



**Impact of Social Network Sites on Developing Brand
Communication in Xian City**

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Article History	Abstract
Received: 1 November 2023 Revised: 15 November 2023 Accepted: 6 December 2023	<p>The digital era mobilises the world cities with various traits and symbolic resources to brand the images of the cities through propagation in Social Media (SM) platforms. This work examines Xian, the fastest developing city in China, which is in the process of building its brand through SM platforms. The model proposed in this work uses elaborative variables that are categorised into four indicators which characterises the behaviours of users in the SM. Each variable is weighted based on the entropy method as each one has a varied level of intensity in the model. The detailed results indicate that the size of the network is a significant factor in construction of brand communication through the SM platforms. Further, the study also includes the descriptive statistics and correlation analysis of individual explanatory variables with the model's output value. The result of this analysis indicates that connections with friends and a number of followers as crucial factors in board communication of Xian city. This work can guide the local municipal authorities to advertise and influence SM users to create a positive brand of the city.</p>
CC License CC-BY-NC-SA 4.0	<p>Keywords: <i>Brand Communication Strategy, Social Media, Entropy Method, Correlation Analysis, Descriptive Statistics, Marketing</i></p>

1. Introduction

The rampant development of internet, information technology, and communication technology has led to the increased involvement of Social Media (SM) in transforming the lifestyles of people. Leveraging the mobile and internet technology, SM was able to fulfil the increased interaction between business organizations, advertising firms and common people. SM is perceived to be ideal medium of communication or advertising as it possesses more interactive, participative, transparent and open traits [1]. Figure 1 shows the statistics obtained from Chinese Statistia website regarding involvement of SM platforms in brand communication of places. The voluminous number of users and steady and rapid developments in SM have facilitated more business organizations and firms to

explore the SM-based marketing scope and capacity of cities [2]. These cities provide a right marketing strategy to promote their features and services in either locally or regionally confined areas, where they can attract more customers and tourists [3], [4]. Generally, the city market is generally dominated by local residents, local governments, and regional firms which relied on conventional brand communication measures of places that use magazines, television, events, stalls, radio, newspapers etc [5]. All these modes of brand communication are done in vertical manner abiding by the laws of government departments [6]. But the main limitation here is the communication is simple or one-way communication which does not involve the feedback mechanisms from the local people, local firms and other stakeholders [7].

