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Edwin Arango Espinal, Carlos Fernando Osorio Andrade, Carlos Alberto Pastrana Arango

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Structural equations and machine learning: an approach to measuring political stability and citizen support in social networks

Edwin Arango Espinal*

Department of Administration and Organizations,
Universidad del Valle,
Caicedonia, Valle del Cauca 762540, Colombia
Email: edwin.arango@correounivalle.edu.co

*Corresponding author

Carlos Fernando Osorio Andrade

Sinergia Group of the Instituto de Educación Técnica Profesional
de Roldanillo (INTEP),
Tuluá, Valle del Cauca 763021, Colombia
Email: carlos.fernando.osorio@correounivalle.edu.co

Carlos Alberto Pastrana Arango

Department of Administration and Organizations,
Universidad del Valle,
Cali, Valle del Cauca 760000, Colombia
Email: carlos.arango.pastrana@correounivalle.edu.co

Abstract: This study examines influence of political stability on digital citizen engagement across the 51 municipalities of the Colombian Coffee Cultural Landscape. Research employs a mixed-methods approach, combining content analysis to operationalise the dimensions of political stability, natural language processing to analyse comments on Facebook, and structural equation modelling to explore the relationships between variables. The findings reveal that political legitimacy and policy continuity are negatively associated with the volume of comments but positively associated with their valence. Political strength shows a positive relationship with both the volume and valence of the comments. This study offers original value by integrating governance concepts with social media analysis in a Latin American context, providing insights into how dimensions of political stability influence digital citizen engagement. The findings have implications for understanding the relationship between political stability and citizen engagement in the digital age.

Keywords: political stability; governance; social media; citizen engagement; political legitimacy; comment valence; comment volume; democracy; natural language processing; structural equation model.

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Biographical notes: Edwin Arango Espinal, Public Accountant from Universidad del Valle, Master in Administrative Law from Universidad Libre, Doctor in Administration from Universidad del Valle, Researcher, Professor at Universidad del Valle Eje Cafetero regional branch and Director of the Eje Cafetero branch.

Carlos Fernando Osorio Andrade, Advertising Communicator by the Universidad Autónoma de Occidente, Master in Organizational Sciences by the Universidad del Valle, Doctor in Administration by the Universidad del Valle, Researcher Grupo Sinergia INTEP, Professor Universidad del Valle sectional Buga.

Carlos Alberto Pastrana Arango is Professional in Foreign Trade from Universidad del Valle, Master in Industrial Organization and Business Management from Universidad del Valle, Doctor in Industrial Organization and Business Management from Universidad de Sevilla, Researcher, Professor at Universidad del Valle.

1 Introduction

Research in local governance has established that good governance forms the foundation for valorising specific territorial resources (da Cruz and Rui, 2016), through the development of collective projects and the articulation of relationships between global and local aspects (Chia et al., 2008). The horizontal and vertical coordination forms that emerge among local actors and institutions, as well as the synergies resulting from their respective collective actions, are consequences of geographical and organisational proximity (Torres-Saldico and Sanz-Cañada, 2018). Consequently, public perception and social endorsement of public administration institutions by citizens become key elements, as political institutions can facilitate coordinated collective construction (Torres-Saldico and Sanz-Cañada, 2018).

Political stability, a fundamental dimension of governance, is defined as the establishment of an administrative structure that operates effectively in accordance with the rule of law in a democratic state. This concept implies that governmental decisions must meet societal expectations and needs (Kirikkaleli and Osmanlı, 2023). Sidamor et al. (2016) consider it a qualitative aspect of public progress, manifested in the preservation of social order through the management and harmonisation of the involved actors. Political stability is crucial for promoting the rule of law, transparency, accountability, and efficient use of resources, which translate into improved performance across various development indicators (Avdeeva and Kovriga, 2018).

This governance dimension is closely related to citizens' opinions about their governments (Fernández-Altamirano et al., 2023). In the current digital age, this citizen endorsement is increasingly reflected on the internet and social media. According to Gurevitch et al. (2009), the internet would become a powerful tool to enhance interaction among citizens and between citizens and the state, expanding the political sphere and broadening spaces for discussion and information dissemination.

Citizen endorsement in the digital context can be measured through the analysis of interactions and opinions expressed on social media. According to the Global Digital Report, the number of internet users has risen from 2.177 billion in 2012 to 5.3 billion in October 2023, representing 65.7% of the global population. Of this total, 61.4% use social media, which has been linked to democracy and citizen participation in policy-making due to its capacity to connect people without time and space constraints (Jha and Kodila-Tedika, 2020).

