were 1. This demonstrates that MCWs are directly connected to each of these keywords, occupying a central position within the network. Notably, the strong connections between MCWs and keywords such as construction, laborer, economy, and industry reveal that these topics form a tightly interconnected structure centered on MCWs. Specifically, the strong association between MCWs and laborer highlights that foreign labor is a primary focus of discourse. Furthermore, the connection with the economy suggests that MCWs' economic contributions and related policy discussions are critical issues. Similarly, the link with industry underscores the significant role and importance of foreign labor in industrial contexts.

4.3.5. CONCOR analysis

To identify block structures within the network, CONCOR analysis was conducted by iteratively calculating correlations among words and clustering those with high similarity. The iteration count for correlation convergence was set to 100, and the number of clusters was defined as four. The analysis revealed that Cluster 2 included MCWs, indicating its central role in the network. Cluster 3 contained keywords such as construction, work, employment, construction industry, manpower, Korea, wages, and foreign, representing discussions primarily focused on employment and construction-related topics. Cluster 4 encompassed laborer, site, worker, safety, industry, support, visa, education, possibility, labor, and economy. These keywords reflect a range of discussions and policy issues related to foreign workers. The results highlight that key words connected to MCWs are grouped into clusters that reflect their relationships and specific thematic contexts. Each cluster represents distinct yet interconnected

Table 10. Results of shortest path analysis



construction industry, work, wages, and employment formed a cluster, indicating a structure centered on employment and economic issues. The Girvan-Newman analysis identified a cluster containing keywords such as industry, foreign, visa, and education, reflecting various policy issues associated with foreign workers. The Clauset-Newman-Moore analysis grouped terms like work, economy, and support, emphasizing the connection between support and the economic aspects of MCWs. Collectively, the clustering results demonstrate that network keywords are clearly grouped based on key discussion topics. Each cluster reflects significant themes within specific contexts and visually represents the relational structure among the keywords in the network. Furthermore, the results derived from the multiple clustering methods provide foundational data for better understanding the multidimensional topics related to MCWs.

5. Discussion

The construction industry is a major global employer, accounting for approximately 7% of the world's workforce [16]. MCWs face significant challenges, including exploitation during recruitment and employment, safety risks, health issues, language barriers, and difficulties in social integration [17-19]. This study aimed to identify key issues and societal perceptions regarding MCWs and to propose policy implications based on these findings. By utilizing social big data, methods such as text mining, network analysis were applied. The discussion, based on the research findings and questions, is as follows:

First, a network analysis was performed to examine the relationships among key keywords related to MCWs. The analysis revealed that keywords such as minority, construction, worker, employment, site, and employee were tightly interconnected. All keywords formed a unified network structure, with high connectivity among the main keywords according to the shortest path analysis. Centrality analysis showed that foreign and construction occupied central roles in the network, with their associated keywords playing critical roles in policy discussions and practical problem-solving. This network structure emphasizes the interdependence of issues related to foreign workers and the necessity of an integrated approach.

Second, the policy and support directions related to MCWs can be summarized into four key areas. First, legal reforms are needed to simplify visa issuance procedures and enhance employment stability. Second, safety training programs should be strengthened to reduce accident rates on construction sites and improve working conditions. Third, customized training content and language support

programs should be introduced to maximize the economic contributions of MCWs. Fourth, cultural and welfare support linked to local communities is essential to promote the social integration of MCWs. These policy directions are expected to improve the quality of life for MCWs and contribute to the sustainable development of the domestic construction industry.

From the above findings, several critical points of discussion were identified. First is the multifaceted nature of the key issues concerning MCWs. The analysis revealed that employment stability, safety issues, education and support systems, and economic contributions are prominent issues. Despite their significant role in addressing labor shortages and boosting productivity in the domestic construction industry, MCWs still face serious challenges, including insufficient safety training and poor working conditions. Therefore, systematic institutional reforms and policy support are necessary to protect workers' rights and ensure the sustainable growth of the construction industry.

