

No Accountability without Transparency and Consistency: Redistricting-by-Formula in Mexico

09/09/2021

Abstract

An independent bureaucracy has carried out automated redistricting processes in Mexico since 1996. However, the process of “fine-tuning” the plans that are initially produced by formula is conducted behind closed doors where parties and experts are allowed to offer proposals. This raises questions about the necessary conditions required for a bureaucracy to operate in a transparent, consistent, and accountable manner. Our research examines this question through the analysis of private records that trace the bargaining process that takes place between parties and bureaucrats. Our results uncover substantial gaps in *transparency* and *consistency*. We highlight the strengths of the process and offer policy recommendations that can help improve the quality of redistricting.

Keywords: electoral management, independence, integrity, redistricting, optimization, transparency, accountability.

Word Count: 8,127 (including references and excluding *Online Appendix*).

1. INTRODUCTION

Boundary delimitation is among the most technically and legally complex processes within electoral management (Handley and Grofman 2008). Despite its significance for democratic representation, the study of rulemaking, adjudication, and application in redistricting remains largely understudied across third-wave democracies. In this article we use Mexico’s redistricting experience to address the “delegation dilemma” and its link with the general problem of balancing bureaucratic control and the inclusion of political parties within electoral management.

Since the 1990s, redistricting in Mexico has been carried out by a formally independent bureaucracy with a “non-partisan” *executive board* responsible for managing elections. Political parties, however, were included at multiple administrative levels of the bureaucracy since the board's inception and have played a central role for the credibility of elections, especially during the country's transition to democracy (Woldenberg 2012, Estévez et al., 2008, Mozaffar and Schedler 2002).

This institutional setup exemplifies the underlying tension some countries face when parties are formally embedded in electoral management as a “fire alarm” mechanism

in order to guarantee rule compliance and the neutral implementation of policy procedures (McCubbins and Schwartz 1984). Furthermore, a better understanding of the interaction between political parties and the purportedly independent electoral bureaucracy at different administrative levels complements the ongoing debate in the electoral governance literature focusing on delegation and electoral independence (Mozaffar and Schedler 2002: 16).¹

This debate has traditionally focused on a threefold classification of formally independent electoral management bodies (EMBs) – *partisan, mixed, and independent* – based solely on the composition of the *executive board* or the institutional mechanisms used to appoint its members (Molina and Hernandez 1999, Hartlyn et al., 2008, Rosas 2010, and Lara Otaola 2018).² It overlooks, however, the different ways in which political parties can be embedded within *de jure* independent electoral bureaucracies, their role as “watchdogs” contributing to electoral integrity, or the degree to which they act as “distrustful principles” constraining the role of the “agent,” in this case the bureaucracy, during the implementation of specific policy procedures.

We argue that the delegation chain in democratic representation has three links: i) from citizens and interest groups to legislative parties; ii) from legislative parties to administrative agencies responsible for managing elections; and iii) from an administrative agency to experts (e.g., *a technical committee*). When parties are invited to observe and engage in the process, all information and decision-making needs to be both *transparent* and *consistent* in order for redistricting -- and, thus, the electoral system -- to be truly accountable and to render a more democratic process.

Here, we analyze bureaucratic-partisan behavior that has been operating behind closed doors within a formally independent bureaucracy. The discrepancy between a purportedly transparent automated process and this closed partisan bargaining interaction

¹ Related work to the delegation and independence debate in electoral management: Molina and Hernandez (1999), López-Pintor (2000), Birch (2008 and 2011), Hartlyn et al., (2008), Estévez et al. (2008), Rosas (2010), Ugues (2014), Norris (2014), Tarouco (2016), Lara Otaola (2018), and Trelles (2018).

² According to IDEA (2021), 131 countries have delegated to formally independent EMBs the responsibility to manage elections. Most of them are third and fourth wave countries across the Global South. See: <https://www.idea.int/data-tools/world-view/54>.

raises a broad set of questions related to *transparency* (e.g., Are Mexico's redistricting rules complete, exhaustive, and unambiguous?) and *consistency* (e.g., Were the 2013 and 2017 redistricting processes compliant with the law? Have discretionary rules been applied consistently within and across processes? Are the observed outputs consistent with how the process was officially portrayed?).



In sum, outsiders in the past have been unable to assess the degree of political manipulation during Mexico's redistricting. We examine the extent to which technocrats supplanted politicians by analyzing how the electoral bureaucracy interacted with political parties within the independent board in the 2013 and 2017 redistricting processes (Lujambio and Vives 2008, Trelles 2017). We utilize a novel dataset comprising the entire set of plans proposed by political parties that has remained unavailable outside the Mexican bureaucracy. Our analysis offers a unique insight into the internal workings of Mexico's independent electoral commission and provides guidance for narrowing the *transparency*, *consistency*, and *accountability* gaps in redistricting.

2. THE ROLE OF TRANSPARENCY AND CONSISTENCY IN REDISTRICTING

It is well established that *transparency* and *consistency* are critical for decision-making in general, and electoral integrity in particular, to be accountable (Fung 2007; Hollyer et al., 2011, Norris and Nai 2017). The principles are these:

Transparency: All steps of the process are publicly available, before, during, and after the decision is made. This includes preparation, planning, discussions, and execution. Rules must be universally available, including relevant constitutional articles, statutory codes, regulations, administrative agreements, and even informal practices. So must be all evidence relevant to the operation of the process, including inputs (e.g. data), actions (e.g. proposals and evaluations), and outputs (e.g. winning plans).

Consistency: Decision-making rules are unambiguous, and consistent with each other. That is, rules do not contradict one another, and the rationale for subordinate

rules is consistent with the goals of higher-order rules. Rules and evidence are consistent. No action should be forbidden by a rule; and the overall pattern of outcomes should be broadly consistent with the declared goals.



A process that is simultaneously *transparent* and *consistent* is also *accountable*. For example, a citizen, interest group, or judge who wants to assess the system, compare outcomes, evaluate whether or not goals were met, or if the decision was politically neutral, would need access to a wide variety of information in accessible formats (Trelles et al., 2016).

As noted by Alvarez and Hall (2008), these principles are closely aligned with legal theories of evidence – e.g., *chains of custody* – and public administration theories of *standard operating procedures* (SOPs) that are key for electoral integrity. In the case of the former, a process that is both *transparent* and *consistent* helps to ensure that there has not been an “abuse of discretion” by the bureaucracy in managing “the evidence” and to guarantee that there is no bad faith of any of the bureaucratic actors involved in the process (Park et al., 2004). In the case of the latter, SOPs reduce uncertainty in complex bureaucratic interactions because they create operating environments and routines that generate credible, predictable, and verifiable outcomes (Johnson 1990, Guy 1990, LaPorte and Consolini 1991, Rijpma 1997, Norris 2017).



A redistricting process characterized by *transparency* and *consistency* for instance, would allow an external agent – e.g., an independent citizen, a minority group, or a court – that is interested in understanding how it works – e.g., its different phases, the actors involved, and decision-making process – to evaluate the process simply by looking at the information that is made publicly available. With this information, the agent should be able to verify if the goals were met and if decisions were consistently applied based on a public operational and normative framework.

In order for information to be complete, all information related to *algorithmic decisions* would need to be available – including the definition of the cost function, algorithm, the executable software used by parties, the source code, as well as the main input data. Furthermore, all information related to the *bureaucratic and partisan*

interaction would also need to be public – e.g., all plans that were generated by machines, bureaucrats, and parties, as well as the record of decisions and justifications for selecting plans.