Although previous research has confirmed the relationship between social media and governance dimensions, including political stability (González-Bailón et al., 2011; Tufekci and Wilson, 2012; Gil de Zúñiga et al., 2012), there is a significant gap in the literature. Most studies in this area are limited to qualitative and descriptive observations. Moreover, a review of academic databases reveals a lack of studies analysing the effect of political stability on citizen endorsement in electronic contexts, especially in Latin America.

To address these gaps in the literature, this study seeks to go beyond descriptive observations by empirically exploring the effects of political stability on digital citizen endorsement (Mossberger et al., 2007). The primary objective is to determine the influence of political stability on citizens' social endorsement of their governments on social media, thus contributing to this evolving field of knowledge.

To achieve this objective, a study was conducted in the populations of the Colombian Coffee Cultural Landscape, an area encompassing 51 municipalities across four departments of Colombia, characterised by its natural, cultural, and economic uniformity, making it a globally exceptional case (Coffee Cultural Landscape, 2020). The research is structured into seven sections, beginning with the theoretical framework, followed by the methodology, descriptive results, and empirical analysis for hypothesis validation. Finally, the discussion and conclusion sections are presented, offering a comprehensive view of the relationship between political stability and citizen endorsement in the digital environment.

2 Theoretical framework

2.1 Political stability

Political stability is a multifaceted concept encompassing various approaches, including the political strength of a party, pluralism in decision-making, political legitimacy, and policy continuity (Maksimovska and Stojkov, 2019). Prado-Lorenzo et al. (2012) have implicitly interpreted it as the permanence of a party in power, considering it a determining factor in improving the quality of life at the local level.

Conversely, authors such as Van Den Dool et al. (2015) link political stability to resilience, understood as the ability to remain steadfast under pressure. This perspective aligns with the concept of a dynamically stable and self-sufficient democratic system proposed by Fidélis and Pires (2009). Hendriks (2014) expands on this notion, suggesting that political stability entails the ability to remain within the electorate's sphere of acceptance, even under pressure, and to maintain unity even in times of internal division. Finally, the NGO Transparencia por Colombia equates political stability with democratic stability, emphasising the importance of clear rules for the free operation of political

parties and the transparent financing of parties and candidates through public and private donations (Transparencia por Colombia, 2020).

A review of Colombian academic and institutional literature allowed for the identification and standardisation of three fundamental dimensions that define political stability, according to the framework proposed by Maksimovska and Stojkov (2019). These dimensions encompass crucial aspects of governance and democratic participation: Firstly, political legitimacy, which is assessed through the rate of citizen participation in local electoral processes. Secondly, political strength in decision-making, reflected in the composition of local government. Lastly, continuity in public management, measured by the existence and maintenance of long-term policies, which in Colombia over the last three decades has been associated with security issues (Vargas-Alzate et al., 2015). These dimensions provide a comprehensive framework for analysing political stability in various contexts. Table 1 offers a detailed summary of these dimensions.

Table 1 Description of the dimensions of political stability

<i>Variable</i>	<i>Description</i>	<i>Authors</i>
A1: Political Legitimacy	Citizen participation in the electoral process	Transparencia Internacional (2020), Gilbert (2015), OCDE (2013), Park (2003), Bouckaert and Van de Walle (2003), Bovaird and Löffler (2003), Tavares et al. (2018) and Fortou, and Sosa (2020)
A2: Political Strength in Decision- Making	Composition of the local government	Muñoz and Bolívar (2015), Prado-Lorenzo (2012), Nelson and Nollenberger (2011) and Van Den Dool (2015)
A3: Policy Continuity	Continuity of public policies and their longterm support in the local context	Varela (2015), Van Den Dool et al. (2015), De Colombia (1991), Programa de las Naciones Unidas para el Desarrollo (2020)

Source: Created by the authors

2.2 Digital citizen endorsement

In recent decades, technological advancements have transformed citizen participation in politics, creating new digital spaces for debate and mobilisation of opinions (Bonsón et al., 2017). Social media platforms, in particular, have become key venues for people to share content and interact (Kaplan and Haenlein, 2010), facilitating constructive exchange and the generation of new ideas.

The influence of these platforms in the political realm is enhanced by the ease of access to online news and the ability of users to interact with this information. This combination of access and active participation not only positively impacts civic and political engagement (Xenos and Moy, 2007; Gurevitch et al., 2009) but also democratises access to political participation (Nkoa et al., 2023). Moreover, these platforms enable the establishment of significant links between citizens and governments (Coleman and Blumler, 2009), which translate into citizen endorsement, becoming social capital for a democratically elected government (Teles, 2012).

