

Analysis of citizen participation after the Mexican constitutional reforms of 2012 through the K2 logarithm of a Bayesian network

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Abstract—Citizen participation is a theme that has developed in government at the federal, state and municipal level in Mexico. For this reason, various agreements, laws, and reforms have been made that strengthen this as a right of Mexicans, such as the reforms of 2012 and earlier that have sought the participation of citizens in public affairs. For this reason, we have analyzed the variables of citizen participation, participation mechanisms, and organizations that represent the structure of citizen participation institutions obtained by the National Census of Government, Public Security, and State Penitentiary System, (2013). Likewise, these variables have been studied through a Bayesian network model that by its characteristics allows a greater probabilistic degree to determine the relationships between them, in such a way that the results allow to see the degree of participation of each one of the variables after the reforms.

Keywords—*citizen participation, Bayesian network, algorithm, states of the Republic, Mexico.*

I. INTRODUCTION

The present study has the objective of analyzing the citizen participation in the states of the Mexican Republic, in the year 2013 after the constitutional reforms referring to the issue in 2012, which start from the demand of the civil society to participate in the political life more frequently and in transcendental decisions. In this sense, the work provides an overview of what has led to these changes further out to encourage the participation of society d. This is through the analysis of the actions and tools that have been taken into account in all the states to encourage the intervention of citizens in public affairs.

Because of the above, the analysis was carried out through the indicators presented by the National Institute of Statistics and Geography (INEGI) through its National Census of Government, Public Security and Penitentiary System State (2013) which determines the variables and indicators to analyze citizen

participation in open databases. Likewise, this database is processed through the ELVIRA program for Bayesian networks, used for its technical characteristics and reliability in the processing of variable relationships .

Similarly, the analysis using this tool and the INEGI database is based on the assumption that after the 2012 reforms, each of the variables and elements that make up the state-citizen participation in Mexico is homogeneous in terms of their application to encourage participation in 2013.

As a result, each one of the variables has been obtained in a percentage way: mechanisms, themes, and organisms that integrate citizen participation in all the states. Where each of the variables indicates in what percentage level each of the sub-variables corresponding to each one is located. That is, what mechanisms are currently occupied, which topics are taught and which organizations have a greater presence. Likewise, the determination of which are the variables that integrate to a greater extent the structures of the institutions of citizen participation.

Background and context

In Mexico, actions have been carried out that encourage citizen participation. Fundamentally, they have been strengthened through reforms and laws that originate this process as a right for society. In this sense and as a recent antecedent, the constitutional reforms of citizen participation made in 2012 that give greater involvement to society in public affairs are taken into consideration.

Likewise, one of the public institutions that have determined the forms and variables to analyze citizen participation is INEGI (2013) which mentions four variables: participation and / or citizen consultation bodies , participation mechanisms and / or citizen consultation , issues of participation and structure of the institutions contained in each of the states that make up the national territory. Likewise, this study is based on

Bayesian networks that determine the level of relationship that each of the elements has.

Thus, the Bayesian network is used in this study for its characteristics, since they are statistical tools oriented to the quantitative and qualitative two-dimensional graphics model (Martínez and Rodríguez, 2003). In other words, they serve for the modeling of a phenomenon through a set of variables and the relationships that exist between them. Fundamentally, they represent the relationships graphically to support a probabilistic analysis. Likewise, they determine the level of dependence or independence of each variable, thus showing the strength of the relationships they have between them.

Hence four variables were considered INEGI (2013) regarding citizen participation mentioned above with their respective sub - analysis variables found in open processing program formats Bayesian networks. It should be noted that the analysis using the Bayesian network and precisely with the ELVIRA software has several advantages, such as greater probabilistic precision, identification of the relationships between variables, identification of dependent and independent variables more quickly, allow representing the qualitative dimension and quantitative in the nodes to be processed. Likewise, this processing is done in a more practical and compact way, in terms of the precise determination of relationships and statistical probabilities, for this reason, it represents a great analysis tool.