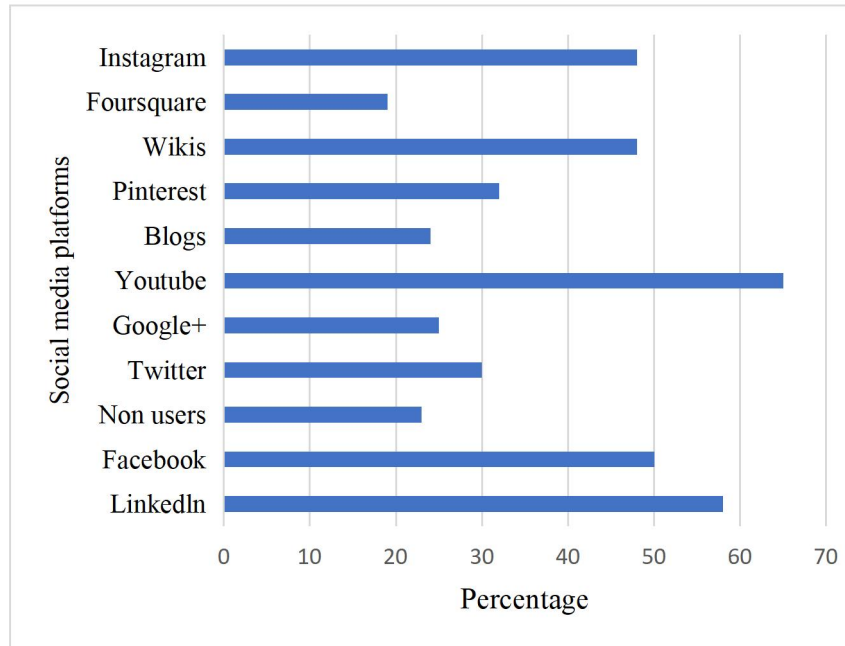


Figure 1. Users of Social Media

As the increase in SM users is becoming definitive, the business firms, people and tourists are now focusing on customised regional communication. The massive popularity with huge target audience of SM websites like Twitter and Facebook urges the governments to invest money and time in the brand communication of places of tourist and industrial destinations. Branding through SM has become a special form of propaganda in recent times and has attracted many researchers to explore the relationship among them, as the brand and community are tightly coupled. Interactions among the community in SM influence the relationship and attitude towards the product, place or specific brand. These formations have multiple and act as a tool in building strong relationships. The five pillars of brand communication in cities through SM are mentioned in Figure 2. They include stakeholders of the brand, marketing strategies or activities, localised SM activities, creation of customer-value relationships and social networking options.



Figure 2. Pillars of Brand Communication in SM

China, one of the fastest developing countries in the context of economy, has envisaged a rampant increase in the business opportunities and world tourism that has been extended beyond borders. Many studies focus towards the business evolution of China in terms of urban network [8], migration from rural to urban areas and change in land ownership structures [9], agglomeration of Chinese cities [10], globalizing image and promoting urban entrepreneurial activities [11], and rationale of public-private associations in urban revitalization and development [12]. The results of these studies have indicated that Chinese cities are imbued with the vital business characteristics namely inventive, risk-taking, profit-oriented and promotional [10]. Nevertheless, a proper understanding of the brand communication using SM in Chinese cities is still in the stage of infancy. This work addresses this need, where a comprehensive analysis of the deployment of SM websites in construction of brand communication in one of the fast-developing Chinese cities namely Xian City.

1.1 Xian City

The city of Xian is located in central part of China, on the banks of Wei River. This is the capital city of Shaanxi province and is one of the largest cities in Northwest China. Its jurisdiction extends over 11 districts, namely Weiyang, Gaoling, Baqiao, Lintong, Xincheng, Lianhu, Yanta, Yanliang, Beilin, Chang'an, Huiyi, and Yanta. It houses famous industrialization zones such as National Xi'an Economic and Technological Development Zone, Xi'an Yanliang National Aviation Hi-tech Industrial Base, National Xi'an Hi-tech Industries Development Zone, Xi'an Fengdong New Town Zone Xi'an Chanba Ecological Zone, Xi'an Qujiang New Zone, Xi'an International Port, Xi'an National Civil Space Industry Base, and Xi'an Fengxi New Town Zone. The land area of Xian extends to nearly 10,752 sq. km. with a population of 12.95 million [13].

The city has many distinguishing characteristics that make itself very significant in the holistic development of China. Xian once was the capital of China and nurtured the Chinese civilization. This city is the mouth of the ancient Silk Road and houses one of the richest and finest cultural heritage. The city has a handful of places like Big Wild Goose Pagoda, Tang Chang'an City Daming Palace Site, and Xingjiao Temple Pagoda which have been listed on World Heritage List. In addition to this, Xian is the land of science, education and military. The city encompasses nearly 63 universities and other educational institutions including seven military academies [14].

The city has a very strong industry base focusing on machinery, electronics, materials, chemicals, aerospace, surveying, aviation, and other fields [15]. Xian is the transport hub as well as the open frontier of the Shanxi province connecting many important places of interest, as it is situated in geometrical center of the country along the national geodetic origin. It has an International Airport, good railway infrastructure along with inland port capable of carrying nearly 659,000 tons of cargo every year. Apart from these elements, the city is famous for its aesthetics with vast mountainous regions and river basins. The city is watered by rivers namely Wei, Jing, Ba, Chan, Yu, Feng, Lao, and Hao with lots of tourist destinations [16].

With these prospects combined with the influence of social media, the city of Xian has evolved as a potential candidate that attracts investors, tourists, students, educationalists, business firms, industries, and people settlements as the city's brand value has increased significantly. This study focuses on unveiling the impact of social media in promoting the brand of Xian city through statistical methods.

