

Article

Spatio-Temporal Evolution Characteristics and Influencing Factors of INGO Activities in Myanmar

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Abstract: Myanmar is among the regions with the most frequent activities of International Non-Government Organizations (INGOs). Analyzing the spatio-temporal patterns of these activities holds crucial importance for optimizing organizational coordination and enhancing governmental oversight. This study focuses on the spatio-temporal evolution characteristics and influencing factors of INGO activities in Myanmar from 2010 to 2021, utilizing spatial autocorrelation and regression analysis. The results show that the number of INGOs in Myanmar has shown a gradual slowdown in growth trends, with the number of activities exhibiting a wave-like pattern, primarily driven by spontaneous activities of INGOs. The spatial distribution of INGO activities in Myanmar is concentrated in the southern plains, with the core located in Yangon, Naypyitaw, and Loilen. Furthermore, there is significant spatial polarization in the hotspot area of INGO activities. The hotspots followed an evolutionary path from “South Myanmar” to “North Myanmar” and then back to “South Myanmar”. INGO activities in Myanmar are more focused on the local economic level, urbanization level, medical level, education level, and total population size, providing the necessary support and services for the local society and making up for the “government malfunction” and “market malfunction”.

Keywords: INGO activities; Myanmar; spatio-temporal characteristics; influencing factors



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1. Introduction

International Non-Government Organization (INGOs) are defined as “any organization which is not established by intergovernmental agreement” [1]. INGOs are characterized by their large numbers, flexible mechanisms, efficient organization, and their ability to circumvent sovereign barriers. They play an increasingly prominent role in providing differentiated public goods and public services, making up for the “government malfunction” and “market malfunction” [2]. They reflect the deep concern of the international community for global and international issues and, to some extent, affect the local political, economic, and cultural landscapes.

After the end of World War II, especially from the 1970s onwards, INGOs experienced unprecedented development [3]. Early scholars’ research on INGOs mainly focused on the study of the cooperative relationship with various non-governmental, non-profit voluntary community organizations and the political state [4–8]. Since the 1980s, the focus of INGO research has gradually shifted towards the fields of human rights and democracy [9,10], social development [11–14], and environmental protection [15–17]. Attention has also gradually shifted towards INGOs’ accountability [18–21] and regulatory issues [22–25], exploring the efficiency and effectiveness of INGOs in regional assistance and governance. Currently, INGOs are gaining influence and attention globally, with increasing globalization and interdependence among countries. The involvement of these organizations in addressing multiple global challenges such as climate change, the refugee crisis, epidemic prevention and control has attracted extensive attention from scholars. They are not only

concerned about the role of INGOs in global governance and regional stability but have also begun to delve into strategies [26,27] and regional modes of cooperation in facing global challenges [28].

Research on Myanmar-related INGOs typically focuses on a single NGO or issue. On the NGO side, McGregor [29] employed the idea of critical geopolitics to explore the use of Western human rights discourses by Australian NGO aid organizations to build with Myanmar. Watanabe [30] summarized the work of Japan's oldest NGO, the Organization for Industrial, Spiritual, and Cultural Advancement (OISCA), to assist with sustainable agriculture training and development in Myanmar. Noam [31] discussed the use of INGOs for nation-building and militarization by the military government (SPDC) in Myanmar under the banner of large-scale conservation projects. In terms of topics, Paratharayil [32] summarized the different ways in which INGOs addressed local psychosocial issues in the aftermath of the Nargis tropical storm. Kusuma [33] and others compared the roles of the state and INGOs in responding to the humanitarian crisis of the Rohingyas. Duan Ran [34] analyzed the role of NGOs in Myanmar's transition and foreign relations, arguing that INGOs have become increasingly active in Myanmar, and described the history and current status of these organizations during different periods in Myanmar, along with the reasons for their rise.

The spatio-temporal distribution of INGO activities and their related factors highlight the inequality of resource distribution. Exploring why INGO activities flow to certain places rather than others is of great significance for optimizing internal and external coordination of organizations, strengthening the management of governmental associations, and deepening the equitable participation of the people. Taking Myanmar as the study area, this study employs time series ordered clustering, global spatial autocorrelation, local spatial autocorrelation, and negative binomial regression to analyze the characteristics of the spatio-temporal evolution of INGO activities in Myanmar and their influencing factors. Since Myanmar started the democratization process in 2010, political deregulation has led to an influx of a large number of INGOs carrying out their activities [35], this study is based on data on INGOs and their activities from 2010 to 2021.

2. Data and Methods

2.1. Data

2.1.1. Data Sources

1. INGO Directory Data

This paper utilized the IGO directory in the Yearbook of International Organizations to identify INGOs active in Myanmar. The Yearbook of International Organizations (2021–2022), published by the Union of International Associations, contains more than 74,000 organizations from over 200 countries and territories worldwide, including intergovernmental organizations, non-governmental organizations, associations, and groupings [36]. The attribute information of the INGO data mainly includes the organization's proprietary name, location, year of establishment, category, theme, UN Sustainable Development Goals (SDGs), and other detailed descriptions.

2. Activity Data

The Global Database of Events, Language, and Tone (GDELT) was used to extract data on INGO activities in Myanmar. The GDELT event database covers a wide range of political, economic, and social activities occurring globally, and it is the world's largest open database of human society, offering the broadest coverage, the most comprehensive content, and the highest resolution across categories [37,38]. The coverage languages include multiple language categories, with a coverage rate of 98.4%. The information recorded in Table 1 was mainly divided into five parts: event ID and time attributes, information about both participants, event behavior attributes, geo-referenced information about the event and both participants, and event management fields [39].

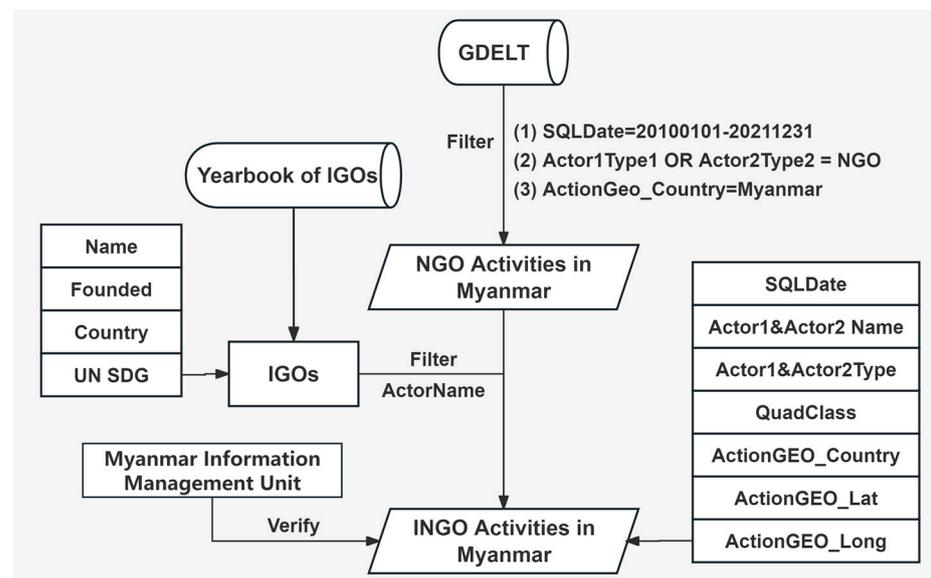
Table 1. Event database-related fields.

