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Research Article

An Intelligent Approach of Analyzing Noise in Media Communication Using Noise Theory

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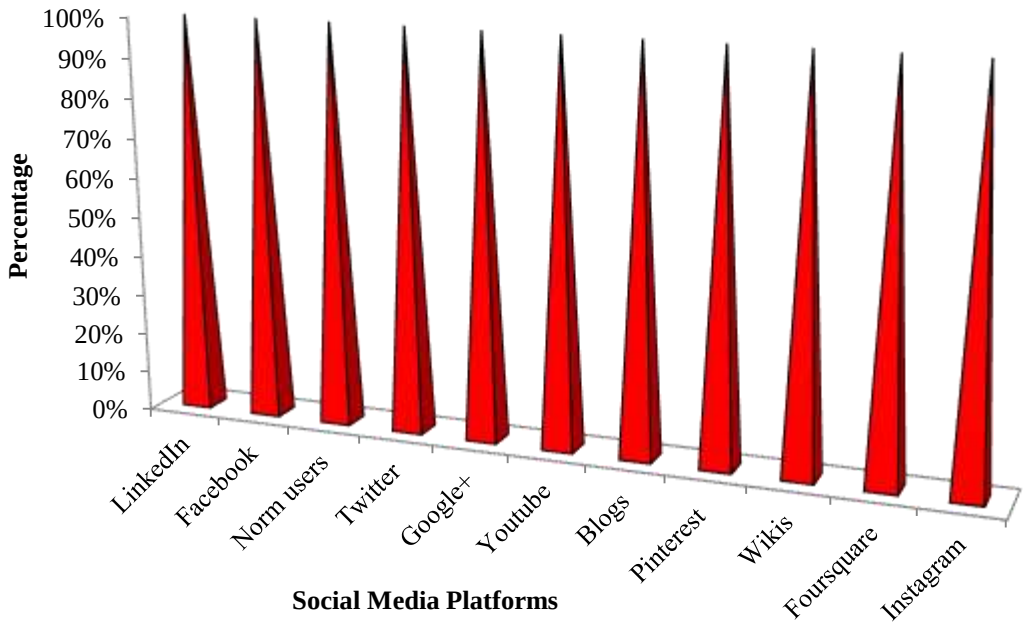
Abstract:

In order to create a positive impression of a city, one can use social media platforms and noise theory to strategically manage the flow of information. This will make sure that the important messages with the city are heard and understood, even with all the online content out there. The city's marketing message may easily be lost in the sea of information that is social media. According to noise theory, this is why it's so important to create material that stands out from the crowd. This research takes a look at how the official "Xi'an Release" platforms of the Xi'an government's new media department spreads the city's image and how new media works in general. In order to address these issues, this study employs quantitative research methodologies to examine the audience, content, along with channels via the examination of 3,357 pieces released on Xi'an governmental social media accounts, as well as the statistical data collected from 384 respondents. There is a positive correlation between the audience's perception of public opinion noise on Xi'an municipally owned media platforms and their satisfaction with Xi'an's city image, as well as with their needs and satisfaction for content, socialization, while entertainment on these platforms. In terms of how they affect audience satisfaction, information demands are at the top, subsequent to social and entertainment requirements. Noise theory is used to deal with comments from the general public. In addition, from this, unique strategies are proposed. The theoretical underpinnings and citations of research data in this work have practical applications for improving Xi'an's productivity, attractiveness, development, while vitality via the control and dissemination of the city's public perception.

1. Introduction

An important foundation for the consumption and transmission of knowledge is social media platforms. Politicians, famous people, and activists have all taken use of its large user base to communicate strategically. The process of systematically gathering and disseminating information is known as strategic communications, or StratCom. Noted people utilize its methods to build their brands and get their thoughts heard. To do these activities efficiently, software programs are used in conjunction with human touches [1]. Because of the pervasiveness of social media in our everyday lives, local governments have started to rely more and more on this new medium to communicate and engage with their constituents. However, determining the efficacy of local governments' social media communication campaigns remains a mystery [2]. Individuals relied more on social media during the COVID-19 pandemic for exchanging pandemic-related information, for everyday communications, and for online professional connections due to the imposition of lockdowns and self-isolation. Concerning topics like public safety, education, and health, the majority of the studies published focuses on the effectiveness of nonpharmaceutical



	LinkedIn	Facebook	Norm users	Twitter	Google+	Youtube	Blogs	Pinterest	Wikis	Foursquare	Instagram
Column2	58	50	24	30	26	65	25	33	48	19	49