Overall, Mexico's EMB has become a reference of good bureaucratic standards among its regional counterparts. From our perspective, however, INE still has important pendings to make the process more transparent, inclusive, and available to the public (Trelles et al., 2016). Most of the formal rules governing the process, for instance, are publicly available (e.g., any person can access an online version of the constitution, the electoral law, or the EMB's regulations and agreements). A first challenge to access all of the relevant information, however, is that it cannot be found in a single repository – for a single or multiple processes. It would be a daunting task for an external actor to collect and understand the redistricting process in a single year or how it has changed – and why – over time.

A second problem, and perhaps a more important one, is that not all information related to the process is made available. When looking at how bureaucrats interact with political parties, for instance, the data, software, and partisan counter proposals have not been made public. That is, an external actor would not be able to replicate the process or evaluate if the objectives were met with publicly available information. Even if a group of scholars or electoral experts gains access to such information, it is not possible to verify or interpret the decision-making process of the EMB's bureaucracy and the Technical Committee by only looking at formal rules and outputs.

A third problem is that where information was made available, we should also ask whether it was timely. That is, *was all relevant information related to these different levels provided ex-ante or ex-post?* Despite Mexico's electoral commission has progressively made more information available to the public over the years (i.e., formal rules and final cartographic output), this has only been done *ex-post*. That is, it would be practically impossible for an external actor to access, replicate, evaluate, and participate in any of the stages of the process in real time with publicly available information.

Lastly, there have been informal and *de facto* rules that have governed the process and that *have not been properly explained and justified*. For example, it has not been clear

how the EMB weighs *socioeconomic, cultural, security, or geographic* considerations against the cost function during the partisan interaction phases. Communication between electoral officials and political parties needs open and formal procedures that should be available for all parties. All actors should be able to express their interests and understand how to communicate them formally. At the same time, the authority should be clear in how those interests will be processed.



3. MEXICO'S REDISTRICTING PROCESS



3.1 The Phases of Redistricting

Mexico's electoral management board is responsible for drawing the three-hundred single-member lower chamber federal districts apportioned among the thirty-two Mexican states. The process begins with the *executive board* appointing a *technical committee* responsible for producing plans for every state according to an explicit scoring function. It ends with the *board's* approval of the final scenario suggested by the TC (Trelles and Martínez 2007 and 2012, Trelles et al., 2016, and Trelles 2017).³

In-between, the TC and political parties represented within the electoral board engage in a five-step process where a computer generates an initial districting plan, parties offer counter-proposals, and the TC selects a final scenario that is later considered by the *board* during the final stage. This process resembles an informal New Jersey's state legislative *Apportionment Board* norm. Since the 1980s, the eleventh member of the New Jersey commission (appointed by the State Supreme Court) has selected the best scoring plan from those submitted by the two major political parties, according to an explicit scoring function that prioritizes the criterion of *partisan fairness* (Stokes 1993).

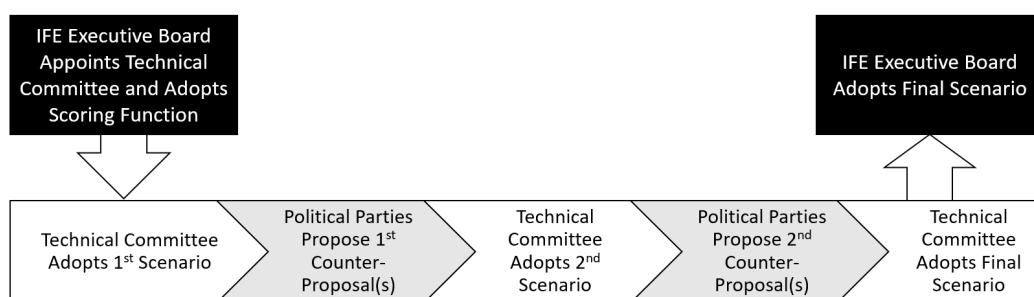
Like New Jersey, Mexico's *electoral commission* uses an explicit scoring function and the parties are encouraged to submit proposals for consideration by a "judge," here, the TC. However, Mexico's redistricting process departs from the one in New Jersey because rather than relying on a single-shot "divide the dollar" game where the two political parties

³ For a detailed account of the history and rules governing the process see the *online appendix*.

are encouraged to out-bid each other by proposing the most politically fair plan, the EMB uses an automated algorithm to set a benchmark that any national party may attempt to beat by presenting a lower-scoring counter-proposal during two consecutive rounds of play.

We depict Mexico's ~~redistricting~~ process in Figure 1. It begins with the *board's* definition of criteria and the appointments of the TC, composed of external experts in areas such as demography, cartography, statistics, optimization, and indigenous population.⁴ Although the criteria for redistricting are derived from Article 53 of Mexico's Constitution, the EMB's *Consejo General* approves the type, number, and hierarchy of the criteria that will be used, as well as the timeline and stages involved in the process. Historically, the most important restriction has been population balance across districts, allowing for a considerable deviation oscillating between +/- 10 and 15 percent, followed by additional criteria such as geometric compactness, preserving municipal boundaries, traveling time, and the inclusion of minority groups.

Figure 1. Phases of the Redistricting Process in Mexico.



Next begins the mapping process. The TC produces the “first scenario” map for each state using an in-house optimization process. The *committee* defines the type of optimization algorithm to be used, the number and type of restrictions included in the cost function, and assigns the weight that each measure will receive. Then, political parties represented within the EMB's *national oversight commission* (known as *la Comisión*

⁴ The TC is chaired by an electoral official who plays an administrative role and serves as a connection point between the technical experts and the different bureaucratic areas (e.g., the census bureau, the registry of voters, or the EMB's cartography and information technology departments).

Nacional de Vigilancia or CNV) and the *local oversight commissions* across the thirty-two states (known as *Comisiones Locales de Vigilancia* or CLV's) are invited to propose an alternative plan. The TC then evaluates all suggested plans and selects a “second scenario” from among the first scenario and the parties’ counter-proposals. The parties are invited a second time to present counter-proposals. The *committee* then evaluates all suggested plans – from among the set of plans that includes the second scenario and second-round counter-proposals, selects a final scenario, and recommends it to the *board* for adoption.

In theory, Mexico’s redistricting is a straightforward, mechanical process. The scoring function is known to all players, and the technical committee should adopt the plan that scores best. Political manipulation can only happen if a political party declines to propose a plan privately known to it that *a)* is an improvement on the scoring function and *b)* makes the party worse off. We are unable to observe such plans. Until now, only the *committee’s* final scenario recommended to the EMB’s *executive board* has been public knowledge, which has worked similarly to obscure any political manipulation during the nuts-and-bolts process. Our detailed analysis of the two previous redistricting rounds using new data reveals that the *Technical Committee* has deviated from its rules to select scenarios that score worse than the algorithmically generated first scenario, suggesting strongly the presence of administrative manipulation of Mexico’s redistricting process.

3.2 Collecting Data from the Process

To evaluate if the observed outputs are consistent with how the process was officially portrayed, to analyze how plans were formulated by parties and evaluated by the EMB in 2013 and 2017, and if discretionary rules were consistently applied within and across processes, we collected all the publicly available information related to the rules, criteria, and the evaluation methods used by the electoral bureaucracy to create redistricting plans during this period. Specifically, we use *a unique set of internal records detailing every proposed change to electoral maps* made by parties and the bureaucracy.⁵

⁵ The available data is not sufficient to exhaustively determine compliance with the process rules. However, we rely on data for analysis of all redistricting plans formally introduced throughout the 2013 and 2017 processes. In 2013, the total universe of possible counter-proposals – assuming all seven parties formulated a plan in all states, levels, and stages of interaction– was 896. Parties formulated 544 counter-proposals. In

We were able to access Mexico's EMB redistricting tool and the cartographic data used with it once the 2013 and 2017 redistricting rounds were concluded. The redistricting software was otherwise available only to political parties and the technical committee. We collected and archived all of the automated generated plans for both of these processes, as well as the full set of plans proposed by parties using this tool – which have not been made publicly available.⁶

Once an automated *first scenario* was generated in every state (x32), each political party was able to formulate a counter-proposal through their representatives at the *state and federal level*, and during *two sequential rounds of interaction*. In order to compare and evaluate plans with a standardized metric, the TC used the values of a cost function associated with each plan. We collected these values for the plans that were generated by the optimization process (*the first scenario*), for the counter-proposals formulated by political parties during the two rounds of interaction, as well as for the plans that were selected as the *second* and *third scenarios*. For each of the redistricting plans that were generated across the 32 states during the 2013 and 2017, we collected the cartographic breakdown at the state, district, and *sección* (Mexico's census tract equivalent) level.