Given the importance of these platforms, governmental entities have focused their efforts on building digital communities, such as 'Fanpages', that facilitate more effective interaction with citizens (McAlexander et al., 2002; Ure, 2016). Simultaneously, these

digital ecosystems provide significant benefits in terms of promotion, dissemination, recognition, conversation, awareness, and loyalty (Cáceres et al., 2011; Sharafi et al., 2019). In the virtual environment, citizens become users, and their participation on the web gives rise to the concept of electronic word-of-mouth (e-WOM), which describes the ability of internet users to share opinions and experiences through comments (Bansal and Voyer, 2000) and declarative actions such as liking, sharing content, reacting, or rating a service on websites and social media (Harrison-Walker, 2001; Y. Liu, 2006).

These opinions can vary in valence, meaning they can be positive, negative, or neutral, thus influencing users' attitudes (Harrison-Walker, 2001; Y. Liu, 2006). Satisfaction or dissatisfaction with experiences and public policies can generate both positive and negative e-WOM (Pérez, 2014), making the measurement of valence a valuable tool for assessing the quality of local governance and social endorsement (Kumlin, 2004). In addition to valence, the volume of interactions, defined as e-WOM activity (Arango-Pastrana et al., 2021), is also crucial. A higher number of interactions increases the visibility and prominence of information (Liu, 2006), as social media algorithms favour content with high interaction. This feature depends on the number of users, in this case, citizens willing to engage in such interaction, as well as the frequency with which they do so.

2.3 Political stability and digital citizen endorsement

The dimensions of governance, particularly political stability, are intrinsically linked to public opinion, directly influencing citizens' digital behaviour (eWOM) (Fernández-Altamirano et al., 2023). In a stable political environment, citizens' trust and satisfaction increase, fostering positive interactions and reinforcing support for governmental institutions (Kuklinski et al., 2001). However, in situations of political instability or public dissatisfaction, negative eWOM is more likely to emerge, which can erode the legitimacy of public policies and affect the overall perception of governance (Russmann et al., 2018).

New information and communication technologies have created more effective environments for building legitimacy, which in turn leads to political stability for governments. Social media, for instance, has become a key tool for constructing political narratives related to the implementation of government plans, thereby strengthening the political legitimacy of those involved (Surdias and Eriyanto, 2018). Additionally, these platforms have the potential to shift the balance of power in favour of disadvantaged political actors, allowing the promotion of controversial policies through discursive strategies that impact a large number of citizens (Nkoa, 2023), or even facilitating the organisation of protests opposing governmental projects.

Research such as that by Bonsón et al. (2017) demonstrates that the use of social media is directly related to support for local government institutions and their performance. These platforms not only positively influence citizens' evaluations of political and economic issues but also serve as powerful tools for popular mobilisation. According to Kim and Lee (2012), social media can play a crucial role in supporting democratic processes by acting as watchdogs over political actors, increasing access to information, and fostering dialogue and citizen participation in political processes.

In the following sections, the impact of the dimensions of political stability (political legitimacy, political strength in decision-making, and policy continuity) on digital citizen behaviour is explained.

2.4 Political legitimacy and digital citizen endorsement

Political legitimacy is a crucial dimension of political stability, as it refers to the acceptance and recognition of a government's power and authority by its citizens (da Cruz and Rui, 2016). This legitimacy is built and reinforced through a process in which citizens perceive that governmental decisions are fair, representative, and aligned with public interests (Waldron, 2018). Political legitimacy is fundamental because it determines the level of support and acceptance a government receives from the population, which in turn influences the stability and effectiveness of its governance. Without this legitimacy, a government faces constant challenges to its authority, which can lead to a decline in political stability and, eventually, a collapse of public trust (Coicaud, 2019).

In the context of this research, political legitimacy has been operationalised as voter participation according to the municipal electoral roll. This approach provides a tangible measure of the degree of citizen support a government receives, as high electoral participation indicates broader endorsement and greater legitimacy, whereas low participation may signal discontent or distrust towards institutions.

Within the digital ecosystem, political legitimacy can have a direct impact on citizen endorsement expressed through eWOM. When a government enjoys high legitimacy, that is, when electoral participation for its election has been high, reflecting strong political legitimacy, citizens are more likely to engage positively on digital platforms (Andargoli et al., 2022). In these cases, citizens tend to share and disseminate messages that support the government and its policies, generating positive eWOM (Li, 2023). This behaviour strengthens the perception of governmental stability and effectiveness, amplifying social support and consolidating legitimacy in the digital realm (Mensah and Mwakapesa, 2022). Conversely, in municipalities where electoral participation is low, suggesting lower political legitimacy, eWOM can be more critical or negative. Citizens may use social media to express dissatisfaction with governmental policies or to challenge the government's authority. This negative eWOM not only damages the government's image in the digital space but can also trigger a cascade effect, where discontent spreads and intensifies, further eroding legitimacy and political stability (Kwong, 2023).