Figure 1. *Social Media Analysis*

treatments and metrics related to COVID-19 [3]. Many parts of society are undergoing a technological revolution right now. These days, the information and communications landscape are one of the most crucial for companies to operate in. The advent of online technology in the realm of marketing brought about a major transformation, which is one facet of this advancement [4]. In response to the widespread criticism of their response to the COVID-19 pandemic, local governments have increasingly relied on information and communication technologies to bolster a variety of crucial data sets that will help them cope with the outbreak. Digitalization has been a boon to Yogyakarta's district and city governments, but whether or not they can use websites while social media to efficiently and effectively map COVID-19 data remains an open question [5]. The recent proliferation of IoT sensors has prompted smart cities to amass massive amounts of data. Machine learning models may be trained on this mountain of raw data to make predictions about the future, which can then be used to improve smart city systems like traffic accident control systems [6]. The new Jakarta Mass Rapid Transit (MRT) system, which is now under construction, is expected to be fully operational by 2019. The building phase of this new form of transportation involves extensive public communication to garner support and generate interest before it can be opened to the public. Websites or social media are part of PT MRT Jakarta's strategy for communicating with the public. [7]. Being social creatures, humans rely on and thrive in communities. There is no way around the need for communication, particularly interpersonal communication. As a person matures, they are able to communicate not just verbally but also by written and spoken means. Internet access is one of them. A large portion of Twitter's user base consists of teens who use the platform to connect with and converse with one another [8].

When utilized properly, social media platforms bring people together on a more personal, societal, political, and economic level. Administrators may use them as powerful instruments for communication to emphasize the importance of transparency and openness. Even municipal governments now have social media accounts. By expanding on ideas like E-Government and E-Democracy, the following piece sheds light on modern democracies [9]. The introduction of ICT has altered many aspects of human and organizational life, including communication, transactional processes, recruitment, and the promotion of goods and services. In order to stay up with the constantly shifting business and advertising trends, organizations have incorporated

information, communication tools, and the proliferation of internet technology throughout their plans [10]. New advertising possibilities arise as a result of people's shifting information perceptions towards the predominance of visual data and the increasing importance of social networks in audience engagement processes. Websites and other digital media with picture content are mostly used for visual interactions in the Internet setting [11].

A disruptive transformation is being created by the growth of information technology, particularly in the communication industry, and the government may take use of this to conduct public communications. The evolution of internet mass media presents an opportunity for public communication, particularly in the dissemination of government policy. When it comes to the socialization of laws in Proolinggo City, the Probolinggo City Government likewise uses this [12]. Social media has recently grown in popularity as a great way to reach out to potential customers directly. Communities social networking sites are mostly used for social interactions and have gained consumer trust via greater user participation. Many companies in the manufacturing, wholesale, and retail sectors have started using social media marketing tactics since the new year started [13]. The impact of social media in today's digital age poses a threat to household resilience by potentially causing family difficulties like divorce [14]. The fast growth of social media in the last few years has changed the way people engage with one another, impacted societal structures, and transformed conventional ways of communication. Because of the rise of virtual contacts over face-to-face communication, these shifts are especially noticeable in family connections [15].

1.1 Research Objectives

Chinese local authorities are making great use of social media to promote tourism, engage with citizens, and manage public perception. One such platform is Xi'an Release, run by the Xi'an government. It uses WeChat and Weibo to share information, address concerns, while showcase the city's cultural heritage in an easily accessible format, showcasing Xi'an's historical landmarks and lively cultural scene in particular.

In today's digital age, cities all over the globe are using their unique characteristics and symbolic assets to build brands that spread via social media. Xian, China's most rapidly expanding metropolis, is the focus of this study because it is establishing its brand via social media. This study proposes a model that describes SM user behavior using elaborative factors that are classified into four