The different procedural stages of Mexico's redistricting process can be of interest to redistricting scholars and practitioners because comparing them allows us to better understand how the type of criteria selected by the EMB and the TC's operationalization decisions affect the cartographic output. Additionally, focusing on each of the phases of the process allows us to evaluate the role of the EMB when adopting or changing rules, as well as the role of the TC while sanctioning plans.

Since its foundation, the mission of the EMB has been to *guarantee the neutrality of all administrative procedures surrounding elections*. As such, both electoral officials and technical experts are expected to be guided by the principle of neutrality when selecting and operationalizing the purportedly “non-partisan criteria and procedures.” In this subsection we analyze if, in fact, the empirical evidence corroborates if the observed

2017, two additional parties – *MORENA* and *Encuentro Social* – participated in the process increasing the universe of possible counter proposals to 1,152. Parties formulated 463 alternative plans. To facilitate the replicability of our analysis, all data and code used for this paper will be made available on Github upon publication.

⁶ In contrast to the 1996 and 2004 redistricting processes, the EMB enabled strategic interaction between parties in 2013 by allowing them to observe counter-proposals formulated by other parties through a web-based platform. The development of this online mapping technology facilitated the generation of a relatively large number of partisan plans.



actions adhered to official criteria, if the rules were applied consistently, and if they yielded neutral outcomes.

We answer these questions by examining the degree to which the EMB and the TC's actions followed *a priori* established rules. We analyze the impact the technical decision-making process had on the *first scenario*, as well as how the technical evaluation of plans affected the selection of the *second* and *final* redistricting plans. For example, micro-level data – such as *the number of counter proposals submitted by each party* – enables the identification of cases in which the final plan for a state is not the best plan proposed by the formal rules; or cases in which new plans were introduced outside of the formal cycle.

Figure 2a offers a visualization of the actual operation of the proposal process in 2013 and 2017. Each block represents a state and the columns represent the year in which redistricting took place. The vertical axis represents the scale reported in each state associated with the optimization function.⁷ The horizontal axis represents the five stages indicated in figure 1, representing: 1) the *first scenario* produced by the algorithm; 2) the *first round* of partisan interaction (vertical axis highlighted in blue); 3) the *second scenario* selected by the TC; 4) the *second round* of partisan interaction (vertical axis highlighted in blue); and 5) the *third scenario* submitted to the EMB's executive board for its final approval.

The outcomes (*dots, connected by lines when a proposal was formulated by the same actor in consecutive stages*) reported on this visualization describe the score of the plans that were adopted by the TC on stages 3 and 5 (considered *winning* plans) and have one of the following five origins: i) plans produced algorithmically in the first stage (red), ii) plans that were proposed by a single party (blue); iii) plans that were endorsed by multiple – at least two – parties and that competed with alternative partisan plans (pale/olive green); iv) plans that were endorsed by all proposing parties (fuchsia); and v) plans formulated by the EMB (green).

⁷ The scale on the vertical axis differs in 2013 and 2017 because of differences in the optimization process (number of restrictions, weighting, and algorithm).

Figure 2a. Redistricting Process Stages and Winners (example)

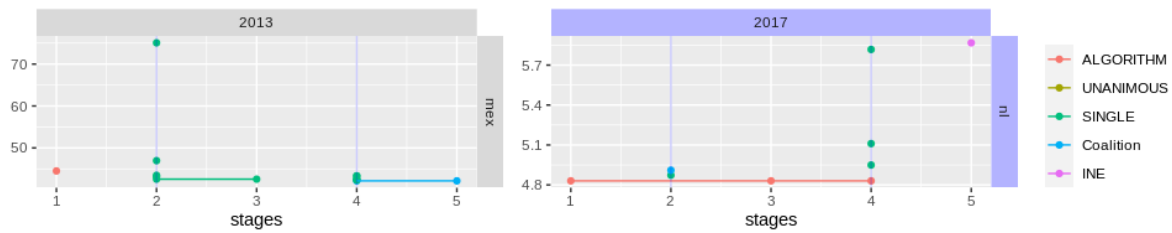


Figure 2a illustrates how the redistricting process evolved in Mexico City in 2013 (left) and in Nuevo Leon in 2017 (right). In Mexico City the process worked out in a way that conforms relatively well with the public portrayal: the algorithm proposed a score that was incrementally improved in subsequent rounds; and the final plan scored best, and was supported by a coalition. The process in Nuevo Leon evolved very differently — although the algorithm’s score was best, it was not adopted – instead, the adopted plan was the worst scoring. Further this plan was never proposed by a party but introduced by INE at the very end of the process – after the submission phase for plans was formally concluded.⁸ Even when the first and second level order statutes did not change and the demographic information (*2010 census*) used in both processes remained the same, differences in the rules of engagement (e.g., the adoption of ~~criteria~~ 8 in 2017) and the way in which the EMB operationalized redistricting rules (e.g., type of optimization algorithm used by the TC and differences in the number, weighting, and hierarchy assigned to criteria) generated drastically different outcomes.

From the optimization standpoint, the figure shows that algorithmically produced plans were more successful (*effective*) in 2017 than in 2013. In the former, the EMB adopted 9 unchanged automated plans, while in the latter it only adopted 5. Since a lower score is associated with a more *efficient* plan (in terms of maximizing the restrictions), we would expect that plans with lower scores to be preferred to plans with a higher cost. Figure 3 shows not only that this did not always happen (either because a rule was violated or a *socioeconomic* consideration was made by the TC), but that the patterns of interaction and evaluation of plans significantly changed at the state level yielding to different outcomes.

⁸ See *appendix* (figure 2b) for a full display of the 2013 and 2017 redistricting processes in the 32 states.

Finally, the figure shows how the adoption of *criteria 8* in 2017 made the adoption of consensus and unanimous plans a more frequent solution. This clearly affected the adoption of more “efficient,” but facilitated the negotiation between parties and reduced the apparent administrative rule violations observed in 2013 when the TC adopted plans with a higher cost. Although in 2017 only two cases were observed in states 14 and 19, the final plans were introduced by the EMB despite partisan or automated plans with lower scores were documented.



4. AUDITING THE PROCESS, CONDUCT, AND OUTCOMES

4.1 Evaluating *Transparency and Information Availability*

We evaluate here if all information necessary to understand how the process works is sufficient to understand the *behavior* of bureaucratic and political actors. That is, if an external agent would be able to understand how redistricting works by looking at the information that is made publicly available.