Based on the above, the following research hypothesis is proposed:

H1. The political legitimacy of the municipal government influences digital citizen endorsement.

2.5 Political strength and digital citizen endorsement

Political strength or institutional governance within a territory, whether for short- or longterm initiatives, fundamentally depends on the executive's ability to secure support from various parties represented in the legislature, including both allies and opposition. This support is crucial not only for the approval and implementation of proposals but also for fostering pluralism in decision-making (Khwaja and Zaman, 2020). In the Colombian context, some authors point out that agreements between governmental actors, such as the

Mayor's Office and the Municipal Council, can have implications beyond mere institutional collaboration. These agreements may involve political and administrative favouritism, which in turn can potentially influence the support of the voting population (Restrepo and Piedrahita, 2021).

This political strength, manifested through legislative support, can significantly impact digital citizen endorsement (eWOM). Councillors and other members of the local legislature often have strong social bases and support networks that they can effectively mobilise in the digital sphere. These bases can be activated to defend or criticise the actions of the executive (mayor's office) on social media and other digital platforms, thus influencing public narrative and citizen perception (VanDusky-Allen and Kettler, 2021). For instance, an allied councillor may use their networks to amplify the mayor's achievements, generating positive eWOM, while an opponent might mobilise their followers to challenge certain policies, potentially generating negative eWOM. Additionally, the executive's ability to maintain a strong legislative coalition can translate into a narrative of governmental stability and effectiveness in digital media, which in turn can positively influence the overall sentiment of citizens as expressed on social media (Bernardi, 2018).

Therefore, the following is proposed:

H2. The political strength of the local government influences digital citizen endorsement.

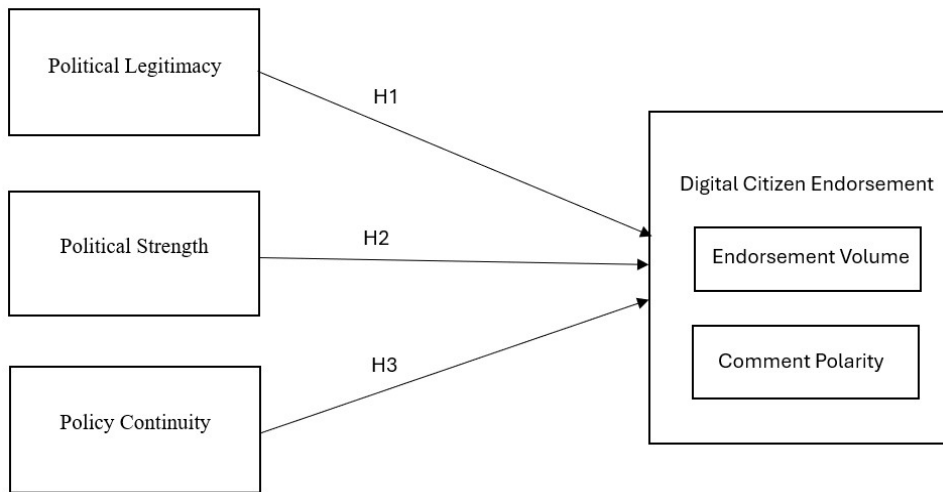
2.6 Policy continuity and digital citizen endorsement

Policy continuity is a crucial dimension of political stability, referring to the ability to maintain and develop long-term strategies that transcend electoral cycles. This dimension aims to safeguard the general interest from short-term political actions that may be detrimental to democracy and territorial development (Boston and Berman, 2017). In Colombia, this continuity is manifested through municipal development plans and national policies coordinated by CONPES, which establish long-term guidelines (Law 152 of 1994, 1994; National Planning Department, 2022).

The relationship between policy continuity and digital citizen endorsement is anticipated. When policies demonstrate consistency and results over time, they are more likely to generate positive sentiment among citizens, which can be reflected in their digital interactions. For instance, security policy has been linked to the collective discourse for nearly three decades (Vargas-Alzate et al., 2015), and specifically, the democratic security policy, implemented for almost two decades in Colombia (Garay Acevedo and Pérez Guecha, 2018), has had a measurable impact on the municipalities of the Coffee Cultural Landscape (Basset, 2018). The effectiveness of these policies, measured through indicators such as the Municipal Performance Measure (MDM), can directly influence citizen perception and, consequently, digital endorsement. Consistent and effective policies tend to generate positive comments and greater engagement on digital platforms, whereas a lack of continuity or unsatisfactory results can provoke criticism and discontent expressed through negative eWOM. Based on the above, the following hypothesis is proposed:

H3. Policy continuity has a positive effect on digital citizen endorsement.