Second, the interconnectivity of issues, as revealed through network analysis, highlights the need for multi-dimensional approaches. The network structure of keywords such as foreign, construction, and worker indicates that discussions related to MCWs are tightly interlinked. These findings suggest that addressing individual issues independently is insufficient and that a complementary approach is necessary.

Third, the study presents policy and educational implications. The findings highlight the need for enhanced safety education, the development of tailored vocational training content, language support programs, and welfare services linked to local communities for MCWs. Furthermore, efforts to increase multicultural acceptance through policy initiatives can help mitigate negative sentiments and promote social integration. These measures are expected to foster coexistence between foreign workers, the domestic construction industry, and local communities.

In conclusion, this study provides objective data for future policy formulation and institutional improvements by analyzing social and policy issues related to MCWs from multiple perspectives. However, the study's focus on quantitative analysis using social big data presents limitations. Future research should incorporate qualitative methods, such as in-depth interviews with foreign workers, employers, and policymakers, to yield richer insights and broader implications.

6. Conclusion and Recommendations

This study systematically identified key issues and trends related to MCWs through social big data analysis, with

the aim of deriving policy and educational implications. The findings highlight that MCWs play an essential role in addressing labor shortages in the domestic construction industry. However, they continue to face significant challenges related to employment stability, safety training, and societal perceptions, requiring targeted interventions.

Foreign workers significantly contribute to resolving labor shortages in the construction sector, yet safety issues and substandard working conditions remain pressing concerns. The lack of safety training was identified as a critical factor contributing to higher accident rates among MCWs.

The network analysis results demonstrated that the various keywords associated with MCWs are intricately interconnected, reflecting a complex network of interrelated issues. These findings suggest that addressing the challenges faced by foreign workers requires a multidimensional and integrated policy approach rather than isolated measures.

In light of these findings, strengthening safety training programs is a priority. Providing effective training content supported by multilingual resources and innovative methods such as VR technology can mitigate workplace risks and improve safety standards. Employment stability also emerged as a critical area for intervention. Institutional reforms, including the issuance of long-term visas, greater flexibility in employment permit systems, and enhanced protections for labor rights, are essential to ensuring that foreign workers can secure a stable foundation for their livelihoods.

The study also emphasizes the importance of promoting social integration through strengthened connections between MCWs and local communities. Programs designed to foster multicultural understanding, such as cultural exchange initiatives and community-based activities, could play a pivotal role in bridging gaps and improving mutual understanding between MCWs and local residents.

Policy monitoring and ongoing research are critical to maintaining relevance and effectiveness. Regular evaluations of policy outcomes, supported by a robust data-driven decision-making framework, will ensure the continuous improvement of initiatives aimed at supporting MCWs. A combination of quantitative analysis and qualitative research will provide deeper insights and more comprehensive solutions to address the challenges faced by MCWs.

This study offers valuable insights into the multifaceted issues surrounding MCWs and contributes to the foundation of informed policy discussions. However, future research should incorporate detailed field studies and qualitative methodologies to propose actionable strategies that promote sustainable growth for MCWs, the construction industry, and local communities alike.

Author Contribution

Conceptualization: Y Noh; Data collection: Y Noh; Formal analysis: Y Noh; Writing-original draft: Y Noh, JH Jang; Writing-review&editing: Y Noh, JH Jang

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Conflicts of Interest

The authors declare no conflict of interest.

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Reference

1. Lyu S, Hon CKH, Chan APC, Jiang XY, Skitmore M. Critical factors affecting the safety communication of ethnic minority construction workers. *Journal of Construction Engineering and Management*. 2023;149(2). <https://doi.org/10.1061/JCEMD4.COENG-12680>
2. Noh Y, Jang J-H. A study on the development directions of educational content for the reduction of occupational injuries among foreign construction workers. *Journal of Industrial Technology Research*. 2023;28(4): 25-41. <https://doi.org/10.29279/jitr.2023.28.4.25>
3. Son KS, Lee SY. Consciousness of safety engineer for foreign workers at a construction site. *Journal of Korean Safety Management Science*. 2008;10(1): 41-47.
4. Ju SH, Noh Y, Jang JH, Hyun BR. Analysis and policy implications of industrial accident trends among foreign construction workers. *Korean Journal of Local Government and Administration Studies*. 2024;38(1): 237-259. <https://doi.org/10.18398/kjlgas.2024.38.1.237>
5. Cho JH. A study on the institutional improvement for the employment stability of foreign workers in the construction industry. *Journal of Korean Disaster Information Society*. 2019;15(4):514-523. <https://doi.org/10.15683/kosdi.2019.12.31.514>
6. Jung KH, Kim GH, Shin YS. A management approach of the construction accidents based on assessing the job stress of Korean and foreign construction laborers. *Journal of Korean Society of Safety*. 2014;29(5):88-98.