Table 3 shows the undocumented plans by actor that we identified within the data that we could access once the 2013 and 2017 processes had concluded. Even when INE (through the CLVs or JLEs) is not described in the formal rules as an actor with the capacity of engaging at different levels (*national vs local*) or stages (*first or second rounds*) of the process, we identified 44 plans made by the electoral bureaucracy in 2013 (registered in the cost function dataset), but we did not have access to the cartography associated to these proposals.⁹ We also identified 381 plans in 2013 that were in the system but that they were not scored. The number of non-scored plans was significantly reduced to 11 in 2017 but it was not 0, as one would expect.¹⁰



⁹ In 2013, we identified 44 plans formulated by INE. 26 out of these 44 proposals originated from the local surveillance commissions (CLVs) and 18 from the *Juntas Locales Ejecutivas* (JLEs). In 44 of these cases, we registered the scores, but no plan was recorded or made available to us by the EMB upon request. In the case of 2017, we identified only one scored plan submitted by DERFE but we were unable to locate the plan.

¹⁰ Missing plans refer to cases where we found no plan associated with a particular score. Additionally, we identified a significant amount of non-scored plans (e.g., duplicates or plans that were in the data but had no associated score). For example, we identified 381 plans that were in the system but they were not scored in 2013. We believe there was no wrongdoing and that the vast majority of unscored plans are proposals that were generated in the system but that they were never completed / submitted by political parties or formally

Table 3. Undocumented Proposals

ACTOR	MISSING PLANS	NONSCORED
2013		
INE	44	0
MC	10	42
PAN	4	46
PNA	4	81
PRD	15	40
PRI	9	44
PT	8	65
PVEM	8	63
2017		
ES	2	1
INE	1	0
MC	1	0
MORENA	3	1
PAN	5	3
PNA	3	1
PRD	5	1
PRI	2	0
PT	3	2
PVEM	3	2

Although cartographic output was available for the vast majority of plans that registered a score, we identified several missing plans for political parties in both 2013 and 2017. In 2013, for instance, we identified 15 proposals that were scored for PRD but no cartographic plan was made available.¹¹ In 2017, the number of missing partisan plans decreased from 58 to 28.

considered by the TC. In order to curate the data, we matched all existing scores to the maps that were available in the dataset and eliminated all alternatives we suspect were either false positives or negatives (e.g., matching a single plan with the cost associated to all parties that endorsed that alternative via a coalition or unanimously or eliminating duplicate plans associated to the same party in a single or multiple stages or levels).

¹¹ In 2013, we identified an actor register as “PRD51,” which formulated 7 plans. We consider them as an administrative correction, all of these proposals were registered exclusively on the second round of partisan interaction (stage 5 of figure 1). The counter-proposals presented by the left-wing party (PRD) at the CNV level in 2013, for instance, were registered as “PRD1” and “PRD2” (see: *Instituto Federal Electoral* (2013). *Evaluación de los trabajos de redistribución que realiza el Comité Técnico para el Seguimiento y Evaluación de los Trabajos de Redistribución*. page 74, Appendix 4). According to the formal rules, however, parties could only present one counter-proposal by stage and level. In case they had different scores, the TC should have considered the lower scoring plan.

4.2 Accountability: Expectations, Rule Compliance, and Exceptions

In this subsection we analyze if the 2013 and 2017 redistricting processes were compliant with the law. That is, we evaluate if, in fact, the electoral bureaucracy fulfilled its claim of framing the redistricting process as open, mechanical, and impartial, if the changes introduced between processes were evaluated by the EMB/TC according to the rules described in section 3, and if the the EMB/TC's intervention made automated plans more likely to be adopted.

Our first hypothesis evaluates if the process followed the operating rules that were made publicly available. If they were, the following should be true:

H1: If the TC applied the rules consistently, we should expect to observe the following outcomes (in relation to the evaluation phase depicted in stages 4 and 6 of Figure 1):

- (A) The partisan counterproposal with the lowest cost function is always adopted by the EMB.
- (B) The TC will select a plan from the universe of partisan counter-proposals or the algorithmically generated maps.
- (C) If parties unanimously support a plan associated with a higher cost (*criteria 8* rule in 2017), that counterproposal is adopted.

Table 4 aggregates by year the cases where the EMB/TC decided to make an exception to the rule when adopting a plan. The first row depicts cases where INE, regardless of the score, decided to invalidate partisan counter proposals because they identified a violation to a pre-established rule (e.g., splitting a minority municipality).¹² The

¹² In 2013, INE explained, after the process was complete, that the software offered to the parties to submit proposals did not properly enforce the municipality fusion criterion – leading parties to submit proposals that were not valid under the complete set of rules. As a response, INE invalidated these proposals from consideration. Our data includes these invalidations, so we summarize these as exceptions to the process. Further, in 2017, the public rules were changed to allow the adoption of a higher-scoring plan with unanimous agreement of the parties -- we summarize these exceptions as well. Finally, an examination of the internal data made available to us revealed a number of instances where in round 4 or 6 INE adopted a plan that had not

second row counts the number of cases where higher-scoring plans were adopted after being supported unanimously by all parties engaging in the process. The third row captures the exceptions where the EMB/TC formulated a plan of its own during stages 3 and 5, which differed from the *first scenario* or partisan alternatives. The fourth row depicts the number of times the bureaucracy formulated an alternative plan (despite its role not being clearly defined or accounted for in the formal rules). Lastly, the fifth row counts the number of cases where the EMB/TC adopted a higher-scoring plan *without* being unanimously endorsed by all parties engaging in the process.

Table 4. Process Exceptions

	2013		2017	
INE Invalidated Proposed Plan	13	5.80%	0	0.00%
Unanimous Higher Score Proposal Accepted	1	1.56%	15	23.44%
INE Modified proposals	1	1.56%	7	10.94%
INE Added proposals	47	73.44%	0	0.00%
Higher Score Plan Without Unanimity	11	17.19%	13	20.31%

Note: Exceptions are suspect, but not necessarily illegal.

The results in the previous table are *prima facie* evidence that rule violations occurred both in 2013 and 2017. Overall, these results reveal that the “best plan” did not always win, that the EMB/TC actively intervened in the process, and that there was significantly more exceptionalism justified – based on unanimous solutions – in 2017 (23.44%) than in 2013 (1.56%). Although exceptionalism can be justified by the adoption of *criteria 8* in 2017, it is concerning to observe that the number of cases where the EMB/TC adopted higher-scoring plans without unanimity was almost as high in 2013 (11) than in 2017 (13). It is also concerning that despite EMB/TC is not formally described as an actor that engages in the process, the number of INE’s unilateral interventions to adopt a map of its own increased from 1 to 7.

been previously introduced. The authority to modify or introduce new plans is not formally documented, but arguably within INE’s purview. We code these as exceptions and summarize their frequency.

4.3 Algorithmic Performance

Our second hypothesis evaluates if the process met its objectives related to algorithmic performance. As we describe in section 3.3, in 2017 the EMB/TC decided to modify the type of algorithm, as well as the number of restrictions and the weights assigned to the criteria used in the optimization process in order to find “better solutions.” As a consequence, some parties have claimed that it has become harder for them to propose lower-scoring plans.¹³ If this actually happened, we would expect to observe the following:

H2: If the algorithm became more effective, we should expect to observe that:

- (A) Automated plans were more likely to produce lower-scoring plans in 2017.
- (B) Automated plans were likely to be adopted as the final maps in stage 5 in 2017.

When analyzing algorithmic *performance* –overall score efficiency (difference between phase 1 and best scoring plan adopted), we found that it was high and consistent across 2013 and 2017, with respectively a 94% and 95% mean level of efficiency.¹⁴ Overall, we found that the algorithm performed quite well in the vast majority of states and that in the 2017 process there was a slight improvement on performance. This is preliminary evidence confirming that a small amount of numerical efficiency can translate into substantially better qualitative performance. In most states, the algorithm performed better in 2017 than in 2013. Table 5 displays the performance – best scoring plan – by creator in both years.

¹³ Interview of the leading author with Miguel Rojano, INE’s Director of Cartography and with Florencio González, former PAN’s representative at IFE’s CNV. Mexico City, June 2019.