The remaining of the work is organised as follows: Section 2 briefs the related work in the research area. Section 3 elaborates on the detailed research methodology and Section 4 presents the important implications of the research while Section 5 gives the conclusion of the article with its future directions.

2. Related Works

The domain of brand marketing of cities has been an important research topic as this will bring the holistic development of the region under study.

2.1 City Branding through Instagram

Detailed research by Fabiana Gondim Mariutti et al., examined the branding of cities through formal statistical procedures with special mention to its favourable aspects and potential threats to

the reputations [17]. It investigated the role of key value-drivers such as perception of stakeholders, involvement of local residents, news agencies and SM in promoting the city branding. The role of different stakeholders and the SM in city branding, for promotion is studied by Ebru Uzunoglu et al. [18]. The study involves the assessment of Instagram, a popular SM in branding the city of Izmir. The SM platform discussed in this study gave a much greater insight in deploying the online platforms for city branding.

A theoretical framework was developed to comprehend the holistic branding of city by leveraging the marketing as well as corporate brands [19]. This work proposes policies for further development based on the opinion of the residents of the city. The influence of choices made in city brands is great in deciding the branding process [20]. This work isolates the prominent factors such as governance-based factors and conceptual factors in bolstering the branding process. The work concludes that the branding of cities demands integration of marketing strategies with good political insight.

A detailed investigation of application of SM services for city marketing in China reveals that SM is a more appropriate tool to promote cities [21]. This is because of interaction, participation, and transparency in SM. The dynamics of the marketing field are rapidly evolving after the involvement of SM [22]. The work studies the influence of SM in branding the city of Ho Chi Minh City and revealed that the consumers trust the SM influencers who study the customer's purchasing intention. This intention is based on trust factor, quality of content, an relation between product and influencer. Research on assessing the role of SM in improving the sales of MSME products in the city of Pematangsiantar was done [23]. The results indicate the active influence of SM in the MSME micro sector by analysing the role of Instagram.

2.2 City Branding through Facebook

The process of city branding is seen in different perspectives in different geographical regions. A detailed comparative study promotion of city branding through SM by three local state bodies namely Cape Town, Philadelphia and Myrtle Beach is studied [24]. The study focuses on aspects of ecology, communication, and brand co-creation and assesses their impacts by deploying SM platforms like Facebook and Twitter. A comprehensive analysis of the mindset of residents of generation in branding their cities based on their satisfaction levels is done by collecting data through proposed questionnaires [25]. The study was conducted in Thessaloniki in Greece and the results reveal that the impact city's image and its branding are positively motivated by the SM.

The deployment of SM platforms in ten Spanish smart cities is analysed using quantitative elements of SM like shares, comments and likes [26]. It can be observed that smart cities have achieved acceptable, rudimentary involvement in SM. The ineffective communication and weak levels of social involvement hindered the brand-building of these cities. Another work on the influence of SM websites in the branding of Spanish cities is done in two phases. The first phase involves a more descriptive and regression-based study while the second phase used the SM tools [27].

A quantitative study by collecting data using questionnaire among the population who are over 18 years old is done [28]. The case study involves Valencia city in Spain. The experimental analysis reveals that a positive effect of the users' intensity of SM on branding. A more detailed work on studying the impact of SM on city branding is done in Johnson City [29]. The role of online communications through online communities, advertisements and Word of Mouth that kindled the purchase intention SM users of travellers in Vietnam is studied by procuring the data of Ho Chi Minh City [22]. The work explored effective strategies that can be deployed in SM platforms to attract customer attention. The results indicate that trust is an important factor that played a crucial role in promoting the brand image of the city.

2.3 City Branding through Twitter

The pandemic has greatly affected the images of many countries and places. A detailed work on post-Covid urban tourism on cities' responses to pandemic is studied by Cecilia Pasquinnelli et al. [30]. The work advances by analysing the brand values with dynamic attributes to combat the economic instability through SM platforms. The interlinked relationship among the fashion industry and famous fashion hubs of the world namely New York, Paris, London, and Milan is analysed

using the SM platform Twitter using contemporary text analysis techniques [31]. This work examined nearly 100,000 tweets during the period of February and March 2018 about the fashion week. The results indicate that the involvement of SM in these cities was at different levels.