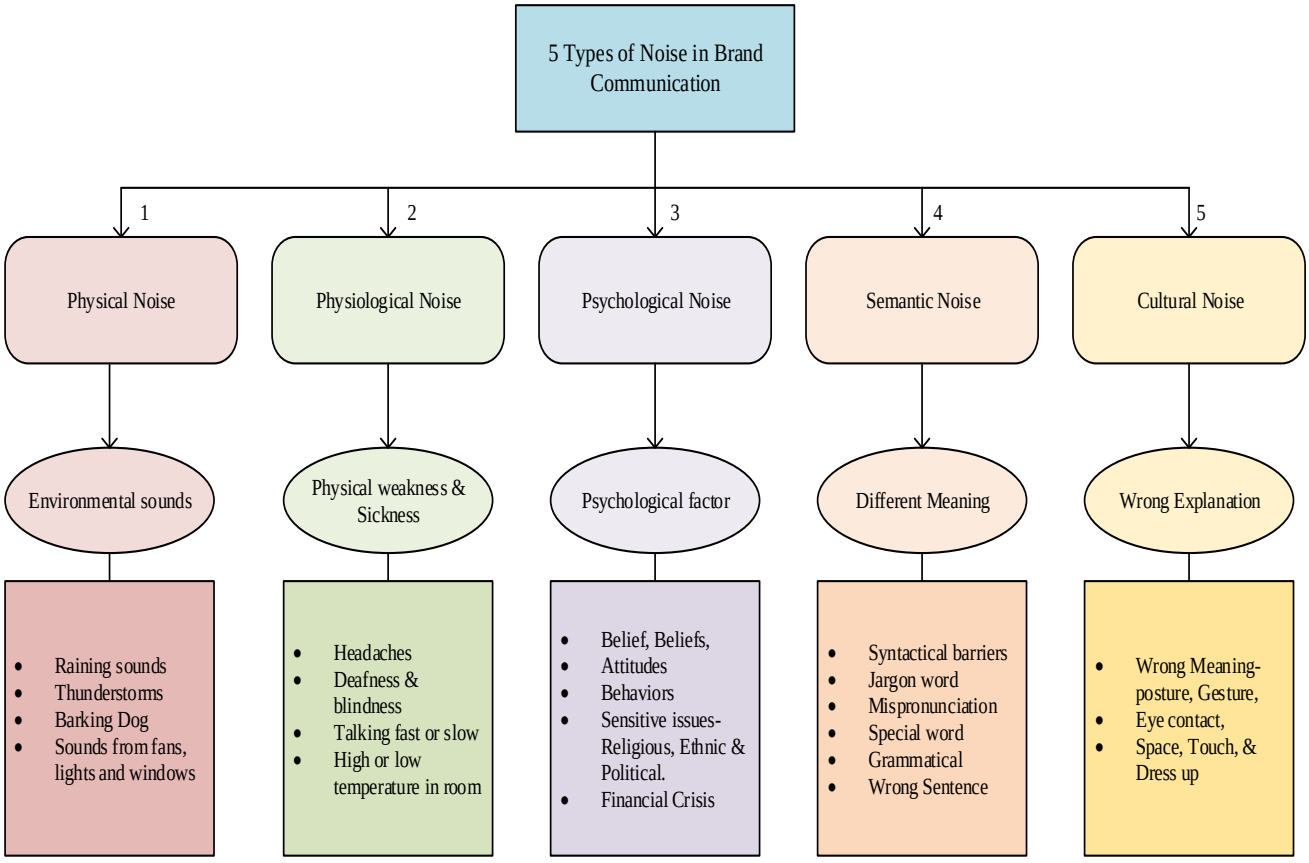


Figure 2. *Noise Theory Model*

indications. Since the model's variables range in intensity, we use the entropy approach to assign weights to them. According to the data, a large network plays a major role in building brand communication on social media platforms. In addition, the research gives descriptive statistics and analyses the link between each explanatory variable and the model's output value. Xian city's board communication relies heavily on those friendship relationships and a large number of followers, according to this investigation. Local municipal authorities might use these works as a reference to promote to social media users and encourage them to establish a good city brand.

1.2 Research Challenges

- **Information control:** Keeping the focus on the city's good qualities while also responding to any critiques or disputes that may arise.
- **Audience engagement:** Making sure material is interesting and useful for a wide range of audiences.
- **Social media management:** Managing online discussions well and responding quickly to comments.

By using WeChat and Weibo, two of China's most widely used social media platforms, "Xi'an Release" facilitates one-on-one interaction with a massive audience via targeted content distribution, real-time updates, and interactive features.

- **Tourism promotion:** Showcasing the world-renowned historical landmarks of Xi'an, such as the Terracotta Army, the City Wall, with the Muslim Quarter, with captivating storytelling and high-quality graphics.
- **Cultural events:** Getting the word out about future cultural events, festivals, and customs to entice visitors.
- **City development updates:** Government policy, urban regeneration programs, and infrastructure project updates to the public.
- **Crisis management:** Responding swiftly to public concerns during crises or unsavory events by use of the platform.

Engagement strategies:

- **Live streaming:** With the use of live broadcasts, we may offer virtual tours of sites, talk to specialists, and get updates as they happen.
- **User-generated content:** Using hashtags and competitions to get people talking about Xi'an.
- **Interactive features:** Making use of comment sections, polls, and question and answer sessions to encourage two-way communication.

Potential benefits of "Xi'an Release":

- **Improved public image:** Keeping Xi'an's favorable reputation in the minds of both locals and visitors by crafting its story.
- **Enhanced transparency:** Facilitating the public's immediate access to official records and announcements.
- **Boosted tourism economy:** Promoting Xi'an more specifically on social media in order to increase tourism.

Here is how the rest of the assignment is structured: Section 2 provides a concise overview of the relevant studies in the field. The study's methodology is described in Section 3, and Section 4 lays out the research's significant consequences. Section 5 concludes the article and discusses its future directions.

2. Related Work

The authors of [16] looked at Xian, China's most rapidly expanding city, which is establishing its identity using social media. That study proposes a model that characterizes SM user behaviors using elaborative parameters that are classified into four indicators. Since the model's variables range in intensity, they use the entropy approach to assign weights to them. According to the data, a large network plays a major role in building brand communication on social media platforms. In addition, the research gives descriptive statistics and analyses the link between each explanatory variable and the model's output value. According to the findings of that investigation, the most important characteristics in Xian city board communication are links with friends with a large number of followers. Insights from that study may help local governments promote their cities to social media users in a good light.