Column	Field Name	Detailed Description
1–5	Event and Date Attributes	The event number and the date of the event in different version formats
6–25	Actor Attributes	Proprietary name, actor code (e.g., NGO), and characterizing attributes for Actor1 and Actor2
26–35	Event Action Attributes	Various attributes of the event (mainly using the event type in the QuadClass field: 1 = verbal cooperation, 2 = material cooperation, 3 = verbal conflict, 4 = material conflict) *
36–56	Event Geography	Geographic information on actors and events
57–58	Data Management	The event date and source URL

* Verbal Cooperation includes significant occurrences of supportive statements, requests, and engagements in diplomatic cooperation. Material Cooperation encompasses collaborative investigations, engagements in material cooperation, and the provision of aid. Verbal Conflict involves disapprovals, objections, complaints, threats, rejection of cooperation, and civilian demonstrations. Material Conflict encompasses all military or police moves, repression and violence against civilians, and the use of conventional and unconventional forms of violence, as well as mass violence.

2.1.2. Data Processing

As depicted in Figure 1, the data on NGO activities in Myanmar from 2010 to 2021 were extracted from the GDELT event database based on event time, actor types, and event location. INGO activities were then identified using the IGO directory. In the end, a total of 128 INGOs operating in Myanmar and 11,082 activity data were obtained, which was basically consistent with the official statistics of the Myanmar Information Management Unit [40].

**Figure 1.** Data process flow chart.

In this paper, we identify a total of 128 INGOs active in Myanmar, of which 26 organizations pursue a single goal, and 102 organizations pursue multiple goals. The selection of SDGs reflects the topics of concern for their activities in Myanmar. As shown in Figure 2, INGOs in Myanmar comprehensively cover 17 goals. The target of Promoting Peaceful and Inclusive Societies (SDG16) has the highest number of organizations, with 71. Quality Education (SDG4) was the second most popular development goal for INGOs in Myanmar, with 60 organizations choosing it. In addition, popular topics among INGOs in Myanmar include No Poverty (SDG1), Good Health and Well-being (SDG3), Gender Equality (SDG5), Decent Work and Economic Growth (SDG8), and Partnerships for the

Goals (SDG17). INGO activities in Myanmar were mainly focused on economic assistance, education and training, human rights advocacy, and disaster response, with a predominant focus on assistance and guidance. Some organizations combined relief services with these guiding activities. INGO assistance and guidance activities primarily include skills training, capacity building, microcredit, awareness building, and cooperative development. In contrast, relief services mainly involved medical education, sheltering, environmental protection, animal rescue, and other projects.

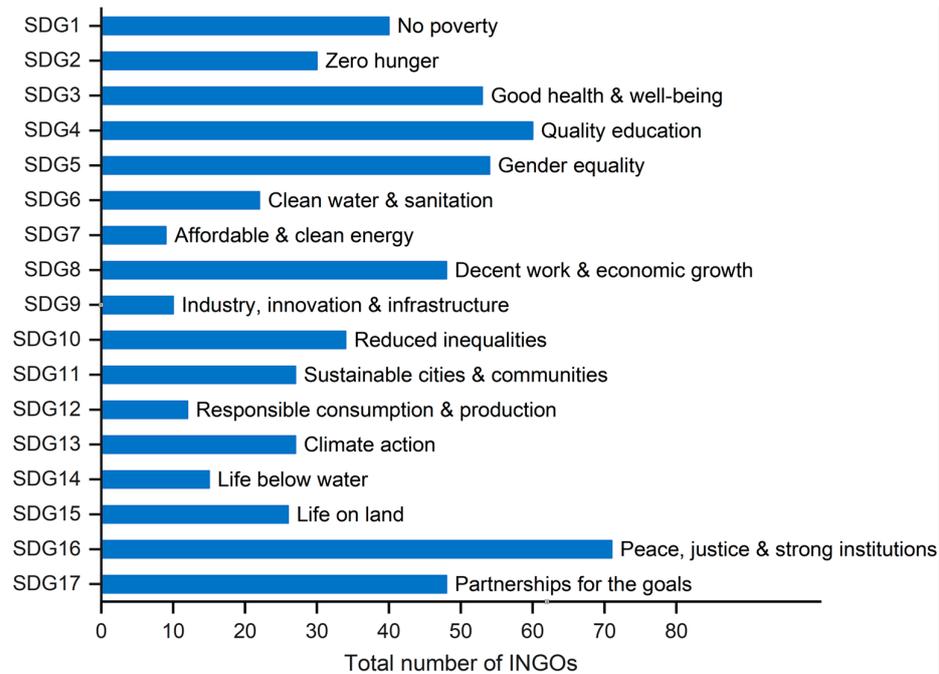


Figure 2. Type and number of International Non-Government Organizations (INGOs) in Myanmar.

2.2. Methods

As illustrated in Figure 3, INGO activities in Myanmar were classified into different periods using time series ordered clustering, and global spatial autocorrelation was then used to analyze the spatio-temporal distribution characteristics of INGO activities in Myanmar. On this basis, local spatial autocorrelation was further employed to clarify the spatial correlation characteristics of INGO activities. Finally, the influencing factors of INGO activities are analyzed.

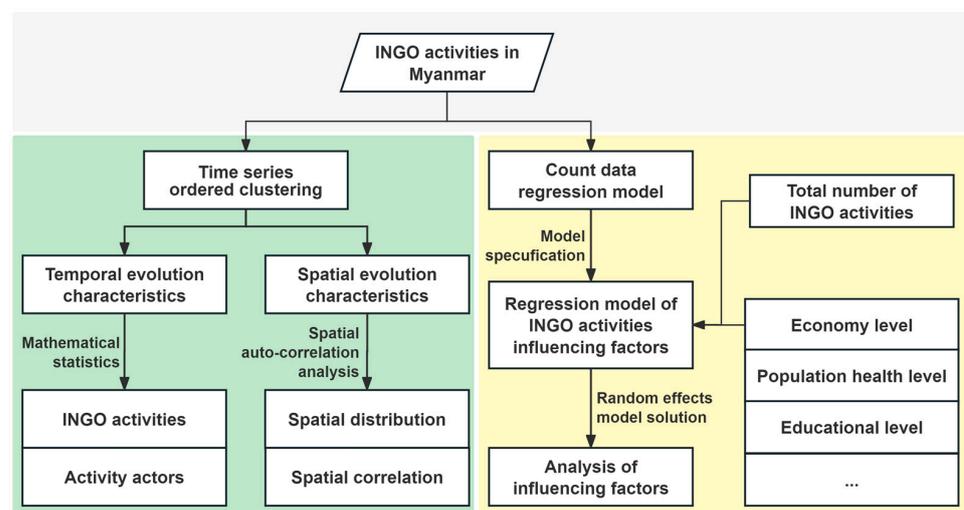


Figure 3. Research technology roadmap.

2.2.1. Time Series Ordered Clustering

Time series ordered clustering is characterized by the clustering of adjacent samples and strong continuity of results, and it is commonly used for cluster analysis of time series data [41]. This study utilized the time series ordered clustering method to classify periods of INGO activity in Myanmar. The central idea is that each sample is a class, and adjacent samples are merged and clustered based on the principle of minimizing the variance within the merged class until they are clustered into one class. The time series is divided into periods based on the clustering results. The sum of squared deviations within class P is defined as D_p :

$$D_p = \sum_{i=1}^{n_p} (x_{p_i} - \bar{x}_p)^2 \quad (1)$$

where n_p is the number of years in period p , x_{p_i} is the number of INGO activities in Myanmar in year i of period p , and \bar{x}_p is the average of the number of years of activities in period p .