A detailed academic discussion on challenges in branding cities delineated the involvement of corporate-level marketing [32]. This work highlights the similarities and contrasts between corporate marketing and city branding. The commonalities between the two are multi-stakeholders with good cooperation. A new Place Brand Centre method meets the conditions for translation of marketing strategies in the context of cities [33]. The proposed model will guide the place branding managers who handle heterogeneous target audience to improve the group-specific communication.

Analysing the User-Generated Content impacts branding of places by unveiling the associations of factors pertaining to the cities of Florence and London [34]. These cities are associated with the fashion industry and the work advances by analysing the pictures and textual information in the form of hashtags in SM. A comprehensive research was done on 18 Spanish cities by analysing heterogeneous variables to study the impact of SM on brand promotion of cities. A set of around 18 variables that depict the behavioral approach inclined to the market along with planning for budget is discussed in this work [35]. As a case study approach the cities of Barcelona and Madrid were considered.

An extensive work that focuses on objectives, methods, expression and challenges in building city brands using SM on metropolitan cities is done by Emma Björner [36]. This work used SM tools to analyse the Chengdu, a famous Chinese city and results revealed that collaboration as well as endorsement are important elements in brand promotion. The influence of digital communication tools and SM in impacting brand promotion in Poland is studied [37]. This work compares two cities namely Poland and Georgia to know the intensity of SM tools in city branding.

Thus, the brief review of the process of city branding operation highlights that the SM platforms play a significant role in establishing a positive image of the cities. The review indicates that the works do not focus on micro-level analysis of the factors that affect the city branding in various aspects. Many works do not focus on the quantitative exploration of the relationship between various factors. The literature witnesses much work on the holistic view leaving the domain of exploring the city branding operation still in the stage of infancy. This work attempts to analyse the impact of SM platforms by analysing the SM information about Xian city of China in the sectors of industry, tourism and education.

3. Methodology

The data for the study is derived from various blogs in the canopy of Aminer (<https://www.aminer.org/data-sna#Last.fm>). The SM platforms like Facebook and Twitter are banned in China. But this study considers the interaction of the SM users on various platforms about the Xian city. The Twitter and Facebook data are used to analyse the impact of SM communication in building the brand of Xian city. Figure 3 shows the involvement of Chinese users in various types of SM content.

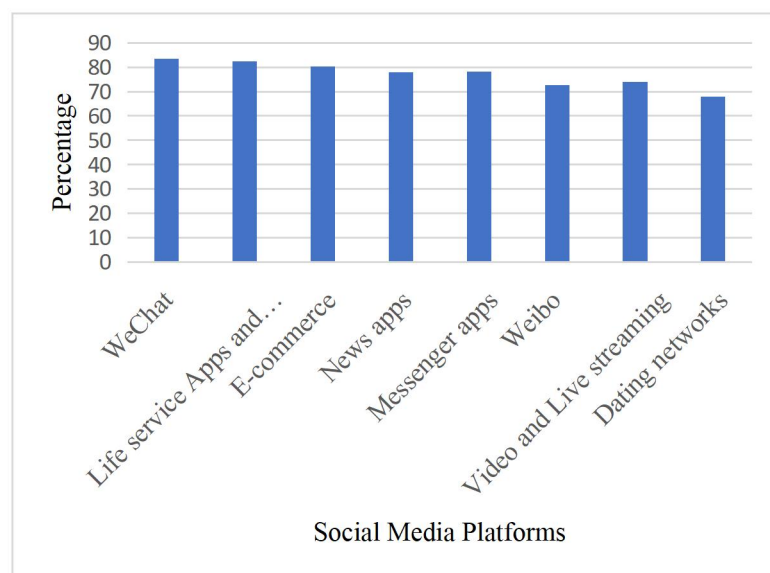


Figure 3. Involvement of Users in Various SM Platforms

The factors that determine the impact of positive brand building of Xian city are listed in Table

1.