¹⁴ See *online appendix* (figure 3).

Table 5. Best Scoring Plan by Creator

YEAR		
ALGORITHM		
2013	5	15.62%
2017	23	71.88%
COALITION		
2013	7	21.88%
2017	3	9.38%
INE		
2013	3	9.38%
PAN		
2013	11	34.38%
PRD		
2013	4	12.50%
2017	5	15.62%
PRI		
2017	1	3.12%
UNANIMOUS		
2013	2	6.25%

Note: Creators refers to initial plan creators, others may have joined in later rounds.

The results presented in Table 5 are startling. They reveal that the algorithm used in 2017, significantly improved the formulation of lower-scoring plans. While in 2013, the algorithm produced only 5 (15.62%) best scoring plans, in 2017 it formulated 23 (71.88%). The table also reveals that not all parties have the same capacity to produce the lowest-scoring plans. The right-wing PAN, for instance, was able to formulate 11 (34.38%) best-scoring plans in 2013, followed by PRD with 4 (12.5%) and 5 (15.62) plans in 2013 and 2017, respectively, and PRI with only one (3.12%) plan in this category during 2017.

Even more surprising, is that the proportion of unexpected winners was disproportionately high in 2017.¹⁵ Results show that while in 2013 only in 15% of the cases the algorithmic solution was adopted, algorithmic success increased to 28%, confirming hypothesis H2(A). They also show that the optimum solution found by the computer was rejected in more than two thirds of the cases in both years (84.38% in 2013 and 72% in 2017). Furthermore, it reveals that in a large number of cases, especially in 2017, 72% of the time the best score was not adopted.



Lastly, we find that unanimous endorsed plans were extremely more common in 2017 (22% vs 3%) – due to the adoption of *criteria* 8, but also that the EMB/TC adopted a

¹⁵ See *online appendix* (table 6).

significantly higher number of plans in 2017 that were not the “best-scoring plan” and that were not endorsed unanimously by all actors (31% vs 19%). This evidence contradicts hypothesis H2(B) and it shows that, despite there was an improvement across processes in terms of algorithmic efficacy, the best solutions were either rejected because parties were able to beat the algorithm in 2013 or because both the EMB/TC and political parties (via *criteria 8*) rejected the algorithmic solution.



4.4 Partisanship Bias and Influence in the Final Outcome

The high rejection rate of the number of valid plans with the lower scores, naturally leads to the following question: *Was the TC’s invalidation of plans and acceptance of higher-score alternatives distributed evenly across parties?* Assuming all parties had the same level of information and understanding of the rules of engagement and evaluation, we would expect to observe the following:

H3: If parties had the same level of information and formulated counter proposals following the same rules:

- (A) The number of invalidated plans would be evenly distributed across parties.
- (B) The number of higher-score plans accepted by the EMB/TC would be similarly distributed across parties.
- (C) Parties would invoke unanimity rule at the same rate (*criteria 8*).




Table 7 shows the number of exceptions by individual creators in 2013 and 2017. For each actor, it aggregates the number of cases where actors invoked *criteria 8*, the number of times where an actor won despite a rule violation was identified, and the number of cases where the plans were invalidated by the EMB.


Table 7. Exceptions by Individual Creator

TYPE		%
2013 - PAN		
Win by sec 8	1	3.12%
Win in violation of the rules	5	15.62%
Invalidated	3	1.21%
2013 - PRD		
Win by sec 8	1	3.12%
Win in violation of the rules	1	3.12%
Invalidated	8	3.24%
2017 - ES		
Win by sec 8	6	18.75%
Win in violation of the rules	4	12.50%
2017 - MC		
Win by sec 8	7	21.88%
Win in violation of the rules	3	9.38%
2017 - MORENA		
Win by sec 8	5	15.62%
Win in violation of the rules	3	9.38%
2017 - PAN		
Win by sec 8	6	18.75%
Win in violation of the rules	6	18.75%
2017 - PNA		
Win by sec 8	6	18.75%
Win in violation of the rules	4	12.50%
2017 - PRD		
Win by sec 8	6	18.75%
Win in violation of the rules	2	6.25%
2017 - PRI		
Win by sec 8	6	18.75%
Win in violation of the rules	4	12.50%
2017 - PT		
Win by sec 8	7	21.88%
Win in violation of the rules	4	12.50%
2017 - PVEM		
Win by sec 8	6	18.75%
Win in violation of the rules	3	9.38%
2013 - INE		
Win in violation of the rules	2	6.25%
2013 - MC		
Win in violation of the rules	2	6.25%
Invalidated	2	0.81%
2013 - PNA		
Win in violation of the rules	1	3.12%
Invalidated	1	0.40%
2013 - PRI		
Win in violation of the rules	2	6.25%
Invalidated	1	0.40%
2013 - PVEM		
Win in violation of the rules	2	6.25%
Invalidated	2	0.81%
2017 - ALGORITHM		
Win in violation of the rules	2	6.25%
2017 - INE		
Win in violation of the rules	2	6.25%
2013 - PT		
Invalidated	3	1.21%

Note: Percentages do not add up to 100% because plans have multiple creators. Denominator for win measures is 32/year. Denominator for invalidations is total proposals in that year.

Results from the table above confirm that plan invalidation and the acceptance of higher-scoring plans by the EMB/TC affected parties differently. For example, in 2013 the TC invalidated 8 plans from the PRD, 3 plans from PAN and PT, 2 plans from MC and PVEM, and only 1 for PRI and PNA.¹⁶ In terms of the actors that won despite an apparent rule violation taking place, the EMB/TC adopted 5 plans of PAN in 2013 and 6 in 2017. In 2017, the EMB/TC also accepted 4 plans that were incurring in rule violations and that were being endorsed by PRI, 4 by ES, 4 by PNA, 3 by MORENA, 3 by MC, 3 by PVEM, and 2 by PRD. In 2017, we also identified 4 cases (2 related to the algorithm and 2 proposed by INE) where the EMB/TC adopted plans that violated the rules.

Although the number of invalidations (21) and partisan plans adopted despite rule violations (46) is relatively low compared to the total number of plans that were presented in both processes, the variation across parties reveals that they either had different levels of information enabling them to formulate more valid proposals or that, even when they knew the rules of engagement and evaluation, they made an effort to push their plan forward. We consider this as preliminary evidence showing that parties were following different strategies when engaging in the redistricting process and that some parties were more successful than others in doing so. 

Lastly, the use of *criteria 8* shows that parties evenly benefited from invoking this rule. Based on the rule established by the EMB in 2017, unanimity is defined as a circumstance where multiple actors (more than one) endorse a plan and no other political party formulates a different solution. In 2017, MC and PT successfully endorsed unanimous plans with higher-scores that were accepted by the EMB/TC in 7 occasions, PAN, PRD, PRI, PVEM, PNA, and ES in 6, MORENA in 5. 

In the remainder of this section we analyze the capacity of parties to influence the final outcome (related to stage 6). If parties had the same information and bureaucratic capacity (i.e., technical expertise) to engage in the process, we would expect them to have a similar influence on the final outcome. Our final hypothesis is described as follows:

¹⁶ In 2017, the values reported are 0 for all parties because the data source we had access to does not show if partisan plans were invalidated by the EMB because they violated an *a priori* or higher hierarchical criteria (e.g., splitting an indigenous municipality that should have been preserved intact).

H6: If formal rules had been followed, all parties shared the same information, and had the capacity to engage in the process, we would expect the following statements to be true:

- (A) All parties would have been equally successful in sponsoring a winning plan.
- (B) Coalition plans supported by multiple parties were never accepted.
- (C) Unanimous partisan plans were only adopted in 2017.