Development of citizen participation in Mexico

The word participation itself has different meanings, however, it refers to purposes that involve involving society in the participation in solving problems, seeking solutions or converging wills (Merino, 1995). Even with the broad significance of the term, it represents the human will to create agreements. That is, it is fundamental in social relationships, since it allows to be involved in decision - making, if there are a number of people who are not included, they are participating in giving confidence to another group in taking the decisions. Therefore, there will always be a partition even if it is not complete.

Likewise, it is observed through two dimensions: as the means of political socialization, in which society is represented; and as the way to expand the public area towards the field of civil society, the involvement of society in public matters in favor of it (Cunill, 1991). In this sense, participation is an important tool for the public sector by virtue of which it involves society and reaffirms that important decisions are represented by the will and criteria of citizens.

There are different forms of participation, such as; social, where individuals belong associations or organizations (Villareal, 2010 cited by Serrano, 2015); citizen, where society has a direct interference with the State, (Serrano, 2015); politics, citizens are involved in political systems, (Somuano , 2005); and community, unification of citizens to address issues of the community (Cunill, 1997). As analyzed, each of the forms seen above has in common to involve citizens in public affairs.

On the other hand, participation fosters the processes of democratization, where through it citizens check the influence of their decisions. Likewise, it contributes to the process of public policies of better quality, increased trust in public institutions and stronger democracy (Guillen et al ., 2009). For this reason, it is necessary to strengthen participation processes, since it has advantages that give credibility to government decisions. At the same time social problems are solved through the plaintiffs, therefore it is a win-win process.

However, the issue of participation involves various objectives and instruments through which they are carried out. Guillen *et al.* (2009) have integrated it in relation to the objective and specific instrument of each, which is shown below in Table 1.

Table 1. Objectives and instruments of citizen participation (Guillen *et al.*, 2009).

	Report	Consult	Involve	To collaborate	Empower
goals	- Give information to the public so that it understands the problems and solutions	- Feedback to the public on the analysis of alternatives and decisions.	- Work with the public throughout the process.	- Colgate with citizens.	- Final decision at the will of the public.
Instruments	- Datasheets - Internet pages - Office visits	- Public comments - Focus groups - Surveys - Public Hearings	- Workshops - Deliberate voting or discussion panels before the vote.	- Citizen advisory councils - Consensus building - Participatory decision making	- Sworn citizens - A voting delegation of decision is. - Delegation of decisions

The above objectives show that an involvement of society in identifying problems, finding solutions and making decisions, as mentioned above. Likewise, some of the instruments that help carry out the objectives, collect the information that society has determined necessary to carry out the participation, wherein some objectives the creation of bodies as such are necessary to strengthen them.

With regard to the issue of citizen participation in Mexico, there is a history of it in the years 1928 to 1940 with the Organic Law of the Federal District and the Federal Territories LODFTF, where through it the Advisory Council of the Mexico City (CCDM), considered by law as citizen participation bodies (Espinosa, 2004). Fundamentally, through the advisory councils, they represented the interests of the citizens, where they could be part

of the proposed reforms for the regulations, as well as externalize the demands of public services.

In the same way, in the nineties, constitutional reforms were carried out that focused on citizen participation in public administration (Cunill, 1997). From this date forward actions have been taken that give greater participation to society to get involved more and more in public affairs.

Later in 2012, a process of constitutional reform of citizen participation was carried out with emphasis on carrying out a broader process. This is important fundamentally because the central axis of the reform is citizen participation since it has the requirement of civil society to recognize that citizens participate in political affairs, not only of votes in elections, but in most of the possible in public decisions (Rodriguez, 2015). This year, as the author points out, it is marked by the fact that the inclusion of diverse forms of citizen participation in the Political Constitution of the United Mexican States, CPEUM, is very important since it is legally and consequently based on it makes generally observed TATES that make up the Mexican Republic.

Likewise, in 2008 seventeen states of the Mexican Republic already have a citizen participation law (Serrano, 2015). In this context, participation has been strengthened in the legal frameworks that govern the country, since, as mentioned above, there are many advantages in carrying out this process.