Finding the consistencies or gaps that could restrict the influence of plans was the goal of the researchers in [17], who sought methods to monitor execution from the planning papers to the goals of elected officials and their voting habits. From the 2017 Calgary municipal election through the fourth quarter of 2020, they employ text content analysis, Twitter data mining, and vote records from the city's digital council minutes. They link the stated preferences to the number of votes cast for each councilman during the research period. Twitter users who were in favor of investing on affordable

housing and transportation were also in favor of investments on the other two most important issues. After some back-and-forth, all but one councilor eventually came to a consensus on public investments (thanks to supra-local financing, which reduced the city's financial burden and encouraged "yes" votes). To ensure the effective execution of plans, planners may learn useful information from elected officials' social media posts, such as their opinions on certain planning efforts, any worries they may have, and any support they may have received. Voters may have a better understanding of their representatives' stances and policies on planning projects with the use of that data. An account is considered cyborg if it is recognized as human in one time frame but as bot in another; the authors of [18] defined that phenomenon quantitatively. In order to detect cyborgs, that definition uses the fact that bot categorization labels change often and that bot probability scores vary significantly. They conduct a massive study including more than 3.1 million Twitter users gathered from two major events in 2020: the coronavirus epidemic with the 2020 US elections. They use network science, machine learning, and manual annotation methods to describe Cyborg accounts after extracting them from two databases. Their research shows that cyborg accounts are purpose-built for strategic communication, classified as both bots and humans, and strategically placed within the social media network to promote their preferred material. The fact that cyborgs may be online for a very long time is another piece of evidence that they are either good at avoiding bot detectors or that platforms are kind enough to let them run their activities.

The goal of the study by the authors of [19] is to find out how social media affected people's movement in New York City before as well as following the COVID-19 pandemic. Two sources of data are utilized: trends in Apple's mobility and data collected from Twitter. Twitter volume or mobility trend correlations for driving as well as transit groups in general are unfavorable, according to the statistics, particularly around the onset of the COVID-19 epidemic in NYC.

The fact that there is a noticeable delay of 13 days between the increase in online communication and the decrease in mobility suggests that social networks responded to the epidemic more quickly than the transportation sector.

Also, the pandemic's effects on car traffic and public transportation ridership were mixed, depending on the influence of social media and official measures. That research sheds light on the intricate relationship between anti-pandemic measures as well as user-generated information, namely social media, and how it affects people's choices to travel during pandemics.

According to the writers of [20], the research set out to do the following: (1) Assess the efficacy of communications made by the Makassar City Tourism Office in fostering Banana Epe Culinary Tourism. (2) To learn how well the Makassar City Tourism Office has done in marketing banana epe as a gastronomic tourist destination on social media, namely the losari beach pavilion. Six informants, all of whom are familiar with the history of banana culinary tourism at Losati Beach Pavilion, participated in that month-long study that took place in Makassar City at the Makassar City Tourism Office. The study used a qualitative research strategy based on the integration of primary and secondary sources for information gathering. Methods such as phenomenological research, interviews, documentation, literature reviews, and casual observations are used to gather data. According to the findings, advertising banana epe culinary tourism on social media is a good idea.

In order to gather extensive data about catastrophe management via Yogyakarta's district and municipal governments' websites and social media, the researchers of [21,22] used descriptive qualitative research. The results demonstrate that the Sleman Regency Government while Yogyakarta City Government have been actively engaging in the use of social media and websites to combat the COVID-19 pandemic. That includes notifying the public of newly diagnosed cases, utilizing data visualization tools to aid in decision-making, collecting data on public health in real-time, and disseminating information to the public. There is a lot of overlap between the front and back-office uses of social media and pages between the governments of Yogyakarta City and Sleman Regency, according to the results. But the material on the website and the people using social media are different.

In their study, the authors looked at the possibility of using social media posts to derive useful labels for machine learning in smart city contexts, with the aim of making predictions about future occurrences and scenarios. They used announced traffic reports and other items as a case study and contrasted the labels generated from social media communications with those events and scenarios. It is possible to use social media communications to categorize events and circumstances meaningfully, according to the findings. Additionally, they provide a more reliable clustering strategy that uses an outlier detection method to reliably extract relevant labels. Also, they evaluate and make public the cleaned-up sensor data that had unknown noise so that other researchers may use the IoT raw data.

According to the authors of [23], the primary objective of that research is to (1) identify the ways in which the government of Makassar communicates on the COVID-19 pandemic management initiative. (2) Studying how the media covers the COVID-19 pandemic management initiative on the Makassar government's "covid19.go.id" website. That study employs a qualitative approach. That research had four informants. At the Communications and Informatics office, that study unfolded over the course of a month. That study used a qualitative research approach. Data collecting procedures involve observation, interviews with documentation. According to the findings, the Makassar government was heavily involved in the handling while service of COVID-19 information by both digital and non-digital communication patterns. Notifications were provided digitally via websites, WhatsApp, Instagram, Facebook, and other social media. The non-digital message is to promote the use of masks, handwashing, and social separation within the community.