Table 1. Factors that Affect Branding of Xian

Factors that influence brand building	Variable	Factors that influence brand building	Variable
Mean value of tweets and posts	X1	Mean value of followers	X7
Mean value of people who are followed	X2	Mean value of retweets about topic of interest	X8
Mean value of comments and questions	X3	Mean value of the responses	X9
Frequency of response	X4	Frequency of comments	X10
Number of followers	X5	Number of friends in SM connection	X11
Number of days since joined the SM platform	X6	Number of interactions within the community	X12

The response variable that quantifies the impact of SM interactions about a city is based on the frequency, time of response and nature of communication in the platforms. The Social Media Network Ratio (SMNR) is the dependent variable, that uses the explanatory variables as mentioned in Table 1 [38]. These are the indicators that are used to investigate the influence of the SM communications on Xian city. As shown in Equation 1:

$$Y = \alpha + \sum_{i=1}^n \sum_{j=1}^m \beta_j w_j X_{ij} + \text{error} \quad (1)$$

Y means the dependent variable which is used to quantify and measure the intensity of SM communication and interactions about Xian city using the indicators mentioned in Table 2. The term α is maintained as a constant value and w_j is the weight assigned to each indicator using the entropy method. β_j is coefficient for the explanatory variables. The term X_{ij} indicates the impact of the dependent variable. In this equation, the term "error" refers to the error term or residual. This component accounts for the variation in the dependent variable Y that is not explained by the other variables in the model. It represents the randomness or unpredictability in the data, capturing those factors that affect Y but are not included in the model. The error term is a standard component in statistical models, acknowledging that not all influencing factors can be, or are, included in the model.

Table 2. Indicators for Assessing the Impact of SM Activity in Brand Development of Xian

Indicator	Description	Variable
Size of the network	Communications happening about the city in the SM accounts.	I1
Social Activity	The potential target audience for each of the SM platforms like followers, friends mutual friends etc.	I2
Visibility	The references were made in the name of the city and its allied provinces in different channels.	I3
Communication	The intensity of online communications through viral tweets, hashtags, trends etc.	I4

The next challenge in this work is mapping of the variable to appropriate indicators to estimate the impact or intensity caused by the communication [39]. The study weights all the indicators using entropy method. The choice of weight coefficients is done by using the information-weighting technique [40]. This method is very useful in making statistical adjustments to the data to improve the accuracy. The coefficients of different variables are determined based on the dispersion degree. This indicates that smaller the entropy, then the dispersion degree will be greater and vice versa. The estimation of weights is governed by Equations 2-4.

$$R_{ij} = \frac{X'_{ijt}}{\sum_i X'_{ijt}} \quad (2)$$

$$IE_{ijt} = -\delta \sum_i R_{ijt} \ln R_{ijt} \quad (3)$$

$$w_j = \frac{(1 - IE_{ijt})}{\sum_j (1 - IE_{ijt})} \quad (4)$$

The value of j in all the three above equations belongs to a set of class indexes as mentioned in Table 2. R_{ij} is ratio of the index i at time t in city j , X'_{ijt} and X_{ijt} represent specific data points for a variable at different times for city j , the term R_{ijt} is the ratio of the index i at time t in the city j . The term IE_{ijt} is entropy of the variable i for city j at time t . The constant value δ is estimated as $(\ln n)-1$, where n is the total number of data considered for the study. The term w_j is weight of the j -th indicator. The weights of the variables are shown in Table 3.

Table 3. Variables and Their Weights Using Entropy Method

Variable	Weight	Variable	Weight
Mean value of tweets	0.361	Mean value of followers	0.469
Mean value of people who are followed	0.145	Mean value of retweets about topic of interest	0.146
Mean value of comments and questions	0.236	Mean value of the responses	0.064
Frequency of response	0.643	Frequency of comments	0.429
Number of followers	0.048	Number of friends in SM connection	0.059
Number of days since joined the SM platform	0.038	Number of interactions within the community	0.035

These variables must be mapped to the indicators for further detailed analysis and to study the quantify the specific trait of SM in brand promotion of the city under study. Table 4 illustrates the mapping made between the indicators and the explanatory variables [27].