Figure 1 presents the proposed research model.

Figure 1 Research model

Source: Created by the authors

3 Methodology

3.1 Sample description

This research analysed the dimensions of political stability (political legitimacy, political strength, and policy continuity) and digital citizen endorsement (volume and valence of comments) across the 51 municipalities that comprise the Colombian region known as the Coffee Cultural Landscape or PCCC. These municipalities are distributed across four departments, as detailed in Table 2.

Table 2 Municipalities of the Colombian coffee cultural landscape

Department	Municipalities
Valle del cauca	Alcalá, Ansermanuevo, Argelia, Caicedonia, El Águila, El Cairo, Riofrio, Sevilla, Trujillo, Ulloa
Quindío	Armenia, Buenavista, Calarcá, Circasia, Córdoba, Filandia, Génova, Montenegro, Pijao, Quimbaya, Salento
Risaralda	Apía, Balboa, Belén De Umbria, Dosquebradas, Guática, La Celia, Marsella, Mistrató, Pereira, Quinchía, Santa Rosa De Cabal, Santuario
Caldas	Aguadas, Anserma, Aranzazu, Belalcázar, Chinchiná, Filadelfia, La Merced, Manizales, Neira, Pácora, Palestina, Riosucio, Risaralda, Salamina, San José, Supía, Villamaría, Viterbo

Source: National Planning Department CONPES 3803, 2014

3.2 Data collection

The data collection methodology for this study was divided into two main approaches: one for assessing political stability and another for analysing digital citizen endorsement.

To evaluate political stability, a comprehensive content analysis of various official sources was employed. These included data available on government websites, public edicts, meeting minutes, contracts, and other public documents required by Colombian legislation. This analysis enabled the evaluation of the existence and implementation level of various aspects related to political stability within the local context. It is important to note that the year 2020 was used as a reference, as relevant information was published in the second half of 2021, thus providing a complete and up-to-date overview.

On the other hand, to measure digital citizen endorsement of local administrations, a data mining strategy focused on social media was implemented. Specifically, all comments posted on the official Facebook pages of the selected municipalities' mayoralties during the year 2020 (from 1 January to 31 December) were collected. This period was strategically chosen to capture the dynamics of citizen interaction during the COVID-19 pandemic and the immediate post-pandemic period, offering a unique insight into how the local administrations' mandate unfolded under extraordinary circumstances. Once collected, these comments were subjected to natural language processing (NLP). Machine learning techniques were applied to analyse the content and determine the valence of each comment, classifying them as positive, negative, or neutral.

3.3 Natural language processing

In this study, NLP was applied to analyse digital citizen endorsement, following a rigorous and multifaceted approach. The process began with the extraction of comments from the official Fan Pages of the PCCC municipalities' mayoralties on Facebook, covering the period from 1 January to 31 December 2020. This extraction was carried out using web scraping, an academic research technique that allows information to be obtained directly from API servers (Jones and Waller, 2013; Marres and Weltevrede, 2013). The software used for this process was Facepager.

Once the data were collected, a machine learning algorithm for sentiment analysis was developed, which included several text preprocessing phases: tokenisation (removal of nonalphabetic characters), filtering (removal of stop words), case transformation (conversion to lowercase), and stemming (reduction of words to their root form).

For model training, the WASSA-2017 dataset in Spanish, a corpus containing positive, negative, and neutral comments, was used (Mohammad and Bravo-Marquez, 2017). The support vector machine (SVM) algorithm was employed to classify comments into positive or negative valence. Additionally, valence classification was conducted through feature weighting using the term frequency-inverse document frequency (TF-IDF) method, which assigns greater relevance to terms that are less frequent in the collection but more common in the individual document (Martínez Cámara et al., 2011; Teso et al., 2018). The software used to apply the model was RapidMiner.

The performance of the algorithm was evaluated using a confusion matrix, achieving an accuracy of 83.9%, comparable to classification processes performed by human experts (Pang and Lee, 2008). Finally, the model was applied to the collected comments, assigning a valence score to each Facebook post shared by the mayoralties, with values ranging from 0 (negative) to 1 (positive).

3.4 Content analysis and operationalisation of independent variables

To operationalise the dimensions of political stability into variables, the coding approach originally proposed by da Cruz and Rui (2016), later refined and operationalised by Teles et al. (2022), was adapted to the Colombian context.

Political legitimacy was measured as the percentage of registered voters who exercised their right to vote. Meanwhile, political strength in decision-making was assessed by considering the degree of political competition and the proportion of councillors elected from the ruling party who publicly support the executive's policies (Muñoz and Bolívar, 2015; PradoLorenzo et al., 2012; Nelson and Nollenberger, 2011). In Colombia, the composition of the municipal council is determined by the E26 document from the National Civil Registry (2019), which specifies the number of councillors from the governing party, coalition, independents, and opposition.