Attracting potential students from all around the world is one of the main objectives in marketing University, according to the authors of [24]. Higher education institutions in countries other than the applicant's home country are seeing an influx of international students driven by rising levels of ambition, mobility, and financial mobility. Young people nowadays, according to a large body of research, utilize the Internet and social networking sites at an alarming rate. Universities are making great use of social media to generate interest and attract applications as a result of these considerations. To reach students from all over the world, they combine social media platforms such LinkedIn, Quora, Facebook, Instagram, Google+, and YouTube with more conventional forms of media like print and broadcast media, as well as with exhibits and educational trade fairs. Social media is a double-edged sword: it may entice potential students, and it can also help build a dedicated online community by disseminating information that today's youth find valuable. In that study, they look at how foreign students use social media to choose the best institution in India for their degree programs. The 183 international students enrolled in 6 Indian universities were surveyed and interviewed in-depth for that research.

A study conducted by researchers in Mataram City, Lombok, examined the implementation of Green Marketing methods at the Five Legs Resto. The effect of these tactics on sales of conventional products as well as social media influence were evaluated in the study [25,26]. Using regression analysis, the research delves into a whole green marketing mix that includes green product, pricing, site, and promotion, and how these factors are interconnected. The results show that supplying environmentally friendly products and being upfront about prices have a favorable effect on selling and social media impact. On the other hand, the results are unaffected by the actual location (Green Place), which points to the increasing significance of online platforms. The impact on social media and the success of products are both boosted by eco-friendly advertising. Their findings add to the body of knowledge on environmentally friendly advertising and provide practical advice to companies that are trying to strike a compromise between doing the right thing by the environment and making a profit. Academic research and practical concerns are both touched by the implications, which will help direct future discoveries in the ever-changing field of sustainability-oriented marketing.

3. Proposed Work

3.1 Xian City

Xian, a city in central China, is on the banks of the Wei River. One of the biggest cities in Northwest China, this is also the capital of Shaanxi province. Lintong, Xincheng, Lianhu, Yanta, Yanliang, Beilin, Weiyang, Gaoling, Baqiao, Chang'an, Huyi, and Yanta are the eleven districts where it has authority. Some of the well-known industrialization zones in Xi'an include the National Xi'an Hi-tech Industries Improvement Zone, Xi'an Yanliang National Aviation Hi-tech Industrial Base, and Xi'an Fengdong New Town Zone. The following areas are part of Xi'an: the Chanba Ecological Zone, the Qujiang New Zone, the International Port, the National Civil Space Industry Base, as well as the Fengxi New Town Zone. Xian is home to 12.95 million people spread out across an area of about 10,752 square kilometers.

The city's unique qualities make it an important player in China's overall growth. A city that nourished Chinese culture, Xian was once the capital of China. Situated at the starting point of the old Silk Road, this city is home to some of the world's most priceless cultural artifacts. Xingjiao Temple Pagoda, Big Wild Goose Pagoda, and Tang Chang'an City Daming Palace Site are only a some of the city's World Heritage-listed attractions. Along with this, Xian is known as the military, educational, and scientific capital of China. There are seven military academies among the approximately sixty-three colleges and universities located inside the municipal limits.

The city's robust industrial sector includes many different types of machinery, electronics, minerals, chemicals, surveying, aviation, and aerospace. Due to its location in the geographic center of the country across the national geodetic origin, Xian serves as both a transportation hub and the open frontier of Shanxi province, linking several significant points of interest. There is an international airport, a well-developed rail network, and an inland port that can handle around 659,000 tons of cargo each year. Beyond these features, the city's scenic appeal is enhanced by the surrounding hilly areas and river basins. Rivers Wei, Jing, Ba, Chan, Yu, Feng, Lao, & Hao provide water to the city, which is home to several tourist attractions.

The city of Xian has grown in recent years, thanks to these opportunities and the power of social media, into a formidable contender for the business, leisure, education, investment, and relocation of a wide range of demographics. Using statistical methodologies, this research aims to reveal the influence of social media on boosting the brand of Xian city.

3.2 City Branding Using Noise Theory

A community that prides itself on its bright street art might use social media to showcase murals in high-resolution, and then invite people to contribute their own finds using a specific hash tag. To get people excited about a big food festival, the city hosting it may launch a social media campaign using interactive polls asking them for their votes for their favorite dishes.

3.3 Noisy Theory Steps

Identify key narratives:

- Tell captivating stories that set the city apart from others by showcasing its distinctive features, such as its history, culture, gastronomy, or natural beauty.

Timely engagement:

- Generate meaningful discourse about the city with its brand by using popular themes and recent occurrences.

Community building:

- Create campaigns that encourage users to share their observations with city-specific hashtags. This will encourage both residents and tourists to contribute user-generated material.

Interactive content:

- Engage the audience and keep their attention with features like as polls, quizzes, and streaming videos.