Table 4. Mapping between the Indicator and Explanatory Variables

Indicator	Variable
Social Activity (I2)	Number of days since joined the SM platform
	Mean value of tweets and posts
Size of the network (I1)	Mean value of followers
	Number of followers
	Mean value of people who are followed
Visibility (I3)	Mean value of retweets about topic of interest
	Mean value of comments and questions
	Mean value of the responses
Communication (I4)	Mean value of retweets about topic of interest
	Mean value of comments and questions
	Number of interactions within the community

	Number of friends in SM connection
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4. Results and Discussion

The detailed investigation of the variables mapped to specific indicators is done based on the model mentioned in Equation 1. The data is obtained from the SM services offered by China as common apps like Facebook and Twitter are banned in the country. The study is made on selected 1000 data from the SM sites which has the Xian city in its comment or tagline. The descriptive statistics about each of the variable are portrayed in Table 5.

Table 5. Descriptive Statistics of the Explanatory Variables

Variable	Mean	Standard Deviation	Coefficient of Variation	Median	Maximum	Minimum
Mean value of tweets and posts	46.86	6.33	0.86	44.78	70.86	27.93
Mean value of people who are followed	44.86	8.02	0.79	40.78	77.82	21.03
Mean value of comments and questions	49.72	7.73	0.67	49.02	80.23	33.85
Frequency of response	50.35	6.86	0.73	47.82	81.75	37.96
Number of followers	41.97	5.97	0.52	40.37	76.87	31.08
Number of days since joined the SM platform	40.91	4.98	0.42	39.97	74.86	29.05
Mean value of followers	50.85	6.86	0.57	47.97	79.65	38.46
Mean value of retweets about topic of interest	46.86	7.53	0.48	47.98	70.65	25.73
Mean value of the responses	46.72	6.98	0.57	44.97	71.97	39.07
Frequency of comments	51.85	5.78	0.48	48.97	80.23	27.83
Number of friends in SM connection	49.63	7.82	0.57	47.86	78.94	31.92
Number of interactions within the community	42.85	6.97	0.48	40.72	75.95	28.46

The comparative analysis of the variables is graphically shown in Figure 4. It can be seen that variable frequency of tweets, comments and posts holds higher significance with a weightage of 0.361. Its descriptive statistics also show elevated results. The variable with the least weight is the number of days since joining the social media platform, at 0.038, followed closely by the number of interactions within the community. The descriptive statistics of these two variables indicate that their effect is less pronounced in brand building of Xian city.