The variable Political Strength in Decision-Making seeks to neutralise the impact of municipality size on the number of councillors. This is calculated as the proportion of councillors belonging to the ruling party and/or coalition (CpG) relative to the total number of council seats (TConc), using the formula $A2 = CpG/TConc$. Here, CpG represents the number of councillors from the ruling party or a coalition supporting the executive, while TConc is the total number of council seats. Dividing CpG by TConc provides a value indicating the proportion of political power held by the ruling party in the council. A higher value suggests a greater capacity of the executive to implement its policies with council support, thus reflecting greater political stability in terms of institutional backing.

To measure policy continuity, the 2020 Municipal Performance Measurement (MDM) Viewer, with an emphasis on security, was used. In Colombia, municipal planning is governed by Law 152 of 1994, which establishes four-year development plans (Art. 40) aligned with long-term national objectives (Art. 32). The National Council for Economic and Social Policy (CONPES), created by Law 19 of 1958, coordinates these policies as the highest authority in national planning (National Planning Department, 2022).

The democratic security policy, established by CONPES 3460 in 2007, has been a central strategy for nearly two decades (Garay et al., 2018), with significant implementation in the Coffee Cultural Landscape municipalities (Basset, 2018). However, the implementation of the peace agreement (Fortou and Sosa, 2020) and changes in local political dynamics following the 2019 elections have highlighted the importance of evaluating the continuity of this policy in the face of shifting political interests.

To this end, the MDM 2020 was analysed, specifically in the area of security. This indicator measures the effectiveness of implementing central public policies in each municipality, assigning a value based on the number of security incidents per 10,000 inhabitants, where zero represents the ideal (National Planning Department, 2020). This measurement allows for the evaluation of the continuity and effectiveness of security policies at the local level, providing insights into political stability and governance in the studied municipalities.

A summary of the operationalisation of the variables is presented in Table 3.

Table 3 Measurement of political stability variables

<i>Dimension of Political Stability</i>	<i>Underlying Variable</i>	<i>Operationalisation</i>	<i>Measurement</i>
Political Legitimacy	Voter participation according to the municipal electoral census	% of citizens who exercised their right to vote	(Number of votes cast/Total number of registered citizens in the electoral census) * 100
Political Strength	Decision-making participation of majority parties in municipal sections	Proportion of political power of the ruling party in the legislature	$A2 = CpG/TConc$; where CpG = Councillors from the ruling party or coalition; TConc = Total seats in the municipal council
Policy Continuity	Number of long-term public policies in allocation and execution	Security index based on the Municipal Performance Measurement (MDM)	Number of security incidents per 10,000 inhabitants (0 = ideal) according to MDM 2020

Source: Created by the authors

3.5 Empirical analysis

After obtaining the valence of the comments and operationalising the dimensions of political stability, a partial least squares structural equation modelling (PLS-SEM) approach was implemented. Since the indicators for the political stability dimension are formative in nature and directly observable, conventional reliability and validity tests were not required (Sarstedt et al., 2019). However, to ensure the robustness of the model, a discriminant validity test was conducted to demonstrate that the variables do not exhibit excessive correlation with each other. Discriminant validity was assessed using two criteria: the Fornell-Larcker criterion (1981) and the Heterotrait-Monotrait Ratio (HTMT) test (Henseler et al., 2015). These tests verify that each construct is significantly different from the others in the model.

For the Fornell-Larcker criterion, correlations between the underlying variables of political stability (political legitimacy, political strength, and policy continuity) and social endorsement on the social media platforms of the municipalities, including valence and volume variables, were analysed. The results of this analysis are presented in Table 4, which shows the correlation matrix among the study variables.

Table 4 Fornell and Larcker criterion

	<i>Policy continuity</i>	<i>Political strength</i>	<i>Political legitimacy</i>	<i>Valence</i>	<i>Volume</i>
Policy continuity	1.000				
Political strength	−0.069	1.000			
Political legitimacy	−0.405	0.043	1.000		
Valence	0.215	0.169	0.172	1.000	
Volume	−0.300	−0.096	−0.126	−0.353	1.000

Source: Own elaboration using SmartPLS: Ringle et al. (2015) “SmartPLS 3”

The diagonal of the matrix represents the square root of the average variance extracted (AVE) of each construct, while the off-diagonal elements are the correlations between the constructs. To satisfy the Fornell-Larcker criterion, the values on the diagonal should be greater than the correlations in the corresponding rows and columns, indicating that each construct shares more variance with its own indicators than with other constructs in the model. As shown in Table 4, the Fornell-Larcker criterion is met.