Data analysis:

- Keep an eye on statistics for social media to see what kinds of material do well, and then change your approach to get the most out of your audience.

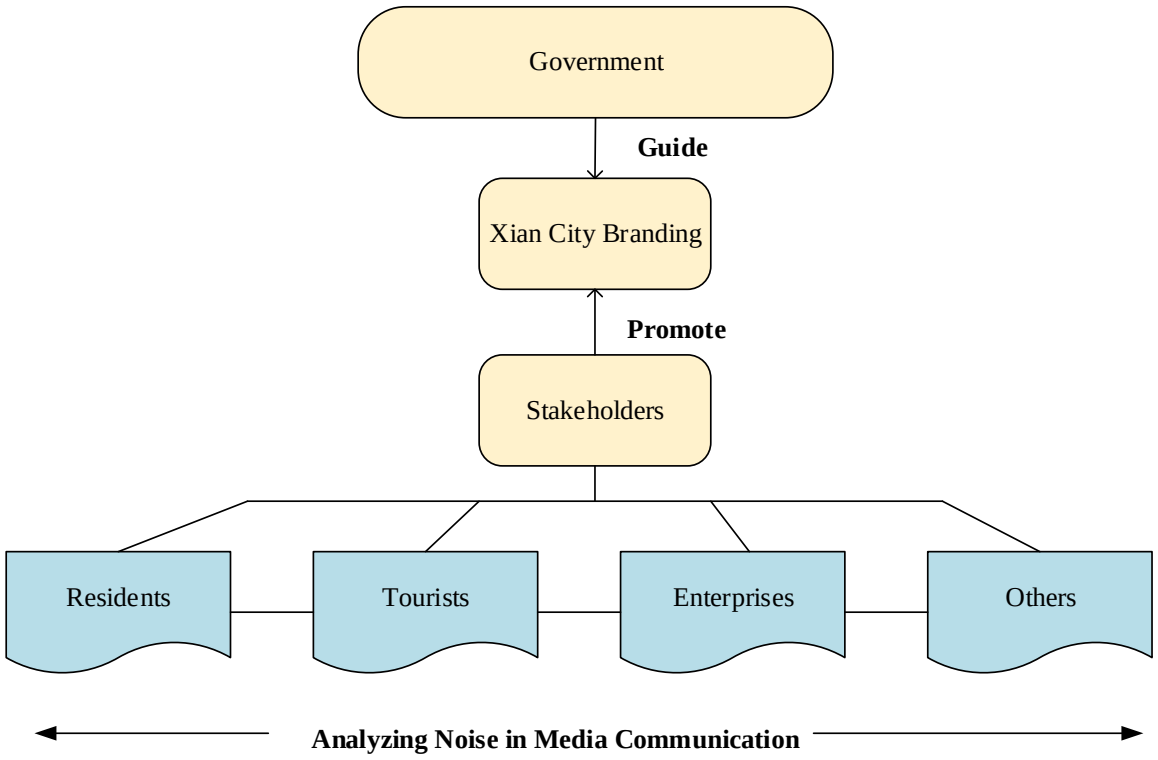


Figure 3. *Model for Noise Theory*

Purpose

To what extent may municipally branding on social media be considered acceptable is the overarching goal of this research. Building an effective city brand in the age of social media requires a conceptual framework for the acceptance of city branding. Utilizing noise theory, it seeks to advance the adoption and use of social media for city branding, particularly in the fields of urban development and planning. Important questions about social media's usage and acceptability in municipal branding strategies are also addressed in the research.

Findings

Finding the right model for a city's branding strategy relies heavily on social media. A more widely acknowledged and effective city brand in the long run is possible with the help of social media's bottom-up influence on the branding process, which might emerge as a result of integrating social media into the branding process. This paper's findings suggest that there are nine dimensions of acceptability that can be used to understand stakeholders' acceptance of city branding. These dimensions include knowledge, information diffusion, experience, connection, congruence, behavioral intention, perceived excellence, engagement, and participation. One can use social media user-generated content (from residents while visitors), content created by local governments, peer interaction, e-WOM, and the engagement and participation medium to gain this understanding.

3.4 Methodology

Several blogs inside Aminer's canopy (https://www.aminer.org/data-sna#Last.fm) provided the data used in the research. China has outright banned social media sites like Twitter and Facebook. However, the focus of this research is on how Xian city-related SM users engage across different platforms. We analyze the influence of social media communication on creating the Xian city brand using data from Twitter and Facebook. The participation of Chinese users in different forms of social media material is seen in Figure 1.

Social media variable Analysis

Mathematical tools like social media variable analysis may help you narrow down your data set. Prerequisites for social media variable analysis include computer data processing, multivariate statistical analysis creation, and statistical data layout.

Consolidating all of the initial variables into a small number of all-inclusive indexes is the fundamental idea behind this approach. To find the primary variables, one must look at the eigenvector that corresponds to the bigger eigenvalues—the burden of the initial variable on the primary variables. In this study, we use this strategy to determine the social space effect variables. These steps make it up.