On the other hand, some studies, such as that of Arzalus (2013), was analyzed citizen participation in Mexican municipalities, where it classifies the topics and types of mechanisms through which it is carried out. In addition, notable success stories such as the state of Chiapas, which has taken actions to include citizens in public decisions, encouraging the participation of citizens in general as well as indigenous groups through advisory councils. In this context, the issue of citizen participation is heterogeneous in terms of results and the involvement of society. It is worth mentioning that due to cultural diversity, among other factors, they could explain the diversity of forms of participation.

Similarly, Hevia, Vergara, and Avila (2011) develop a study of citizen participation in the federal government, which was found by analysis and revision of laws the existence of instances of non - governmental participation in Mexico. However, it is difficult to measure the effectiveness that they have to promote citizen participation, but it is not impossible since indicators can be created that can carry it out. In this sense, in the states there are various bodies or institutions that promote social participation, however, monitoring

is necessary to identify how this process occurs in each territory of the country.

Therefore, it is important to analyze what is happening in terms of citizen participation in each of the states of the Mexican Republic, since as rights embodied in the constitution, it is necessary to observe the panorama regarding the topic.

II. MATERIALS AND METHODS

Bayesian network models are considered techniques that analyze several variables of a given phenomenon to give immediate inferences, which other models do not allow (García *et al.*, 2016). In this sense, tools such as computer programs are used to process information through open sources of data, which are structured and ordered in their content for processing.

On the other hand, Bayesian networks are used in the area of Artificial Intelligence for the approximation analysis. Fundamentally they use nodes that refer to variables or concepts, where their links belong to relationships that occur between them. Therefore, these relationships mean deductions cause represented in terms of probabilities condition where (Torres *et al.*, 2017) or qualitative discrete domains are used as shown in the following equation.

$$P(x_1, \dots, x_n) = P(x_i | \text{parents}(x_i)) \quad (1)$$

Similarly, Hruschka *et al.* (2007), mentions that the use of Bayesian networks determines the indeterminate variables relationship in advance. In effect, they quantify and describe the relationships found, even with the lack of data in their entirety. In other words, the result of these networks depends on the distributive probability of the input variables, nodes, which are random and discrete, as shown in equation 2.

$$P(c_j | x_i) = P(x_i | c_j) P(c_j) / P(x_i | c_k) P(c_k) \quad (2)$$

The most representative method of machine learning in the artificial intelligence approach is the K2 algorithm. This method is widely used even if it has the disadvantage of requiring the specification of an enumeration order in variables. The idea is to maximize the probability of the structure given the data in the search space of the cyclic graph directed respecting this order of enumeration.

Technique and Method

For the present investigation and with regard to the tools for the processing of the Bayesian network, a Le Novo computer has been used, with a Windows 7 Starter operating system, Intel Celeron processor and a 32-bit operating system. regarding the technical characteristics. Likewise, in software or executable program called Elvira v 0.162, which shows the relationship that exists between the variables used and that is based on Bayesian network models.

In order to carry out the study, information on the variables was obtained from the portal of the National Institute of Statistics and Geography (INEGI), specifically from the National Census of Government, Public Safety and the State Penitentiary System (CNGSPSPE) (2013). In such a way that I determine the dependent variable citizen participation and the independent ones as mechanisms of participation, organisms of participation and subjects of citizen participation that integrate the general process.

In agreement with the independent variables, some of them with their sub-variables are present in each of the States of the Mexican Republic. However, it is not known which of them is higher level in them. Therefore, the grouping of the variables is done in numerical codes obtained from the INEGI database in XLS format, for which the database conversion will be carried out with the ELVIRA program with its respective K2 logarithm for its later probabilistic analysis, the XLS variables are arranged in the following table:

VARIABLES OF CITIZEN PARTICIPATION BY STATE

Entity		code	Variables
		No.	Participation organizations
one	Aguascalientes	one	Community assemblies
two	Baja California	two	Citizen consultation assemblies
3	Baja California Sur	3	Citizen councils
4	Campeche	4	Advisory councils
5	Coahuila de Zaragoza	5	Public safety advice
6	Colima	6	Citizen committees
7	Chiapas	7	Social Organizations
8	Chihuahua	8	COPLADE or counterpart
9	federal District	9	State delegations (made up of citizens)
10	Durango	10	Organs of social comptroller to works and / or public services (integrated by citizens)
eleven	Guanajuato	eleven	Traditional organizations
12	Warrior	12	Other
13	gentleman	99	You do not know
14	Jalisco		Participation mechanisms
fifteen	Mexico	one	Visits of authorities to communities or colonies
16	Michoacán de Ocampo	two	Forums or days of citizen attention in government offices
17	Morelos	3	Request reception modules
18	Nayarit	4	Telephone line with exclusive use for citizen participation
19	New Lion	5	Email with exclusive use for citizen participation
twenty	Oaxaca	6	Website of the Public Administration of your Federal Entity, or a link within it, for citizen participation
twenty-one	Puebla	7	Supervision of public works and / or services
22	Queretaro	8	Popular queries
2. 3	Quintana Roo	9	Surveys
24	San Luis Potosi	10	Other
25	Sinaloa	99	You do not know
26	Sonora		Issues of citizen participation
27	Tabasco	one	Planning
28	Tamaulipas	two	Evaluation
29	Tlaxcala	3	Comptroller
30	Veracruz	4	Surveillance and / or reporting of public servants
31	Yucatán	5	Transparency
32	Zacatecas	6	Design of regulatory provisions initiatives
		7	Public security

	8	Transit
	9	Civil protection
	10	Public services
	eleven	Public Works
	12	Urban Development
	13	Social development
	14	Economic development
	fifteen	Environment
	16	Ecology
	17	Allocation of resources of Funds or Trusts
	18	Others
	99	You do not know
Structure		
	1480	Organs of participation and/or citizen consultation
	1490	Mechanisms of participation and/or citizen consultation

Due to the above, and due to the advantages of the ELVIRA program in terms of Bayesian network models, a study was carried out with a quantitative approach regarding the processing of information. Likewise, a qualitative approach for the description and analysis of the characteristics of the variables and their results through the descriptive study by virtue of which it can be interpreted and described. Finally, the technique of data collection will be through the use of a digital format of the content of the information for citizen participation.

III. RESULTS AND DISCUSSION

The results of the processing of information from the "CSV" file of the ELVIRA program are shown below. First, the dependent and independent variables that makeup citizen participation according to the database have been determined. It was found that the entities and participation issues are independent, that is, in the case of entities, it refers to each and states Republic, which by themselves already exist beforehand and cannot be manipulated by other variables. On the other hand, in the case of participation issues, they are independent for what they essentially represent, in other words, the involvement of the people or the free will that they represent, likewise they may or may not be in the mechanisms, agencies or structures of participation without this directly relating them, as shown in figure 1 below:

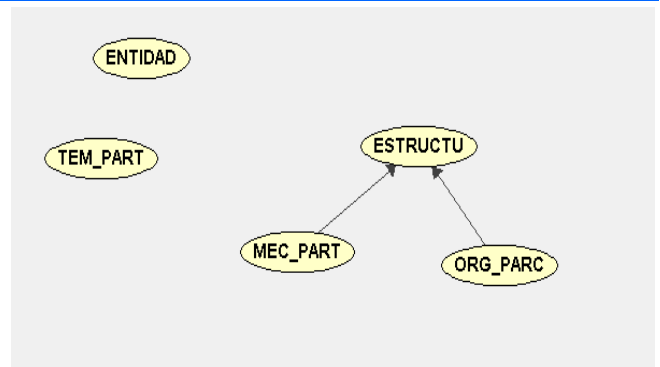


Fig. 1. Determination of variables and their interrelation.