Table 8 groups the number of winning plans by creator. Despite the algorithm became more successful in 2017 (winning 28% vs 15% of the time), results reveal important partisan differences. In 2013, for instance, the right-wing PAN was, by far, the most successful party to single-handedly present winning plans. The only other party that was able to single-handedly present winning scenarios was the PRD with 2 plans in 2013 and 1 in 2017. Although unanimity rule was only adopted for the 2017 process, we observed that successful partisan coalitions were formed in both 2013 and 2017, and that they were more successful in the former (28% vs 21%). Lastly, these results show that when parties unanimously endorsed a plan, it was significantly more likely for them to be adopted in 2017 (increasing from 2 to 10).

Table 8. Winning Plan by Creator

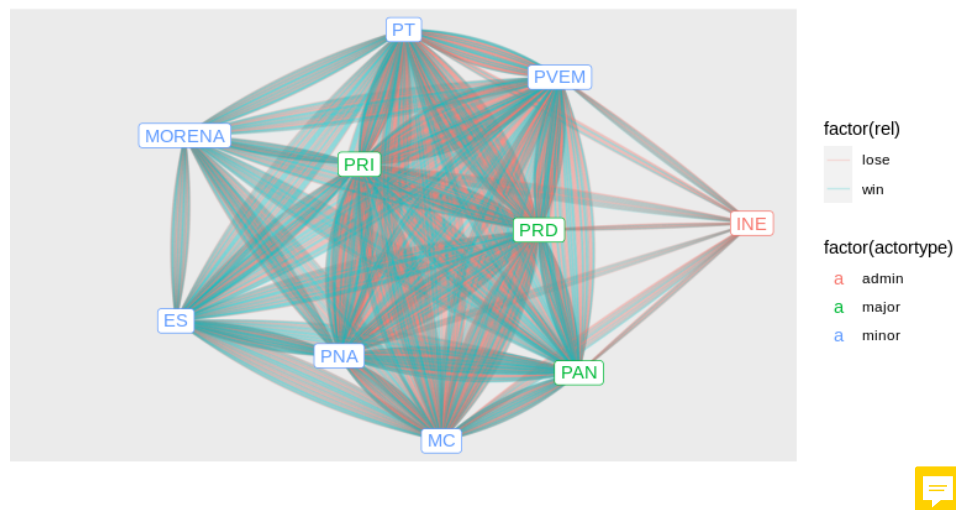
	WINS	%
ALGORITHM		
2013	5	15.62%
2017	9	28.12%
COALITION		
2013	9	28.12%
2017	7	21.88%
INE		
2013	1	3.12%
2017	2	6.25%
PAN		
2013	13	40.62%
2017	2	6.25%
PRD		
2013	2	6.25%
2017	1	3.12%
PVEM		
2017	1	3.12%
UNANIMOUS		
2013	2	6.25%
2017	10	31.25%

Note: Creators refers to initial plan creators, others may have joined in later rounds.

We understand that as institutional and political actors gain more experience – *learn how to operate in the redistricting process* – after participating in multiple cycles, some procedural rules had to be modified or adapted. In order to achieve a higher degree of consistency, for instance, the adoption of *criteria 8* by the EMB in 2017 clearly reflects the need to adopt more flexible rules that facilitate human interaction and creates additional incentives for building consensus.

Lastly, figure 4 illustrates the differences in collaboration among parties and INE using network analysis.

Figure 4. Partisan and Bureaucratic Collaboration



This figure reveals how the connecting edges of major parties (PRI, PAN, and PRD) – and some smaller parties that usually form electoral coalitions with major parties – are wider than others showing that they were more active than smaller parties. Consequently, those that engaged more lost more, but also won more redistricting battles. The figure also confirms that most of the interaction (winning and losing) took place among parties, but the bureaucracy remained active beyond producing the algorithmically generated plans by simultaneously proposing a matching plan.

5. IMPLICATIONS AND POLICY RECOMMENDATIONS

Our analysis reveals that the internal process differs substantially from its neutral, formulaic public depiction. The internal process often deviates from the official rules, and *most of the final outcomes that emerge are the result of partisan bargaining* rather than the strict application of the quantitative criteria that are publicly advertised. The Mexican experience shows that automated redistricting algorithms, in combination with human interaction, can serve as effective consensus building mechanisms. Political parties can draw plans that sometimes improve upon the cost function and they are likely to present amendments that garner cross-party support. The inclusion of parties in the redistricting shows that *endorsement and credibility* of the process can be supported, as long as rules are *transparently and consistently applied*. This is why the mediation of an independent board is key to guarantee a full disclosure of information and the neutrality of the decision-making process.

While we find no malfeasance, nor anything approaching the pathologies of redistricting in the US, the Mexican public should be concerned by the substantial gaps between the public perception of the process, its accountability to audit, its formal rules, and its actual operation. That is, the “fire alarm” system only becomes effective in administrative procedures susceptible of becoming highly politicized when rulemaking is explicit and expanded access to government records are available. With these improvements, Mexico’s process has the potential to become a model of best-practices for redistricting across the world.

We argue that greater transparency can inoculate against some of the issues we raise. Mexico’s electoral management board has made important technological advancements. Moreover, technology and information could be used to go beyond transparency and engage the public in the redistricting process. Not only can map-sharing tools be made available online, but also software applications that would allow the public to become a partner in the process (Trelles et al. 2016). Having more eyes on the redistricting problem may yield more solutions that beat the optimization algorithm, further reducing opportunities for manipulation, and would further allow the public to look under the hood to understand more fully the political consequences embodied by the

choice of criteria, their operationalization, and their weighting in the cost function. In the near future, it might also be the first step towards building a more open and inclusive process.¹⁷

Finally, Mexico is perhaps unique among democracies in the use of automated redistricting and partisan strategic interaction to draw new district boundaries. A strain of redistricting reformer in the United States is “let the computer do it” (McDonald 2004). Theoretically, an independent board can adopt objectively neutral criteria, they can be operationalized, a cost function that weights these criteria can be computed, and a computer can attempt to minimize the cost function. Mexico’s experience illuminates some of the potential pitfalls with the automated redistricting approach, but it also offers an alternative solution. It offers an example that lies between the current partisan gerrymandering observed in many US states and delegating redistricting to a formally independent board that is completely insulated from the main interested actors competing for power – an option that seems completely unfeasible in the near future for the United States.

We formulate the following policy recommendations that can serve as a template to evaluate the objectivity of two key dimensions for redistricting around the globe:

- A) *To advance transparency*, the public should be provided open access to all information, including: i) at the beginning of the process, all data and software used by the EMB/TC should be publicly available; ii) during the process, the records (including proposed plans, scores, and selection decisions) should be shared with the public as redistricting progresses; and iii) at the end, The EMB/TC should make public a systematic evaluation of

¹⁷ So far, the redistricting process in Mexico is restricted to electoral bureaucrats and political parties. However, both parties and the board can benefit by opening the process to the public. The 2014 electoral reform, for instance, allows independent candidates to compete for legislative offices but, so far, only parties are allowed to participate in redistricting. Other social voices and interest groups could be considered during the redistricting process if the proper channels are developed. Experiences in other countries show that new mapping technologies and the use of web-based platforms make public mapping both feasible and convenient (McDonald and Altman 2018 and Trelles 2017).

the degree to which the objectives were met and the degree of compliance by institutional, partisan, and interest groups that engaged.

- B) *To advance consistency* we recommend that: i) any change made to the administrative rules should be accompanied by an explicit public rationale that justifies those rules in terms of the specific legislative objectives; ii) changes to how criteria are hierarchized and operationalized should be justified both technically and with respect to legislative objectives, and a measurable evaluating criteria included for evaluating the effectiveness of these changes at the end of the process; and iii) the redistricting mapping tool (*software*) can be adapted to minimize rule violations. For example, if the EMB has identified pre-existing conditions that should not be modified by political parties (e.g., fragmenting indigenous municipalities), it can introduce such restrictions to the software.