X is a data matrix consisting of a number of samples with p variables.

$$X = \begin{bmatrix} x_1^{\top} \\ x_2^{\top} \\ \dots \\ x_n^{\top} \end{bmatrix} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1p} \\ x_{21} & x_{22} & \dots & x_{2p} \\ \dots . & \dots & & \dots \\ x_{n1} & x_{n2} & \dots & x_{np} \end{bmatrix} \quad (1)$$

Matrx Z is the result of a standardised transformation applied to data matrix X.

$$Z_{ij} = \frac{x_{ij} - \overline{x_j}}{S_j}, i = 1,2, \dots, n; j = 1,2, \dots, n \quad (2)$$

$$\overline{x_j} = \frac{\sum_{i=1}^{n} x_{ij}}{n}, s_j^2 = \frac{\sum_{i=1}^{n} \left(x_{ij} - \overline{x_j}\right)^2}{n-1} \quad (3)$$

$$\boldsymbol{Z} = \begin{bmatrix} z_1^T \\ z_2^T \\ \dots \\ z_n^T \end{bmatrix} = \begin{bmatrix} z_{11} & z_{12} & \dots & z_{1p} \\ z_{21} & z_{22} & \dots & z_{2p} \\ \dots & \dots & & \dots \\ z_{n1} & z_{n2} & \dots & z_{np} \end{bmatrix} \quad (4)$$

The value of the correlation matrix R may be obtained by using matrix Z.

$$R = \left[r_{ij}\right]_{p*p} = \frac{Z^T Z}{n-1}$$
$$r_{ij} = \frac{\sum_{k=1}^{n} z_{kj} z_{kj}}{n-1}, i, j = 1,2, \dots, p \quad (5)$$

Table 1. *Factors that Affect Branding of Xian*

Factors that influence brand building	Variable	Factors that influence brand building	Variable
Sum of tweets and posts	X 1	Sum of followers	X 7
Sum of people who are followed	X 2	Sum of retweets about topic of interest	X 8
Sum of comments and questions	X 3	Sum of the responses	X 9
Frequency of response	X 4	Frequency of comments	X 10
Number of followers	X 5	Number of friends in SM connection	X 11
Number of days since joined the social media platform	X 6	Number of interactions within the community	X 12

As stated by characteristic calculation of $|\lambda_p - R| = 0$, we get eigenvalue $\lambda_1, \lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_p \geq 0$. Eigenvector a_i is coefficient of main Variable F_i.

$$F_i = q_i X$$
$$a_i = \frac{\lambda}{\sum_{i=1}^{n} \lambda} \qquad (6)$$

It is determined the variable loading matrix $A = \sqrt{\sqrt{\lambda} a}$

The common variable may be better explained by obtaining matrix B by rotating matrix A by greatest variance. The response parameter that measures the effect of social media interactions on a city is dependent on the platforms' communication type, reaction time, and frequency. Table 1 lists the explanatory factors, and the dependent variable is the Social Media Network Ratio. When studying the impact of SM communication on Xian city, these are the metrics employed. It may be shown from Equation 7:

$$Y = \propto + \sum_{i=1}^{n} \sum_{j=1}^{m} \beta_j w_j X_{ij} + error \qquad (7)$$

Using the indicators listed in Table 2, the amount and intensity of social media communication and interactions with Xian city is quantified and measured by the dependent variable Y. A constant value is maintained for the term α and w_j is the entropy-based weight given to each indication. The explanatory variables' coefficient is denoted as β_j. The idea of X_{ij} shows how the dependent variable has an effect. In this particular equation, the word "error" is used to describe the residual or error term. If the other model variables do not adequately describe the observed variance in the dependent variable, Y, then this component will do the trick. It captures the elements that influence Y but aren't part of the model, representing the data's randomness or unpredictability. To account for the reality that not all potential variables may be included in a statistical model, the term "error" is a common component.The next step in this process is to determine which indicators are most suitable for mapping the variable to in order to quantify the effect or severity of the communication. Using the entropy technique, the research assigns weights to all of the indicators. The information-weighting approach is used to choose the weight coefficients. Statistical modifications to the data may be made much more accurate using this strategy. The dispersion degree is used to find the coefficients of various variables. This means that the dispersion degree increases as entropy decreases and decreases as entropy increases. In order to estimate weights, we use Equations 2-4.

$$R_{ij} = \frac{X'_{ijt}}{\sum_i X^i_{ijt}}$$
$$IE_{ijt} = -\delta \sum_i R_{ijt} ln\, R_{ijt} \qquad (8)$$
$$w_j = \frac{(1 - IE_{ijt})}{\sum_j (1 - IE_{ijt})}$$

The class indexes are shown in Table 2, and the value of j in every one of these equations belongs to that set. R_{ij} is the city's index i/index j at time t j, X^i_{ijt} and X'_{ijt} stand in for discrete values of a variable throughout time in city j, the expression R_{ijt} denotes the proportion of the index i in city j at time t. The entropy of the i parameter for city j at the moment t is denoted by the phrase IE_{ijt}. The whole number of data points used in the research, denoted as n, is used to estimate the constant value δ, which is $(ln^n n)$-1. Indicator weight w_j is the j-th phrase. Table 3 displays the variable weights.