Likewise, according to figure 1 above, it is observed that the only dependent variable is the " participation structure ", which is related to other independent variables such as " participation mechanisms " and "participating agencies". In this sense, the " structure " directly involves these variables, where both reinforce each other in order to build a space dedicated to taking into account the perspectives and points of view of the citizens. On the other hand, it is necessary to remark that the structure remains without dependence or without relation to the states and the Participation Terms because in it it is not necessary that there is a determination of topics that must follow the mechanisms or organisms.

Moreover in Figure 2, is obs even the result of processing raw, that is, as shown in the system to subsequently give a qualitative interpretation. Each of the results is shown for each of the four dependent and independent variables in terms of their sub-variables. Also, these results are by the codes of the table of contents that are indicated by percentage in each one of them.

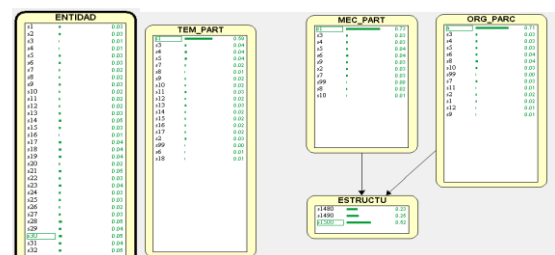


Fig. 2. Inferences of the variables of citizen participation.

Then, the analysis is done through graphs as tools for the analysis of the information which is based on the study of subjects, mechanisms and participation organisms in the 32 states, wherein each category a graph is shown that shows the sub-variables.

The first graph corresponds to issues of citizen participation, in which the theme of the greatest delivery is that of planning with 59% M; followed by comptroller, vigilance and transparency with 4%; evaluation topics with 3%; and finally, the design of regulatory provisions, public safety, transit, civil

protection, public services, public works, urban development, social development, economic development, environment, ecology, allocation of funds or trusts, and others. It is not known, each one with less than 2%. This can be seen in Figure 3.

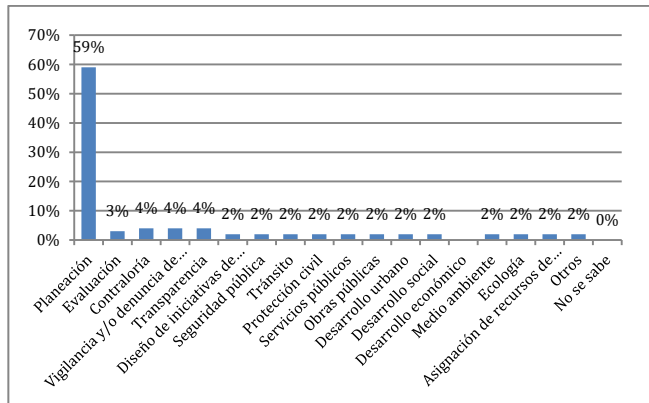


Fig. 3. Topics of citizen participation in the Federative Entities.

As it was seen previously, the main subject taught in the federative entities is that of planning in a general way, which implies that the citizens are taken into account in the initial aspect of the decision making in the government. Some other topics that have a lower percentage refer to specific topics that require a certain degree of knowledge for society in general.

On the other hand, as regards participation mechanisms, the one that is most used is the visits of authorities to the communities or colonies with 73%; followed by email with exclusive use for citizen participation, website of the public administration of the Federal Entity with 4% in both cases; then reception modules of requests, exclusive telephone line for participation, state delegations, forums or conferences, supervision of works with 3%; and finally, with 2% and 1%, popular consultations and others (Figure 4).