In sum, the lessons derived from Mexico's redistricting experience are valuable for both practical and theoretical reasons. From a practical perspective, countries that have experienced extreme levels of politicization in redistricting – e.g., the United States – can learn from this experience because the process in Mexico has been historically managed by an independent board, using non-partisan criteria, and allowing political parties to interact within an institutional setting. From a theoretical standpoint, there are many assumptions that can be derived and tested from the interaction among electoral officials and political parties in this multi-stage process. More importantly, perhaps, is that our understanding of these policy-specific interactions contributes to clarifying how *de jure* autonomous bureaucracies can become more accountable, transparent, and consistent, while effectively including political parties as monitoring agents within the institution.

6. REFERENCES

- Allen, Liz, Amy Brand, Jo Scott, Micah Altman and Marjorie Hlava. (2014). "Credit where credit is due." *Nature* 508(7496):312–313.
- Altman, Micah and Michael P. McDonald. (2011). "BARD: Better Automated Redistricting." *Journal of Statistical Software* 42(4):1–28.
- Alvarez, R. M., & Hall, T. E. (2008). Building secure and transparent elections through standard operating procedures. *Public Administration Review*, 68(5), 828–838.
- Aparicio, Javier y Javier Máquez. (2010). Tamaño del Congreso, redistribución y umbral de representación, en Gabriel Negretto (ed): *Debatiendo la reforma política: claves del cambio institucional en México*. Colección Coyuntura y Ensayo, México: CIDE.
- Birch, S. (2008). Electoral institutions and popular confidence in electoral processes: a cross-national analysis. *Electoral studies* 27(2): 305–320.
- _____. (2011). *Electoral Malpractice*. Oxford: Oxford University Press.
- Carson, Jamie L., Michael H. Crespin, Charles J. Finocchiaro, and David W. Rohde. (2007) "Redistricting and party polarization in the US House of Representatives." *American Politics Research* 35(6): 878-904.
- Cox, Gary and Jonathan Katz. (2002). *Elbridge Gerry's Salamander: The Electoral Consequences of the Reapportionment Revolution*. Cambridge, U.K: Cambridge University Press.
- Estévez, Federico, Eric Magar and Guillermo Rosas. (2008). "Partisanship in Non-Partisan Electoral Agencies and Democratic Compliance: Evidence from Mexico's Federal Electoral Institute." *Electoral Studies* 27(2):257–71.

Fung, Archon, Mary Graham, and David Weil. (2007). *Full disclosure: The perils and promise of transparency*. Cambridge University Press.

Guy, Mary E. 1990. High-Reliability Management. *Public Productivity and Management Review*. 13(4): 301-13.

Hartlyn, Jonathan, Jennifer McCoy and Thomas M. Mustillo. (2008). "Electoral Governance Matters: Explaining the Quality of Elections in Contemporary Latin America," *Comparative Political Studies*. 41(1): 73-98.

Handley, Lisa, and Bernard Grofman, eds. (2008). *Redistricting in comparative perspective*. Oxford University Press.

Hollyer, J.R., Rosendorff, B.P. and Vreeland, J.R., (2011). Democracy and transparency. *The Journal of Politics*, 73(4), pp.1191-1205.

IFE. (2004). "Acuerdo del Consejo General del Instituto Federal Electoral por el que se aprueban los criterios y consideraciones operativas que se utilizarán en la formulación de los proyectos de división del territorio nacional en trescientos distritos electorales federales uninominales, así como la creación del Comité Técnico para el seguimiento y evaluación de los trabajos de distritación." (IFE CG104/2004).

_____. (2005). "Distritación 2004–2005: Camino para la democracia." Published in English (2009) as "*Mexican Electoral Districting. Memoir of the 2004 Federal Redistricting Process*." México: IFE.

_____. (2013a). "Acuerdo del Consejo General del IFE para aprobar los criterios que se usarán en la creación de 300 distritos federales uninominales en que se divide el territorio nacional." (IFE CG50/2013).

_____. (2013b). "Acuerdo del Consejo General por el que se aprueba la propuesta de criterios que se utilizarán para formular los estudios y proyectos para la división

del territorio en 300 distritos electorales uninominales federales, a propuesta de la Junta General Ejecutiva.” (IFE CG50/2014).

INE. (2015). “Modelo Matemático y Algoritmos.” Registro Federal de Electores.

_____. (2016). Acuerdo del consejo general del instituto nacional electoral, por el que se aprueban los criterios y reglas operativas para la distritación federal 2016-2017, así como la matriz que establece la jerarquización de los mismos para su respectiva aplicación (INE/CG165/2016).

Johnson, Cathy Marie. 1990. New Wine in New Bottles: The Case of the Consumer Product Safety Commission. *Public Administration Review* 50(1): 74-81.

LaPorte, Todd R, and Paula M. Consolini. 1991. Working in Practice but Not in Theory: Theoretical Challenges of High-Reliability Organizations. *Journal of Public Administration Research and Theory* 1(1): 19-47.

Lara Otaola, Miguel. (2018). To include or not to include? Party representation in electoral institutions and confidence in elections: A comparative study of Latin America. *Party Politics*. 24(5): 598-608.

Lijphart, Arend. (1990). “The Political Consequences of Electoral Laws, 1945–85.” *American Political Science Review* 84(2):481–96.

López-Pintor, R (2000) *Electoral Management Bodies as Institutions of Governance*. New York: United Nations Development Programme.

Lujambio, Alonso and Horacio Vives. (2008). From politics to technicalities: Mexican redistricting in historical perspective. In *Redistricting in Comparative Perspective*, ed. Lisa Handley and Bernard Grofman. Oxford: Oxford University Press.

Norris, Pippa. 2017. *Strengthening electoral integrity*. Cambridge University Press,

Norris, Pippa and Alessandro Nai. (2017). *Election Watchdogs. Transparency, Accountability, and Integrity*. Oxford: Oxford University Press.

- Magar, Eric, Alejandro Trelles, Micah Altman and Michael P. McDonald. (2017). "Components of Partisan Bias Originating from Single-Member Districts in Multi-Party Systems: An Application to Mexico." *Political Geography* 57(1):1-12.
- McCubbins, M. D., & Schwartz, T. (1984). Congressional oversight overlooked: Police patrols versus fire alarms. *American Journal of Political Science*, 165-179.
- McDonald, Michael P. 2004. "A comparative analysis of redistricting institutions in the United States, 2001–02." *State Politics and Policy Quarterly* 4(4):371–95.
- McDonald, Michael P. and Altman, Micah. (2018). *The Public Mapping Project: How Public Participation Can Revolutionize Redistricting*. Cornell University Press.
- Molina, J, Hernandez, J. (1999). La credibilidad de las elecciones latinoamericanas y sus factores. El efecto de los organismos electorales, el sistema de partidos y las actitudes políticas. *CENDES* 41: 1–26.
- Mozaffar, S, Schedler, Andreas. (2002). The comparative study of electoral governance – Introduction. *International Political Science Review*. 23(1): 5–27
- Norris, P. (2014). *Why Electoral Integrity Matters*. Cambridge: Cambridge University Press.
- Palacios Mora, Celia y Erubiel Tirado Cervantes. (2009). "Circunscripciones electorales plurinominales: configuración geográfica y equilibrio poblacional, 1977–2007." *Investigaciones Geográficas, Boletín del Instituto de Geografía, UNAM* 68:102–15.
- Park, Roger C, David P. Leonard, and Steven H. Goldberg. 2004. Evidence Law: A Student's Guide to the Law of Evidence as Applied in American Trials. St. Paul, MN: Thompson-West.
- Parker, Frank. (1990). *Black Votes Count*. Chapel Hill: University of North Carolina Press.