4. Results & Discussion

In order to conduct in-depth analyses and evaluate the unique quality of social media for the city's brand promotion, it is necessary to map these factors to the indicators. The indicators and explanatory factors were mapped, as shown in Table 4. In order to conduct in-depth analyses and evaluate the unique quality of social media for the city's brand promotion, it is necessary to map these factors to the indicators. We see the results of the indicator-explanatory variable mapping in Table 4. Based on the framework indicated in Equation 1, the variables linked to particular indicators are investigated in depth. Because popular social media applications like Twitter as well as Facebook are blocked in China, the data comes from the country's own SM services. Based on a random sample of one thousand SM sites that include Xian city in some way (comment, slogan, etc.), this research draws its conclusions. In Table 5 you can see the descriptive statistics for each of the variables. Figure 2 and 3 is a graphical representation of the variables' comparison study. A weightage of 0.361

Table 2. *Metrics for Evaluating the Effect of Social Media on Xian's Brand Development*

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

Table 3. *Weights of Variables Utilizing the Entropy Method*

Variable	Weight	Variable	Weight
Sum of tweets	0.361	Sum of followers	0.469
Sum of people who are followed	0.145	Sum of retweets about topic of interest	0.146
Sum of comments and questions	0.236	Sum 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

Table 4. *Charting the Relationship Between the Indicator with Explanatory Factors*

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

Table 5. *Statistics for the Explanatory Variables: A Descriptive Analysis*

Variable	Mean	Standard Deviation	Coefficient of Variation	Median	Maximum	Minimum
Sum of tweets and posts	46.86	6.33	0.86	44.78	70.86	27.93
Sum of people who are followed	44.86	8.02	0.79	40.78	77.82	21.03
Sum 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
Sum of followers	50.85	6.86	0.57	47.97	79.65	38.46
Sum of retweets about topic of interest	46.86	7.53	0.48	47.98	70.65	25.73
Sum 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

indicates that the varying frequency of tweets, comments, and posts is more significant. Also, the descriptive statistics reveal some quite impressive outcomes. Shortly after the amount of community contacts, the total amount of days since entering the social media site has the lowest weight at 0.038. These two characteristics have a smaller impact on Xian city's brand development, according to descriptive data. Applying the indicator variables to the model suggested in Equation 1 allows for an effective analysis of the brand-building operation's effects. In Table 6 you can see the outcomes. It is clear that the social engagement of the SM members is the second most important element in deciding the city's brand communication, after network size. A more nuanced understanding of the variables is also gained by comparing the correlation among the descriptive variables and the Y value, which is

Table 6. *Analysis of the Indicators*

Indicator variables	Y
Social Activity (I2)	0.642
Size of the network (I1)	0.741
Visibility (13)	0.534
Communication (I4)	0.504

conducted in this study. By plugging the Y-values of an indicator variable into Equation 5, one may approximate the correlation coefficient between descriptive variables. The variables that explain this phenomenon are denoted by p. "Social Activity," "Network Size," as well as "Visibility" are some of the factors whose coefficients are included in it.

$$Cor = \frac{n(\sum py) - (\sum p)(\sum y)}{((n\sum p^2 - (\sum p)^2)(n\sum y^2 - (\sum y)^2)\text{^}0.5} \quad (9)$$

5. Conclusion

We mention that several previously untapped urban economic zones have flourished in recent years. We demonstrates the significant role that different social media platforms play in brand communication in these locations, a role that is challenging to evaluate, analyze, and measure. The purpose of this study is to analyze and assess the impact of social media websites on Xian city's brand marketing efforts. This study suggests a model that uses data obtained from many sources utilizing AI-based techniques and is based on major social media characteristics and related indicator variables. The entropy approach, which measures the metric's relevance on the city's brand communication, is used to weigh each variable in the influence study. By examining the most important aspects of social media platforms, such as followers, network size, and level of social interaction, the descriptive and correlational analyses provide weight to the research. The findings point to the network's scale as the main communication tactic for Xian city branding. Additional descriptive and correlational study reveals that social media platform methods, such as connections and the number of friends or followers, are also crucial in promoting the city's good characteristics. Since the majority of the populace uses social media, this research may be used to raise awareness among state and local authorities so that they can compete in the economic world. Creative, integrative, participative, well-informed, sustainable, socially cohesive, and transparent dissemination of state authority methods is required in the social media. The research may be expanded in the future to include more explanatory while indicator variables, allowing for a more generalized analysis.

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- **Ethical approval:** The conducted research is not related to either human or animal use.
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