The total sum of squared deviations after dividing the sample into k classes is D . The neighboring p and q classes are merged to form a new pq class with variance increment I_{pq} . At each merging, the two classes with the smallest variance increment I_{pq} are selected to be merged until all classes are merged into one. In this study, based on the time series ordered clustering, the INGO activities in Myanmar are divided into three periods, as shown in Figure 4: the initial period (2010–2012), the development period (2013–2017,) and the stagnation period (2018–2021).

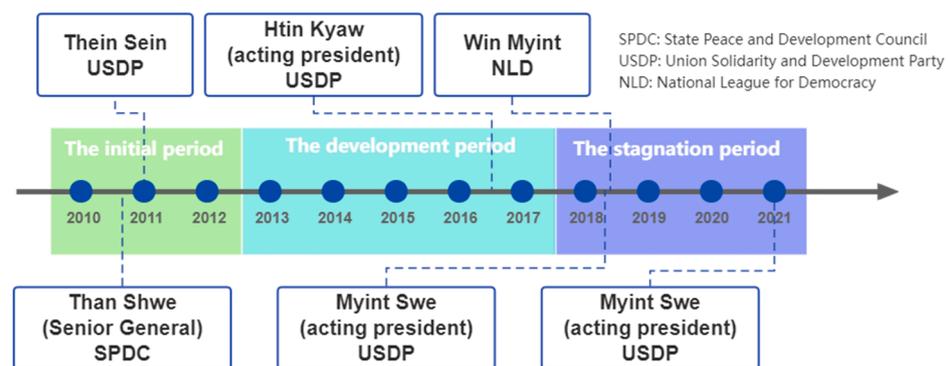


Figure 4. Time period divisions and presidential terms.

2.2.2. Global Spatial Autocorrelation

Global spatial autocorrelation analysis can be used to reveal the spatial distribution characteristics among geographic phenomena and to measure the spatial distribution patterns of point elements. The commonly used formula for global spatial autocorrelation is Moran's I index [42]. Moran's I is a spatial statistic used to calculate the spatial similarity of observations. The calculation is formulated as follows:

$$I = \frac{\sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{S^2 \sum_{i=1}^n \sum_{j=1}^n w_{ij}} \quad (2)$$

where W_{ij} is the spatial weight matrix, with elements assigned a value of 1 for spatial adjacency and 0 for non-adjacency, x_i and x_j denote the attribute values of the region, \bar{x} is the unit mean of the study area, and S^2 is the sample variance. Moran's I ranges from -1 to 1 , where positive values indicate positive correlation, negative values indicate

negative correlation, and 0 indicates random distribution. The standardized statistic for Moran's I exponential test is the Z-score, which is calculated as follows:

$$Z_I = \frac{I - E[I]}{\sqrt{V[I]}} \quad (3)$$

where $E[I]$ and $V[I]$ are the expected value and coefficient of variation of $Z[I]$, respectively. The value of Z-score reflects the degree of deviation of Moran's I, relative to its expected value. Positive values indicate a tendency for observations to cluster spatially and negative values indicate a tendency for dispersion. This method is used in this paper to examine the spatio-temporal distribution characteristics of INGO activities in Myanmar.

2.2.3. Local Spatial Autocorrelation

In order to reveal the correlation characteristics of INGO activities in local spatial regions, further analysis using local spatial autocorrelation is required. Local spatial autocorrelation [43] is a method used to study the phenomenon of local agglomeration or dispersion in geographic space, and one of the most commonly used metrics is the Local Indicators of Spatial Association (LISA). LISA assesses spatial autocorrelation by calculating the local Moran's I index for each location. The localized Moran's I index is formulated as:

$$I_i = z_i \cdot \sum_{j=1}^n W_{ij} z_j \quad (4)$$

where z_i and z_j are the deviation of the number of INGO activities in the i th and j th regions (states) from the mean, and W_{ij} is the normalized spatial weight matrix. The LISA plot shows the local Moran's I index for each location in space, identifying different spatial patterns through color and spatial shapes.

In this study, we use the LISA cluster diagram [44] to explore the spatial clustering of INGO activities and their spatio-temporal evolution in Myanmar's divisional regions (states). "High-High Cluster" indicates a hotspot area, which means that there are clusters with high values in and around a location. "High-Low Outlier" indicates a high value at a location but a low value in its neighborhood. "Low-Low Cluster" indicates a coldspot area, which means that there are clusters with low values in and around a location. "Low-High Outlier" indicates a low value at a location but a high value in its neighborhood.

2.2.4. Regression Analysis of Influencing Factors

Quantitative analysis of influencing factors mostly adopts the mathematical statistics analysis method. The number of INGO activities in Myanmar is represented by count data, which is non-continuous data with obvious discrete characteristics. A discrete O-test was performed on the number of INGO activities in the sample regions (states). The results showed that at the significance level of 0.1%, the variance statistical value was 154,396.42, and the average value was 921.83. The variance was significantly greater than the mean, indicating that the data were over-dispersed. The over-dispersion issue can be addressed using a negative binomial regression model [45–47]. This assumes that the number of INGO activities in the regions (states) follows a negative binomial distribution. Therefore, the negative binomial regression model is used to test the influencing factors and significance of the number of INGO activities in Myanmar. The regression model is as follows:

$$y_{it} = \beta_0 + \sum_{k=1}^k \beta_{kit} \ln x_{kit} + \varepsilon_{it} \quad (5)$$

where i denotes the 14 regions (states) of Myanmar, t represents time, k represents the number of independent variables, y_{it} represents the observation number of INGO activities in the i th region (state) for period t , x_{kit} represents the observed value of the k th independent

variable for the i th region (state) in period t , β_{kit} represents the regression coefficient, and ε_{it} denotes the random error term.

Based on previous studies [48–52], this paper considers the basic context and data availability of the study area. Seven influencing factors, as shown in Table 2, were selected for regression analysis to explore the primary factors affecting the number of INGO activities. To avoid the influence of multicollinearity on the model, a VIF test was conducted on the variables, and the results are shown in Table 3. The VIF values of each variable were less than 5, which proves that there was no multicollinearity between the variables.

Table 2. Meaning and source of independent variables.

Influencing Factor	Interpretation	Theoretical Analysis	Source
Economic level (x_1)	Natural log of the gross national product	Gross national product (GNP) can reflect the degree of economic development of a region. Regions with lower levels of economic development may face more developmental challenges and require more external assistance.	World bank database
Medical level (x_2)	Infant mortality rate per 1000 live births	The Infant mortality rate reflects the quality of medical resources and services in a region. There may be more INGO activity in areas with lower levels of medical care.	World health organization's official website
Education level (x_3)	Percentage of urban population with secondary education	INGO is more concerned with providing basic education, vocational training, and improving access to education. The number of INGO activities is likely to be higher in areas where the level of education is poor.	World population prospects database
Urbanization level (x_4)	Percentage of the population living in each region (state) as urban as opposed to rural	The less urbanized the area, the more social problems may arise, such as poverty, social exclusion, etc., which may also require the involvement of INGOs.	
Foreign population size (x_5)	Natural log of number of foreign populations	A larger foreign population may increase the demand for infrastructure and services, causing an increase in the number of INGO activities.	
Total population size (x_6)	Natural log of total population	Areas with large populations are likely to face more social issues and development challenges and therefore may attract more INGO participation.	Myanmar statistical yearbook
Natural disaster level (x_7)	Ratio of the population affected by natural disasters	Ratio of the population affected by natural disasters reflects the extent to which an area has been affected by natural disasters. In severely affected areas, INGOs may be able to provide emergency assistance.	