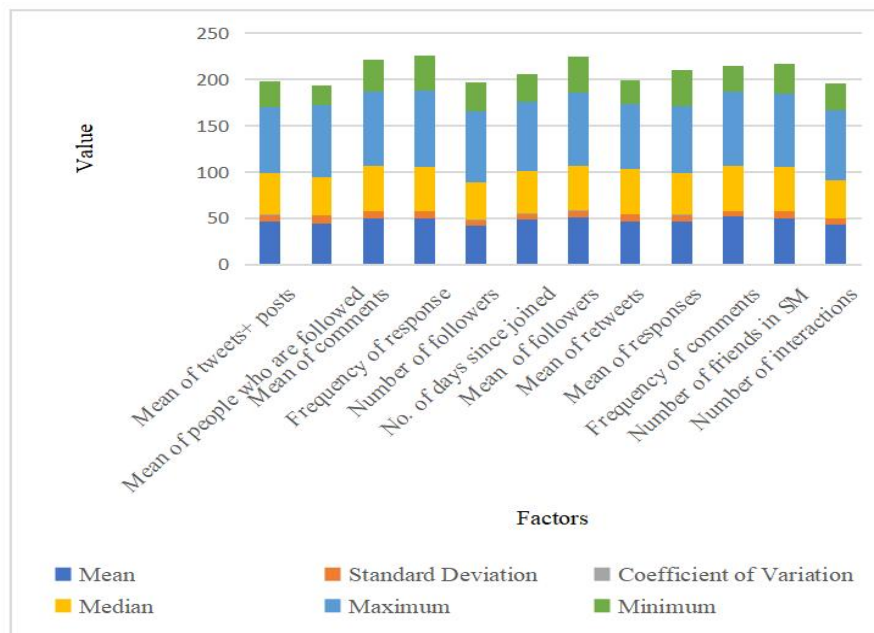


Figure 4. Comparative Analysis of Descriptive Statistic of the Variables

To effectively analyse the impact of the brand-building operation the indicator variables are applied to the model proposed in Equation 1. The results are described in Table 6. It can be seen that network size is a predominant factor in determining the brand communication of the city followed by social activity of the people who are in the SM.

Table 6. Analysis of the Indicators

Indicator variables	Y
Social Activity (I2)	0.642
Size of the network (I1)	0.741
Visibility (I3)	0.534
Communication (I4)	0.504

In addition to this, the work also compares the correlation between the Y value and the descriptive variables to obtain a more granular view of the variables. Equation 5 gives the method to estimate the correlation coefficient of descriptive variables with the corresponding Y values of its indicator variable [41]. Here p indicates the explanatory variables. Table 7 analyzes the correlations between variables, showing how strongly each is related to the dependent variable Y. It includes coefficients for variables like "Social Activity," "Network Size," and "Visibility".

$$\text{Cor} = \frac{n(\sum py) - (\sum p)(\sum y)}{((n\sum p^2 - (\sum p)^2)(n\sum y^2 - (\sum y)^2))^{0.5}} \quad (5)$$

Table 7. Correlation Analysis of the Variables

Variable	Correlation Coefficient	Variable	Correlation Coefficient
Mean value of tweets	0.572	Mean value of followers	0.491
Mean value of people who are followed	0.597	Mean value of retweets about topic of interest	0.384
Mean value of comments and questions	0.482	Mean value of the responses	0.525

Frequency of response	0.396	Frequency of comments	0.535
Number of followers	0.457	Number of friends in SM connection	0.603
Number of days since joined the SM platform	0.263	Number of interactions within the community	0.519

The correlation analysis indicates that the social media connections play a very influential role in determining the impact of brand promotion in cities. This is ascertained by the correlation value of average count of the people who have a substantial number of followers. The date of joining the SM platforms and retweets do not have a significant impact on the brand-building process. Hence, the study indicates that the SM followers, interactivity and the size of the network are predominant factors in determining the brand-building process of the Xian city. The work analyses the SM data content to analyse the indications in the SM through entropy and information weighing method which is a unique trait of the research as it alleviates the bias in the data collected.

5. Conclusion and Future Work

[42] states that in recent years, it has witnessed a flourish in the urban economic zones of many cities and towns which were unexplored earlier. [43] illustrates that various SM platforms play a vital role in brand communication in these places, which is very difficult to assess, analyse and quantify. This work focuses on quantifying and evaluating the influence of SM websites as an effective communication strategy on brand promotion for Xian city. This work proposes a model based on important SM parameters and the allied indicator variables where the data is sourced from data sources using AI-based tools. The influence is studied by weighing each of the variable using the entropy method, which quantifies the significance of the metric on the brand communication of the city. Also, the descriptive and correlation analysis further strengthens the study by analysing the predominant factors that affect the brand communication strategy in SM platform like social interactivity, network size and followers. The results indicate that the size of the network acts as a predominant communication strategy in branding the Xian city. Further correlation and descriptive analysis shows that the strategies like connections and the number of friends or followers in the SM platform also plays a vital role in promotion of positive aspects of the city. This study can be deployed to create awareness among the municipals and state authorities to be competitive in the business world where most of the population are SM users. The strategies employed by the state authorities must be propagated in the SM in a more creative, integrated, participatory well-informed, sustainable, socially cohesive and transparent manner. In future, the work can be extended to consider more explanatory and indicator variables to generalise the study.

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