To complement the discriminant validity analysis, the HTMT criterion was applied, with the results presented in Table 5. According to Henseler et al. (2015), to confirm discriminant validity, the correlation values between variables should not exceed the threshold of 0.85

Table 5 Heterotrait-Monotrait Ratio

	<i>Policy continuity</i>	<i>Political strength</i>	<i>Political legitimacy</i>	<i>Valence</i>	<i>Volume</i>
Policy continuity					
Political strength	0.069				
Political legitimacy	0.405	0.043			
Valence	0.215	0.169	0.172		
Volume	0.300	0.096	0.126	0.353	

Source: Own elaboration using SmartPLS: Ringle et al. (2015) "SmartPLS 3"

As observed in the HTMT matrix, none of the correlations between the variables exceeds the critical value of 0.85. This indicates that there are no significant issues with heterotraitmonotrait correlations among the variables in the model. Therefore, these results provide additional evidence supporting the discriminant validity of the constructs within the political stability model.

Finally, before proceeding with the estimation of the structural model, it is crucial to conduct a collinearity test. This test is essential for identifying potential strong relationships between dependent variables, which could indicate that they are measuring similar aspects and, thus, affect the validity of the results. To assess collinearity, the variance inflation factor (VIF) is commonly used. According to Hair et al. (1999), the VIF value should not exceed 4 to avoid problems of high collinearity.

Table 6 presents the results of the collinearity test for the independent variables included in our model:

Table 6 VIF values of the outer (Measurement) model

<i>Variable</i>	<i>VIF</i>
Policy continuity	1.000
Political strength	1.000
Political legitimacy	1.000
Valence	1.000
Volume	1.000

Source: Own elaboration using SmartPLS: Ringle et al. (2015) "SmartPLS 3"

As can be observed, all variables present a VIF of 1.000, which is well below the critical threshold of 4 established by Hair et al. (1999). These results indicate that there are no issues of high collinearity among the independent variables in the model. The absence of collinearity strengthens the validity of the model, as it suggests that each variable is measuring a unique and distinct aspect of political stability. This allows us to proceed confidently with the estimation of the structural model, knowing that the relationships between the variables are not distorted by significant redundancies or conceptual overlaps.

4 Descriptive results

Table 7 presents the descriptive results of the study. Regarding the comments, a total of 307,045 comments were collected and analysed during the selected period for the 51 municipalities that make up the Coffee Cultural Landscape (PCCC).

Table 7 Descriptive results

<i>Variable</i>	<i>Mean</i>	<i>SD</i>	<i>Minimum</i>	<i>Maximum</i>
Comment volume	3.468	0.605	2.021	4.397
Comment valence	0.477	0.045	0.391	0.601
Political legitimacy	59.35%	0.0461	48.24%	69.01%
Political strength	34.19%	0.1855	0.00%	90.91%
Policy continuity	3.11	2.93	2.93	15.37

Source: Created by the authors

4.1 Structural model results

The study of the structural model in PLS focuses on estimating and assessing the hypothetical connections between the constructs. Using the bootstrapping technique, the significance of the path coefficients is calculated to evaluate the strength and direction of the relationships between the variables in the model. Table 8 presents the results of the analysed relationships, along with their respective path coefficients and significance levels.

Table 8 Empirical results

<i>Variable</i>	<i>Comment volume</i>	<i>Valence</i>
Political legitimacy	−0.294*	0.307**
Political strength	0.180*	0.146**
Policy continuity	−0.427**	0.351**

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.15$

Source: Created by the authors

Overall, the applied model is appropriate as the included variables show statistical significance. Regarding Political Legitimacy, a negative and significant relationship with Comment Volume is observed ($\beta = -0.294$, $p < 0.15$), while it shows a positive and significant relationship with valence ($\beta = 0.307$, $p < 0.05$). This suggests that higher political legitimacy leads to a lower volume of comments, but these tend to be more positive, supporting H1.

Political Strength exhibits a positive and significant relationship with both Comment Volume ($\beta = 0.180$, $p < 0.15$) and valence ($\beta = 0.146$, $p < 0.05$). This indicates that greater political strength is associated with an increase in the volume of comments and a tendency towards more positive comments, supporting H2.

4.2 Global model fit

When estimating structural equation models using partial least squares (PLS-SEM), it is crucial to evaluate the indicators that determine the quality of the model's fit to the data. One of the most important statistics for this purpose is the SRMR (Standardised Root Mean Square Residual). The SRMR measures the discrepancy between the observed and predicted correlations by the model. According to Hu and Bentler (1998), SRMR values below 0.08 indicate a good model fit. In our case, as shown in Table 9, the SRMR has a value of 0.049, which is well below the threshold of 0.08, indicating an excellent overall model fit.