Table 3. Results of VIF test.

Variable	VIF	1/VIF
x_1	4.804	0.208
x_2	1.202	0.832
x_3	2.462	0.406
x_4	3.642	0.275
x_5	20580	0.388
x_6	3.909	0.256
x_7	1.726	0.579

3. Results and Analysis

3.1. Temporal Evolution Characteristics Analysis

3.1.1. INGO Activities' Characteristics

From 2010 to 2021, the number of INGOs in Myanmar showed an S-shaped growth trajectory, while the number of activities showed a wave-like progression. In 2021, the number of INGOs in Myanmar had increased by 103 compared to the figures in 2010, representing an average annual increase of about 9%. In 2010, the volume of INGO activities in Myanmar was 3.94% of that in 2021, with an average annual increase of 8.73%. During the initial and developmental periods, the influx of INGOs led to an acceleration in the number of activities. Conversely, during the stagnation period, there was a noticeable slowdown and decline in the number of INGO activities.

Several INGOs began conducting exploratory activities after Myanmar opened up to the outside world in 1988. After that, the Myanmar government carried out a series of political and economic reforms, and a large number of INGOs came in to carry out activities. After the establishment of the new government in Myanmar in 2011, INGOs have increased and expanded both in number and in scope of activities. As illustrated in Figure 5, there has been a gradual increase in INGO activities since 2010, coinciding with the gradual liberalization of Myanmar's political environment.

1. The initial period saw a rapid increase in INGO activities from 460 to 1308 between 2010 and 2012. This period was marked by the devolution of power from the military government to the National League for Democracy (NLD) and the former Prime Minister, Thein Sein, who became a democratically elected president. Following the formation of the new government in 2011, the pace of democratization in Myanmar accelerated, restrictions on INGOs were eased [53], and Myanmar gradually moved towards democracy. The political deregulation allowed for a broader space for INGO activities, leading to a significant influx of INGOs into Myanmar. The number of INGO activities skyrocketed, with organizations focusing on social relief and welfare services flourishing during this period.
2. The development period witnessed Myanmar's evolution from the "Democratic Transition Period" to the "Democratic Consolidation Period", a crucial phase in the country's transition to democracy [34]. With the reduction of conflict, the state shifted its focus towards improving national living standards. The vigorous development of infrastructure and economic construction was accompanied by challenges related to human rights and environmental issues, which led to INGOs committing to human rights and democratic reforms. INGOs became a new force in Myanmar's political transition, with an increase in both the number and scope of their activities compared to the previous period.
3. The stagnation period began in 2018 when the NLD was formally elected to the new government. Some INGOs that had dissented from the NLD were sidelined. In the November 2020 parliamentary election, the NLD overwhelmingly won a majority of seats, a result that caused alarm and dissatisfaction among the military, leading to a coup to regain political control. This event interrupted Myanmar's political transition. Coupled with the large-scale outbreak of the COVID-19 pandemic, societal turmoil, economic downturn, and worsening of people's livelihoods, the development of INGOs in Myanmar was restricted once again, with a decline in the number of INGOs and their activities compared to the previous period [34].

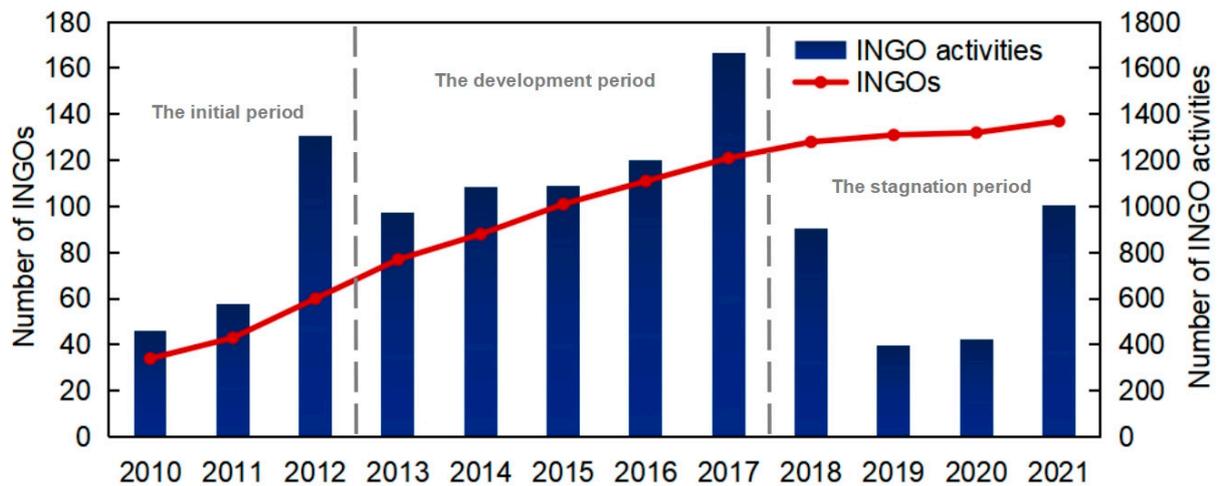


Figure 5. Number of INGOs and activities in Myanmar from 2010 to 2021.

3.1.2. Activity Actors' Characteristics

Statistics on the initiators and targets of INGO activities in Myanmar from 2010 to 2021 are shown in Figure 6. The results indicate a clear tendency for the targets of INGO activities in Myanmar, with most activities initiated by INGOs. These organizations primarily carry out public welfare activities and provide financial support, technical guidance, and training for Myanmar's democratic transition. The most frequent activities were spontaneous by INGOs (without targets), followed by activities targeting other actors in Myanmar. Inter-INGO activities (with INGOs as targets) were not prominent, while the level of activities initiated by other actors in Myanmar was low.

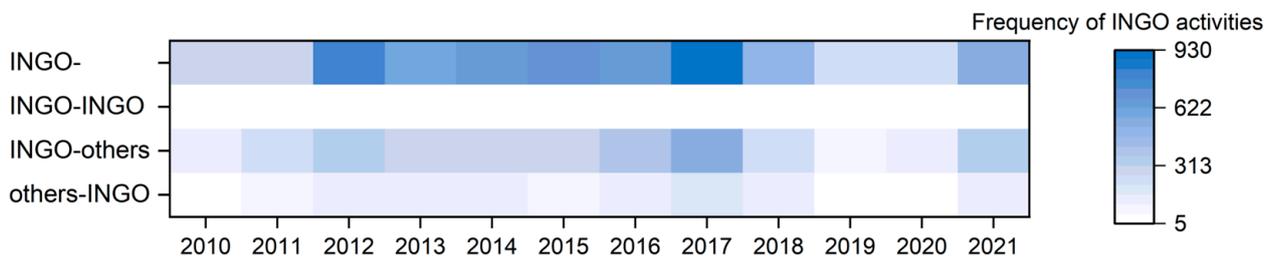


Figure 6. Heat map of INGO activity initiators and targets.