- <https://doi.org/10.14346/JKOSOS.2014.29.5.088>
7. Jung KH, Lee H, Kwon H, Park JE, Shin YS. A development of safety education model for a foreign worker in domestic construction sites. *Journal of Korean Institute of Building Construction*. 2015;15(2):227-235. <https://doi.org/10.5345/JKIBC.2015.15.2.227>
 8. Noh Y, Jang JH, Lee JY. Analysis of current status of VR-based safety education for foreign construction workers and direction of development of safety education. *Journal of the Korea Academia-Industrial Cooperation Society*. 2024;25(4):155-164. <https://doi.org/10.5762/KAIS.2024.25.4.155>
 9. Noh Y, Jang JH. The impact of safety culture on safety participation behavior among foreign construction workers: the mediating effect of safety consciousness and the moderating effect of age. *Korea and International Society*. 2024;8(4):1019-1047. <https://doi.org/10.22718/kga.2024.8.4.039>
 10. Kim JM. The quantification of the safety accident of foreign workers in the construction sites. *Korean Journal of Construction Engineering and Management*. 2024;25(5):25-31. <https://doi.org/10.6106/KJCEM.2024.25.5.025>
 11. Cho H, Oh E, Yi F, Do TTH, Ren L, Ahn S. Living lab project for first aid and CPR education of foreign workers on a construction site. *Journal of Korean Society of Occupational Health*. 2024;34(4):299-308. <https://doi.org/10.15269/JKSOEH.2024.34.4.299>
 12. Park H. Current status and improvement plan for foreign construction laborer. *Journal of Korea Contents Association*. 2015;15(9):555-561. <https://doi.org/10.5392/JKCA.2015.15.09.555>
 13. Cho JH. A study on the institutional improvement for the employment stability of foreign workers in the construction industry. *Journal of Korean Disaster Information Society*. 2019;15(4):514-523. <https://doi.org/10.15683/kosdi.2019.12.31.514>
 14. Lee SB, Yoo S, Shin D. A study on the improvement of safety education of foreign workers at construction sites. *Journal of Standard and Certification Safety*. 2021;11(2):103-113. <https://doi.org/10.34139/JSCS.2021.11.2.103>
 15. Choi HB, Shin YS, Kang KI. A study on productivity of foreign labors in domestic apartment construction sites: focused on evaluation of productivity and productivity impediment factor. *Journal of Korean Institute of Building Construction*. 2005;5(1):75-79. <https://doi.org/10.5345/jkic.2005.5.1.075>
 16. Barbosa F, Woetzel J, Mischke J, Ribeirinho MJ, Sridhar M, Parsons M, Bertram N, Brown S. *Reinventing construction: a route to higher productivity*; McKinsey Global Institute: New York, NY, USA, 2017.
 17. Dhal M. Labor stand: face of precarious migrant construction workers in India. *Journal of Construction Engineering and Management*. 2020;146:1761.
 18. Han SH, Park SH, Jin EJ, Kim H, Seong YK. Critical issues and possible solutions for motivating foreign construction workers. *Journal of Management in Engineering*. 2008;24(4):217-226. [https://doi.org/10.1061/\(ASCE\)0742-597X\(2008\)24:4\(217\)](https://doi.org/10.1061/(ASCE)0742-597X(2008)24:4(217))
 19. Kongchasing N, Sua-iam G. The main issue working with migrant construction labor: a case study in Thailand. *Engineering, Construction and Architectural Management*. 2022;29:1715-1730. <https://doi.org/10.1080/ecam-05-2020-0376>