In addition to the SRMR, it is important to consider other fit indicators to obtain a more comprehensive evaluation. In this regard, the NFI (Normed Fit Index) was also calculated. The NFI compares the chi-square of the proposed model with that of a null model. NFI values above 0.90 are considered indicative of good fit (Bentler and Bonett, 1980).

Regarding Policy Continuity, a negative and significant relationship with Comment Volume is observed ($\beta = -0.427$, $p < 0.01$), but a positive and significant relationship with Valence ($\beta = 0.351$, $p < 0.05$). This suggests that greater continuity in policies is associated with a lower volume of comments, but these tend to be more positive, confirming H3.

Table 9 Global model fit

<i>Indicator</i>	<i>Value</i>	<i>Reference threshold</i>
SRMR	0.049	<0.08
NFI	0.930	>0.90

Source: Created by the authors

As shown in Table 9, the NFI of our model is 0.930, exceeding the threshold of 0.90, which further supports the conclusion of a good model fit. The combination of a low SRMR and a high NFI provides strong evidence that our PLS-SEM model fits the observed data well. This enhances confidence in the identified structural relationships and the conclusions derived from the model.

5 Discussion and conclusions

The applied empirical model provides insight into the relationship between political stability, as a dimension of governance, and digital citizen endorsement in the context of the municipalities of the Colombian Coffee Cultural Landscape. The three dimensions of political stability examined – political legitimacy, political strength, and policy continuity – showed significant effects on both the volume and valence of social media comments, highlighting the importance of these factors in shaping digital public opinion.

Firstly, the negative relationship between political legitimacy and comment volume, along with its positive effect on valence, suggests that higher electoral participation may lead to a less noisy but more positive digital environment. This finding aligns with Waldron's (2018) theory of political legitimacy, which posits that when citizens perceive governmental decisions as fair and representative, they tend to express greater support. However, it contrasts with the studies of Andargoli et al. (2022) and Li (2023), which suggest that higher political legitimacy should lead to a greater volume of positive online interactions. This discrepancy could be explained by the peculiarities of the Colombian context, where high electoral participation might indicate general satisfaction and, thus, less need for expression in digital spaces.

Political strength demonstrated a positive relationship with both comment volume and valence, supporting the hypothesis that greater legislative support for the executive translates into a more active and positive digital environment. This finding aligns with the observations of VanDusky-Allen and Kettler (2021) on how legislators' support bases can be effectively mobilised in the digital sphere. It also concurs with Bernardi's (2018) perspective on how a strong legislative coalition can translate into a narrative of stability and governmental effectiveness in digital media. However, it is important to note that this result might also reflect a bias in digital representation, where supportive voices may be overrepresented due to the active mobilisation of political bases.

Policy continuity showed a negative relationship with comment volume but a positive relationship with valence, suggesting that stability in policy implementation, particularly in the area of security, may lead to less online discussion but of a more positive nature. This finding aligns with the literature that emphasises the importance of policy continuity for political stability and development (Boston and Berman, 2017). However, it also raises questions about whether a lower volume of comments might indicate a decrease in digital civic engagement, an aspect that warrants further investigation.

It is noteworthy that these results were obtained in the context of a pandemic (the year 2020), which may have influenced the dynamics of digital interaction. The health crisis could have increased citizens' reliance on digital platforms to interact with their local governments, possibly amplifying the observed effects. This contextual aspect adds an additional layer of complexity to the interpretation of the results and underscores the need for longitudinal studies that can capture how these relationships evolve in different contexts.

Moreover, the findings of this study contribute to the growing body of literature on the role of social media in governance and citizen participation. They reinforce the observations of Bonsón et al. (2017) regarding the direct relationship between social media use and support for local government institutions and align with the conclusions of Kim and Lee (2012) on the crucial role social media can play in supporting democratic processes. However, they also raise important questions about the representativeness of digital interactions and how these relate to offline opinions and behaviours.

6 Limitations and future research directions

This study, while providing valuable findings, has certain limitations that should be considered. Firstly, the focus on a specific geographical area (the Colombian Coffee Cultural Landscape) and a particular time period (2020) may limit the generalisability of the results. Additionally, the exclusive use of Facebook data might not fully capture the diversity of digital citizen interactions. Future research could expand the geographical and temporal scope of the study and include other social media platforms to obtain a more comprehensive picture. It would also be valuable to explore how contextual factors, such as the COVID-19 pandemic, may have influenced the results. Another promising line of research would be a longitudinal study to examine how these relationships evolve over time.

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