As shown in Figure 7, summarizing INGO activities with internal actors in Myanmar, the three most active actors are government, military, and civilian. INGO activities with the Myanmar government increased during the initial and development periods, while during the stagnation period, INGO activities with the government declined but remained dominant. The overall process of INGO activities with civilians is notably high during the development and stagnation periods. This suggests that INGOs, as an emerging force in the country's socio-political development, have had a multifaceted impact on Myanmar's development. On one hand, they have compensated for the shortcomings of the Myanmar government's governance in many areas, with their non-governmental and independent nature. On the other hand, they have conducted many popular activities by leveraging their civic and pro-people characteristics.

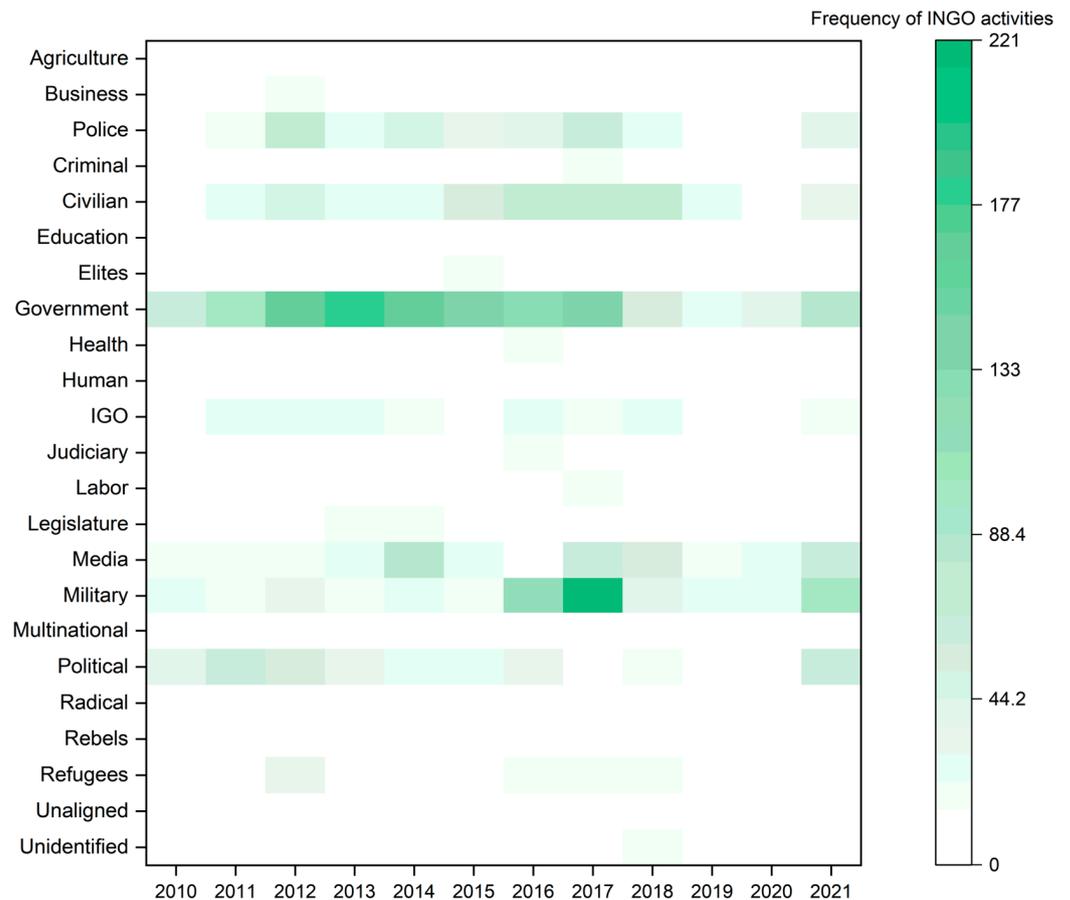


Figure 7. Heat map of other actors in Myanmar.

3.2. Spatial Evolution Characteristics Analysis

3.2.1. Spatial Distribution Characteristics

As illustrated in Figure 8 and the spatial distribution of types in Figure 9, INGO activities were observed in all regions and states of Myanmar. High-incidence areas were primarily concentrated in Yangon Region, Shan State, and Rakhine State, while low-incidence areas were mainly found in Chin State, Kayah State, Mon State, and Tanintharyi Region. INGO activities are largely located in the plains and easily accessible areas, as INGO activities need public support to draw attention to their activities or causes.

In the initial period, INGO activities were primarily concentrated in regions with easily accessible transportation networks, and their overall scale remained limited. Areas with higher activity levels were mainly distributed along Naypyidaw, the Irrawaddy River, and the Salween River, with Shan State, southern Kachin State, and northern Magway Region being high-incidence areas. During this period, INGO activities concentrated in the central plains of Myanmar were primarily collaborative, with an emphasis on verbal cooperation. Material cooperation efforts were limited to a few specific regions, while verbal conflicts were mainly concentrated on the borders of regions (states). Myanmar's low level of economic development and its complex terrain, characterized by western mountains and an eastern plateau, contributed to disparities in development between different regions and states. As a result, core cities in the central regions became early focal points for INGO activities. In other areas, the reach of INGO activities remained limited, and during this period, INGO presence had not yet spread across the country.

During the development period, INGOs rapidly spread throughout the country, and their activities extended to most regions. Even in some hard-to-reach areas, INGO activities had appeared. During this period, the predominant manifestation was the expansion of high-incidence areas from the central regions to the surrounding areas, while the neighbor-

ing inactive zones had transformed into low-incidence areas. Central Myanmar, represented by Loilen and Yangon, remained a high-incidence area, while the hilly terrain of the western region had become a high-incidence area for INGO operations. The central plains of Pakokku and Taunggyi have seen a decline in INGO activity and have transitioned to low-incidence areas. In terms of the type of INGO activities, verbal cooperation remained the dominant type of INGO activity, but as the number of cooperative activities increased, so did the number of conflicts. The number of verbal and material conflicts was essentially the same. It is worth noting that in hard-to-reach areas, INGO activities consisted entirely of cooperative initiatives, with no apparent conflict activities.

In the new conditions of social development, INGOs undertook various initiatives to influence Myanmar's social development and raise public awareness. These efforts had three main dimensions: first, with the backing of their organization and foreign funding, they implemented a range of public welfare programs in the areas of education, water resources, health, and general welfare. Second, they promptly addressed selected social issues within Myanmar, raising public awareness and fostering collective engagement. Third, they participated in the government's legislative process as an emerging force in a transitional society. For the people of Myanmar, the natural environment was closely related to their homes, values, and beliefs. With the influx of foreign investment during this period through the development of natural resources, INGOs also paid attention to it. They participated in the legislative process of the Myanmar government peacefully and rationally.