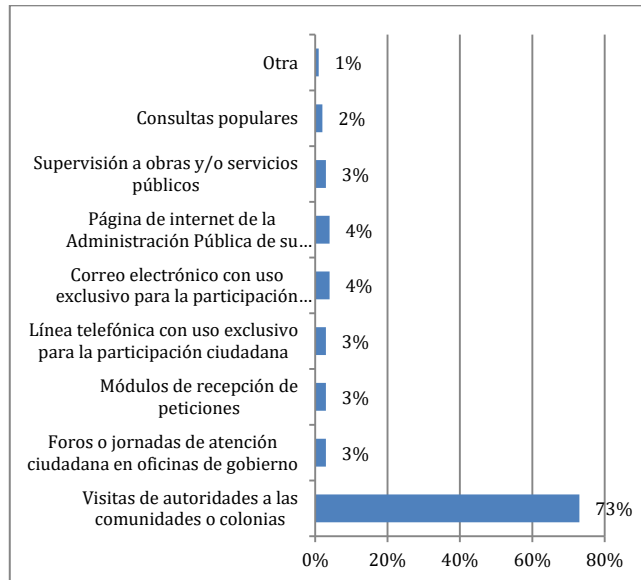


Fig. 4. Citizen participation mechanisms.

In this scenario, this can be an effective and viable mechanism, that is, it gives better results when there is a direct relationship between government and society, that demands and solution proposals are widely heard through this tool. Likewise, the other mechanisms have a low percentage, this can be due to several factors, such as lack of knowledge, lack of confidence and diffusion of the same.

In the same way that the mechanisms, citizen participation bodies directly shape the structures in the financial entities. In this sense, the organisms mostly used are the community assemblies with 71%; followed by citizen committees and social organizations 4%; later by citizen councils, advisory councils, public safety councils, comptroller bodies, traditional organizations, with 4%; finally, assemblies of citizen consultation, state delegations with 1% (Figure 5).

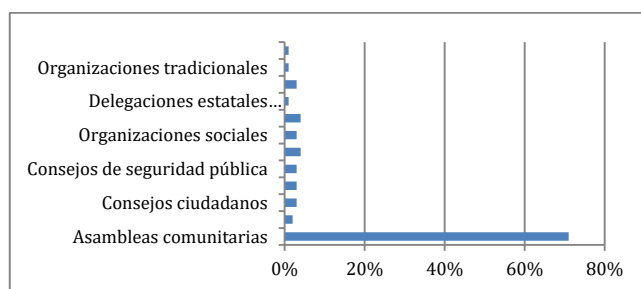


Fig. 5. Citizen participation organizations.

Finally, regarding the structure of institutions, variable that indicates the level or greater presence of the first three variables, that is, of how much participation, mechanisms, and issues of participation represent the structure of the institutions that promote citizen participation.

Therefore, the following data were found: subjects of citizen participation with 52%; citizen participation mechanisms with 25% and citizen participation bodies with 23%. In other words, what it means is that participation issues represent a large part of the structures of participation, followed by the mechanisms and finally the organisms. In this sense, there is a government initiative to encourage participation, there are bodies that strengthen it and mechanisms by which they are carried out.

IV. CONCLUSION

This study covers the period 2013 after the modification of the constitutional reforms of citizen participation in Mexico, which in general have improved the policies of citizen involvement in the development of government plans. Likewise, the relationship that exists between the variables under study in this investigation with the K2 algorithm was identified.

Moreover, although the issues of citizen participation appear to have a greater presence in the structure of participation by e states, it is necessary to strengthen mechanisms, as to expand the coverage of these is crucial to wider dissemination through mechanisms. Likewise, it is necessary to use larger participation organizations so that mechanisms and issues can be included in the same way, which would allow greater transmission of participation.

Likewise, it is necessary to expand the use of mechanisms, organizations and participation issues, since in most cases they are concentrated in only one, which is inefficient in terms of dissemination and use of the existing structure, ie If there were more useful in all mechanisms and agencies, more citizens could be included in the relationship with the government.

Regarding the three variables of participation, mechanisms, and organisms, each one shows a sub-variable that has greater strength or presence. In this sense, it is necessary for the government to use strategies to disseminate the others that did not get much intervention. In other words, it is necessary to analyze the limitations they have had and to rethink each of them focusing on the needs of the citizen, since they all show a heterogeneity which replaces the assumption of research which is based on the fact that homogeneity would be found in the application of each of the variables.

Finally, being part of a study of 2013, this research could be comparative with the current data regarding the issue of citizen participation since with the advancement of technology and the process of

changing habits in society it is necessary to determine the current scenario regarding the issue in the entities.

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