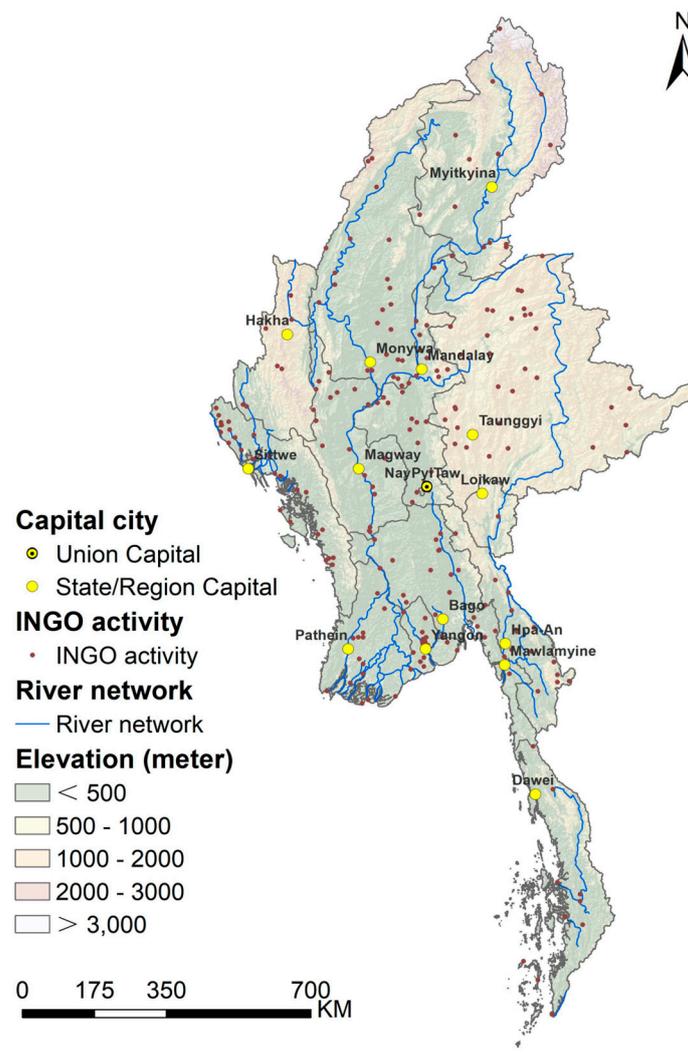


Figure 8. Cont.

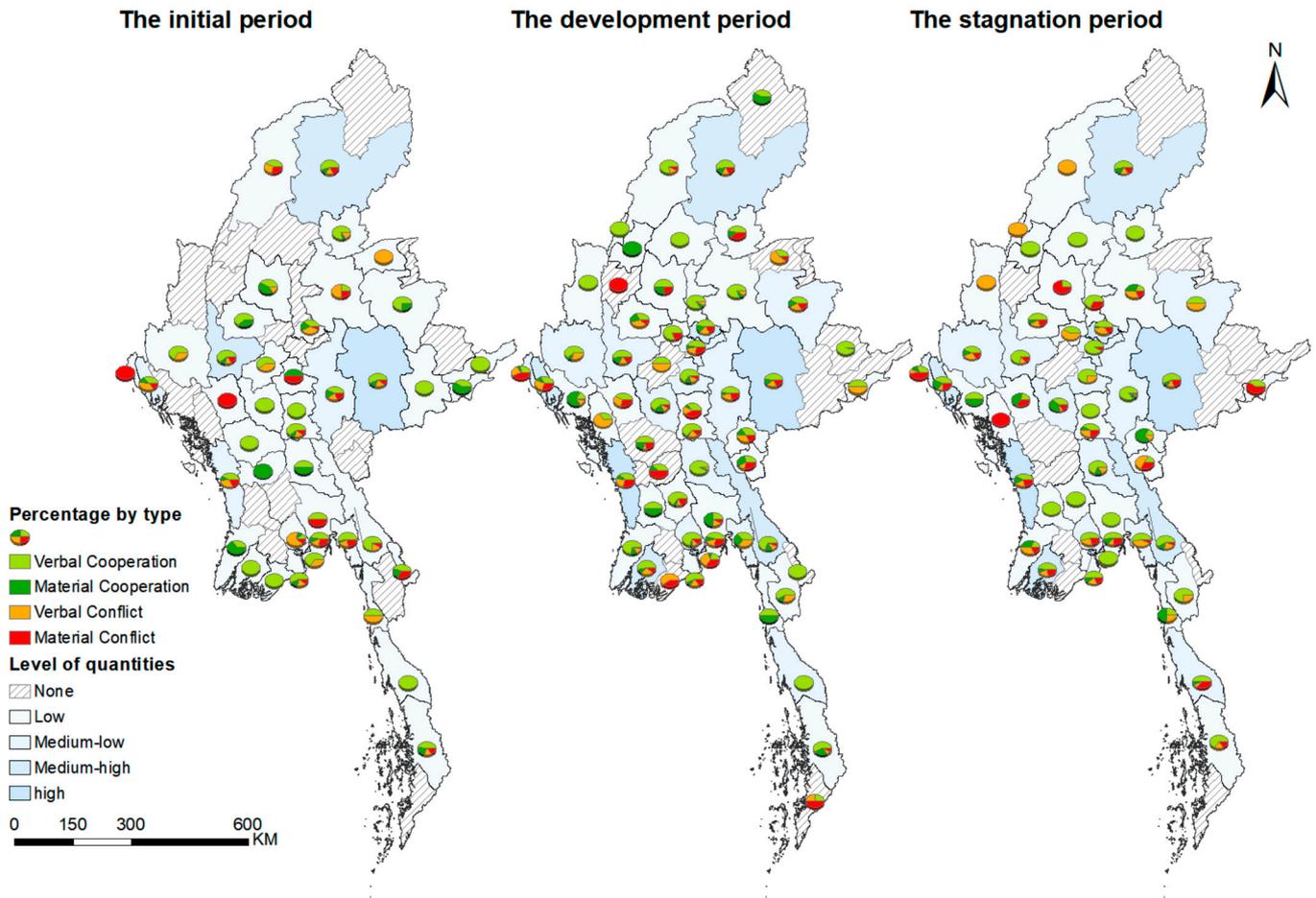


Figure 9. Spatial distribution of type and number of INGO activities in Myanmar over different periods.

3.2.2. Spatial Correlation Characteristics

1. Global Spatial Autocorrelation

To measure the high and low aggregation of INGO activities, the average Moran's I index of three periods was calculated to explore their spatial aggregation pattern and evolution characteristics. As shown in Table 4, the global Moran's I index of the three periods was positive. The test results for the initial period were particularly significant, indicating that INGO activities across counties showed a strong positive spatial correlation on a global scale during this phase. Similarly, during both the development and stagnation periods, the global Moran's I index passed the 1% significance test, demonstrating a noteworthy positive spatial correlation in INGO activities throughout Myanmar. This correlation suggested a clear spatial clustering trend characterized by proximity. In essence, the national pattern of INGO activities in Myanmar predominantly showed "high-high" clusters and "low-low" clusters. From the initial period to the development period, the global Moran's I index increased, the spatial agglomeration effect of INGO activities increased, and the spatial distribution difference was significant. From the development period to the stagnation period, the global Moran's I index decreased, the spatial agglomeration effect increased, and the spatial distribution difference tended to be balanced.

Table 4. Global Moran’s I index for the number of International Non-Government Organization (INGO) activities.

Period	Moran’s I	Z-Score	p-Value
The initial period	0.215	2.353	0.018
The development period	0.486	4.745	0.001
The stagnation period	0.322	3.404	0.001

2. Local Spatial Autocorrelation

Furthermore, the local spatial autocorrelation analysis method was used to analyze the local spatial correlation pattern of the aggregation effect of INGO activities in Myanmar, and the LISA agglomeration map was obtained in Figure 10. From 2010 to 2021, only Yangon showed a “high-high” cluster. Situated in the southeastern corner of Myanmar’s central plains, Yangon holds a prominent position as the nation’s economic and cultural epicenter, as well as a vital transportation hub. During the early period of Myanmar’s government transformation, it magnetically drew a substantial number of INGOs, evolving into a central hotspot for INGO activities. This region exhibited a rapid growth trend, intimately tied to the economic and cultural exchanges within its vicinity. Originating from Yangon, the influence radiated outward, encompassing areas to the north of Yangon, the southern regions of Yangon, and then further extending to the south of the Irrawaddy region. These regions were primarily characterized by a “low-high” outlier pattern.

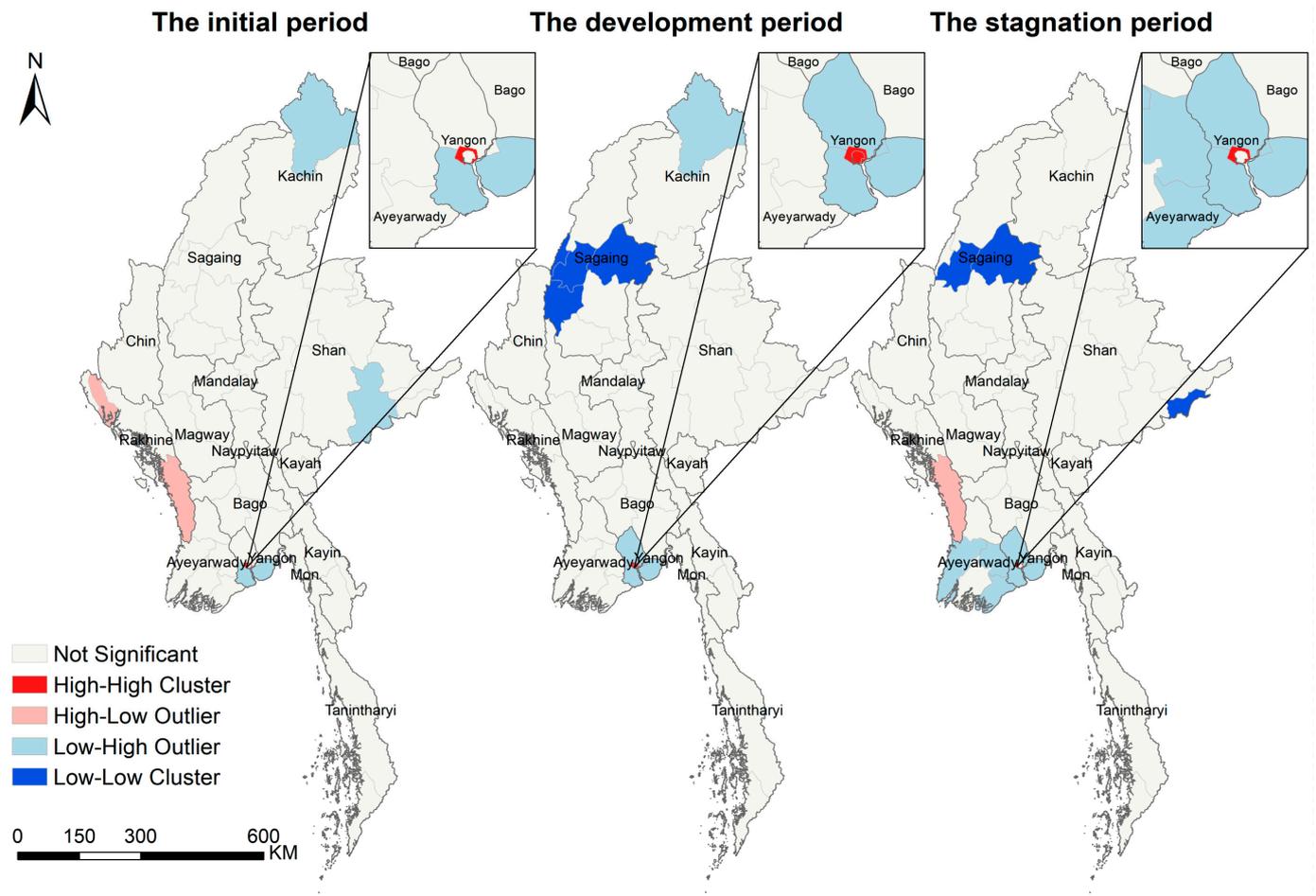


Figure 10. LISA cluster map of local spatial autocorrelation over different periods.

As a result of the natural and geographical constraints in the northern highlands of Myanmar and the Shan State Plateau in the east, INGOs have been gradually involved in

these areas since the development period. This led to the areas in central Sagaing Region (Tamu, Mawleik, Katha, Kalembo) and eastern Shan State (Tachileik) being characterized as “low-low” clusters, forming a low-incidence distribution pattern of INGO activities in and around them.

In the initial period, the northern and southern parts of the western Rakhine Mountains displayed “high-low” outliers. This was mainly due to the limited INGO activities in remote areas at the outset. However, with the rapid progression of Myanmar’s democratization process during the development period, the operational scope and growth potential for INGOs in Myanmar improved once more. A multitude of Western INGOs entered Myanmar, equipped with substantial funding and well-established operational systems, venturing into various aspects of environmental protection, maternal and child healthcare, and human rights.

From the global and local spatial autocorrelation analysis of INGO activities in Myanmar from 2010 to 2021, it has been found that the spatial correlation of INGO activities in Myanmar has further strengthened, with the overall correlation in the development period being the strongest and the local agglomeration effect not changing significantly. The “high-high” cluster area is mainly distributed in the Yangon region.

3.3. Regression Analysis of Influencing Factors

From the regression results (see Table 5), the coefficients for the medical level, urbanization level, and total population size were all positive. The coefficients for the medical level and total population size were significant at the 1% level, while the coefficient for the urbanization level was significant at the 5% level. All three were statistically significant at the 95% confidence level. The results show that the medical level, urbanization level, and total population size had a significant positive impact on the number of INGO activities. This meant that holding all other variables constant, the worse the medical level, the higher the degree of urbanization, the larger the total population, and the higher the number of INGO activities. Myanmar is a developing country, its medical resources are unevenly distributed, and many remote areas lack basic medical facilities and services. Since most of the popular topics of INGO activities in Myanmar are aimed at improving the well-being of neglected people, such as those related to health and well-being (SDG3), education (SDG4), peace, justice, and strong institutions (SDG16). Based on their own beliefs, these organizations choose people with serious needs, according to the needs of health and well-being indicators. In areas with a low medical level, it is difficult to pay attention to vulnerable groups when they sporadically express their demands because people have little strength and consciousness to establish necessary and smooth communication channels with the government. Myanmar is also a multi-ethnic country with a total of 135 ethnic groups, and ethnic conflicts are prominent. INGOs often exert their own advantages, awaken democracy, and actively become important carriers for expressing public opinion, connecting the government, and realizing political participation. In areas with larger populations, especially urban areas, the demand for community service is more significant, attracting more INGO activities.

The coefficients for the economic level and education level were negative. The regression coefficient of the poverty level was significant at the 1% level, while the coefficient of the education level was significant at the 5% level, both of which were statistically significant at the 95% confidence level. The results show that the economic level and education level will have a significant negative impact on the number of INGO activities. This means that INGOs are more inclined to carry out activities in areas with poorer economic conditions and lower levels of education. The emergence of INGOs is influenced, to a certain extent, by the contradiction between social productivity, the increasing demand for people’s material and cultural needs, and social public services, with the lack of public goods and services provided by the government and enterprises. It is the result of the joint action of effective social management and social disorder. Myanmar’s economic level is relatively low, most of the population is in poverty, and the level of education is

relatively low. This has resulted in a low level of social development, with many people facing challenges such as poverty, health issues, and limited access to education. In areas with low levels of economic development and insufficient education, people's social needs will be more urgent. INGOs are more willing and conscious to engage in public welfare undertakings in these areas. INGOs will invest resources in these poor areas and provide education, medical, and social assistance to alleviate the plight of local residents. This also indicates that INGOs take into account local phenomena of the "government malfunction" and "market malfunction" when deciding where to conduct their activities.

Table 5. Negative binomial regression results.

Term	Coef	Std. Err	z	p	OR	OR 95%CI
intercept	−12.000 **	4.249	−2.824	0.005	0.000	0.000~0.025
X ₁	−1.128 **	0.383	−2.944	0.003	0.324	0.153~0.686
X ₂	1.397 **	0.393	3.553	0.000	4.045	1.871~8.743
X ₃	−3.669 *	1.723	−2.130	0.033	0.025	0.001~0.746
X ₄	1.488 *	0.589	2.525	0.012	4.426	1.395~14.044
X ₅	0.196	0.119	1.655	0.098	1.217	0.965~1.536
X ₆	1.574 **	0.406	3.875	0.000	4.826	2.177~10.700
X ₇	4.207	2.946	1.428	0.153	67.176	0.209~21633.913
R-sq				0.198		

Note: ** is the level of significance ($p < 0.01$) and * is the level of significance ($p < 0.05$).

The foreign population size and natural disaster level did not pass the significance test, indicating that their impact on the number of INGO activities was not statistically significant. This indicates that neither the size of the foreign population nor the level of natural disasters significantly impacts the number of INGO activities. Although the foreign population may increase the demand for infrastructure and services, there are other more urgent or important social issues in Myanmar that require INGO participation, such as healthcare, education, and poverty. Many INGOs have established permanent or representative offices in Myanmar, along with a stable operational system and personnel network. These INGOs often have long-term projects and programs designed to support social development, improve education, improve medical services, etc. Therefore, their activities are largely normalized and are not significantly influenced by the occurrence of natural disasters.

4. Discussion

The temporal pattern of INGO activities in Myanmar is closely linked to the country's political transition and social development. Combined with the timeline and the number of INGO activities, the 2010 national elections not only facilitated the operations of INGOs but also marked a significant step towards democracy in Myanmar. The new government has taken a series of measures to try to attract the support and investment of the international community. The initial period (2010–2012) marks the democratic opening of Myanmar and the initial phase of INGO activity in the country. The development period (2013–2017) is a period of political transition and the development of INGO. Although the government continued to advance the process of political reform and reconciliation, the uncertainty of the political transition period heightened political and social unrest. The number of INGO activities remained relatively stable or slightly increased during this period, but there was a certain degree of fluctuation due to political instability and social unrest. During the stagnation period (2018–2021), the military continued to wield significant political influence. Over time, the political situation has begun to become unstable, and the number of INGO activities has fluctuated dramatically.

INGO activities in Myanmar reflect INGOs' potential and challenges in addressing social issues. From the perspective of the number of INGOs, the number of INGOs in Myanmar continued to rise from 2010 to 2021, which reflects that INGOs, as a way to

solve social problems, can usually increase the degree of social participation and may also contribute to the formation and improvement of some useful social values. From the activity's target perspective, INGOs, as formal organizations, operate on the principle of anonymity, rather than the interpersonal relationships common in similar communities, allowing them to select a broader range of service targets. In addition, INGOs are relatively formal departments with well-defined governance structures, providing them with considerable flexibility in their operations. These features enhance INGOs' ability to solve social problems and have a relatively large range of activities. From the perspective of spatial distribution, INGO activities exhibit a clear aggregation effect and imbalance in distribution. Both INGOs themselves and INGO donors may have specific preferences, thus limiting their service to a specific group of people. Clearly, the preferences of organizations or donors may result in an imbalance in the distribution of INGO activities, favoring certain groups over others.

According to regression analysis, INGO activities in Myanmar are influenced by factors such as local economic level, urbanization level, medical level, education level, and total population size. At the economic development level, INGOs effectively compensate "market malfunction" and "government malfunction". At the level of urban development, INGOs' ability to provide public goods or services may vary greatly in different regions. For instance, in highly urbanized areas, INGOs are likely to receive greater resource support, enhancing their service provision capacity. However, in areas where urbanization is weak, INGOs' ability to access resources and provide services is more limited. At the level of social public services, INGOs also focus on Myanmar's more pressing population needs, including medical care, education, and other social issues. Additionally, in analyzing factors affecting the number of INGO activities, national policy reasons may restrict INGO activities, but policy formulation and implementation often take time, and the impact of these policies also has a lag effect. Especially in Myanmar, a country with a complex political environment, the formulation and implementation of INGO policies may be affected by various factors, resulting in some policies not being effectively implemented. Subsequently, the interaction and influence between policy factors and other factors (such as economic, social, geopolitical) can be introduced. Future quantitative research could explore the correlations between policy factors and other variables and their comprehensive impact on INGO activities.

This study focuses on the spatial and temporal distribution characteristics of INGOs and their influencing factors from a geographical perspective. However, the activity data in this paper were only from the GDELT event database. Although this database provides extensive information about the time, place, and participants of INGO activities, media coverage of INGO activities is usually selective and may not capture all INGO activities in Myanmar. In the subsequent study, more comprehensive and detailed data on INGO activities could be obtained by other sources of information, such as the official INGO website, field surveys, and interviews, to gain a more accurate understanding of the characteristics of different INGO activities. In addition, we have also noticed that INGOs of the same type or with common funders tend to show a certain tendency in their activity areas, potentially involving different fields and stakeholders. Future research could delve into their roles in Myanmar society and the true purpose of their activities by examining specific organizations or regions and exploring the interaction patterns between INGOs, local communities, and governments.

5. Conclusions

This paper extracts INGO activity data in Myanmar based on the International Organization Yearbook and the GDELT event database. Firstly, the temporal evolution characteristics of the number and actors of INGO activities in Myanmar are analyzed. Then, the spatial evolution characteristics of INGO activities are analyzed from the perspectives of spatial distribution and spatial correlation. Finally, a regression analysis of multiple factors affecting the number of INGO activities is carried out. The conclusions are as follows:

1. From 2010 to 2021, the number of INGOs in Myanmar has shown a gradual slow-down in growth trends, with the number of activities exhibiting a wave-like pattern, experiencing initial, development and stagnation periods. INGO activities are closely related to the social development of Myanmar across these periods. In terms of activity actors, INGOs mainly engage in spontaneous activities. The government, military, and civilian are the actors with the highest level of involvement in INGO activities.
2. INGO activities are present in all regions and states of Myanmar, with relatively high numbers in Yangon Region, Shan State, and Rakhine State. There are more cooperative activities than conflict activities in most areas. INGO activities show obvious spatial aggregation effects mainly distributed in the southern plains, with the core located in Yangon, Naypyidaw, and Loilen, showing a pattern of continuous spread around the core city. A significant spatial polarization phenomenon was observed in the hotspots of INGO activities. The hot spots followed an evolutionary path from “southern Myanmar” to “northern Myanmar” and then back to “southern Myanmar”.
3. The results of the regression analysis show that INGO activities in Myanmar focus more on the local economic level, urbanization level, medical level, education level, and total population size. INGOs provide the necessary support and services for the local society, making up for the “government malfunction” and “market malfunction”. At the same time, they also reflect the humanitarian mission of INGO and its concern for social well-being.

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