Rijpma, Jos. A. 1997. Complexity, Tight-Coupling and Reliability: Connecting Normal Accidents Theory and High Reliability Theory. *Journal of Contingencies and Crisis Management* 5(1): 15-23.

Rosas, G. (2010) Trust in elections and the institutional design of electoral authorities: evidence from Latin America. *Electoral Studies* 29 (1): 74–90.

Rossiter, D.J., R.J. Johnston and C.J. Pattie. (1997). “Estimating the Partisan Impact of Redistricting in Great Britain.” *British Journal of Political Science* 27(2):319–31.

Sonnleitner, Willibald (2001), *Los Indígenas y la Democratización Electoral: Una Década de Cambio Político entre los Tzotziles y Tzeltales de Los Altos de Chiapas (1988-2000)*. México: COLMEX/IFE.

_____. (2013), *La Representación Legislativa de los Indígenas en México: De la Representatividad Descriptiva a una Representación de Mejor Calidad*. Mexico: Tribunal Electoral del Poder Judicial de la Federación (TEPJF).

Donald E. Stokes. (1993). *Legislative Redistricting by the New Jersey Plan*. New Brunswick, New Jersey: Fund for New Jersey.

Tarouco, GdS (2016) The role of political parties in electoral governance: delegation and the quality of elections in Latin America. *Election Law Journal* 15(1): 83–95.

Trelles, Alejandro. (2018). *Building Democracy: De Jure and De Facto Electoral Autonomy in Electoral Management Bodies in Latin America and Africa*. University of Pittsburgh: Doctoral Dissertation.

_____. (2017). Redistricting, Transparency, and Political Representation of Minority Groups in Mexico: 1990-2017. In Luis Carlos Ugalde y Saíd Hernández Quintana, *Strengths and Weaknesses of the Mexican Electoral System, 1990-2017. Federal and Local Perspectives*. Mexico City: Electoral Tribunal (TEPJF).

Trelles, Alejandro and Diego E. Martínez. (2012). “Electoral Boundaries. Lessons for California from Mexico’s Redistricting Experience.” *Política y Gobierno*. 19(2). Mexico DF: CIDE.

_____. (2007), “Fronteras electorales, aportaciones del modelo de redistribución mexicano al estado de California.” *Tesis de Licenciatura*. México: ITAM.

Trelles, Alejandro, Micah Altman, Eric Magar and Michael P. McDonald. (2016). “Datos abiertos, representación política y redistribución en México.” *Política y Gobierno*.

Tucker, Harvey J. (1985). “State legislative apportionment: legal principles in empirical perspective.” *Political Geography Quarterly* 4(1):19–28.

Ugues, A. (2014). Electoral management bodies in central America. In: Norris, P (ed.) *Advancing Electoral Integrity*. Oxford: Oxford University Press, pp. 118–134.

Woldenberg, José. (2012). *Historia mínima de la transición democrática en México*. México: El Colegio de México. 150 pp.

7. ONLINE APPENDIX (Supplementary materials: not for publication but available online)

Appendix 1. Historical context of redistricting in Mexico

In the early 1990's Mexico delegated electoral management and redistricting authority to an independent bureaucratic agency.¹⁸ Since 1996, this electoral board has employed customized automated algorithms to tailor redistricting plans deemed optimal on *a priori* criteria. While devoid of politicization and controversy that are routine in the U.S. (Frank 1990, Carson et al., 2007, McDonald and Altman 2018), redistricting in Mexico has had important implications for political representation and the rising salience for minorities, particularly indigenous communities (Sonnleitner 2001 and 2013, Magar et al. 2017, and Trelles 2017). The constitutional framework has not changed much, but socio-political, technological, and administrative shifts have affected how districts have been drawn (Trelles and Martínez 2007).¹⁹

A major advancement unique to Mexico is the adoption of automated redistricting as part of the formal process. IFE's Cartography Department developed a software interface for the 2004 process that allowed a *technical committee* (TC) of experts to compare and evaluate plans according to a scoring function composed of multiple weighted restrictions. Alleging improvements in algorithmic performance, the EMB has decided to alter the number and weighting of these variables over time.

Although IFE nearly completed the 2013 redistricting process, the new district boundaries were rejected during the final phase of the process by IFE's executive board in

¹⁸ The Federal Electoral Institute (IFE, now INE) was created in 1990 and earned administrative autonomy in 1996. After the latest round of electoral reform in 2014, the independent board changed names to National Electoral Institute (INE), reflecting its aggrandized authority over subnational elections. We avoid cluttering the text with acronyms by referring to the IFE/INE as "the independent board or EMB," or simply "the board" in the text. Since the EMB's establishment, federal electoral boundaries have been modified in 1996, 2004, and 2017.

¹⁹ Article 53 of the constitution, prescribing population as the basis for redistricting, dates from 1977. This article provides a very general framework establishing that the renewal of the federal cartography should be based on the census and that in order to determine the number of districts assigned to each state the total population of the country should be divided by the total number of single member majority districts (300), considering that no state can be assigned less than 2 districts.

the preamble of the 2014 electoral reform.²⁰ Three years later, in 2017, the board repeated the redistricting exercise executing the process based on exactly the same legal framework and census information, but operationalizing criteria in a slightly different way in order to make “the process more efficient.” The process similarly played out, but without failure at the final adoption step.

Reversion to a *status quo* redistricting plan is still a political act that tends to benefit the current majority party or coalition (Cox and Katz 2002), so the 2013 failure suggests Mexico’s process is politicized. Furthermore, even if a plan was adopted in 2017, the rules by which the electoral commission operates may not fully constrain political manipulation of the process (Estévez, Magar and Rosas 2008, Lijphart 1990, Rossiter, Johnston and Pattie 1997). Even ostensibly neutral rules and the application of specific criteria themselves may embody biases that produce predictable political outcomes (Parker 1990). Rather than removing political bias, redistricting-by-formula may perpetuate it in a different guise.



²⁰ According to former IFE’s President, Leonardo Valdés, it was the PAN that negotiated with the ruling party (PRI) to postpone the redistricting process after the 2015 mid-term election because the right-wing party believed they would lose seats to the PRI. In order to approve the energetic reform, which was part of a political agreement called “*Pacto por México*,” the PRI agreed to postpone the federal redistricting until INE was established in 2014 and the 2015 election had taken place with the 2004 electoral geography. Interview of the leading author with Leonardo Valdés. Mexico City, April 2015.

Appendix 2. Characterizing the Rules from the Redistricting Process

Unfortunately, understanding Mexico's redistricting process would be a daunting task for members of the public and even for electoral scholars who approach this process for the first time.²¹ Most of the details describing what redistricting is, how it works, how the process has evolved over time, or how it has affected political representation comes from independent research outside of the electoral bureaucracy (Lujambio and Vivves, 2008, Palacios and Tirado 2009, Aparicio and Máquez 2010, Sonnleitner 2001 and 2013, Magar et al., 2017, Trelles et al., 2016, and Trelles 2017).²² In this subsection, we contribute to this discussion by identifying what we can infer from formal rules, and the gaps where additional information is required in order to fully understand the process. This information is key for *transparency*, *consistency*, and *accountability* because in order to evaluate whether the process reached its goals or whether it was faithfully – and neutrally – executed, we first need to understand how it is operated and how it was supposed to work.

In order to systematically identify any inaccuracies or gaps in the existing rules, we divide and analyze the normative framework governing Mexico's redistricting process at four levels: a) *The constitution*; b) *Secondary – electoral – law*; c) *Procedural agreements*; and d) *Administrative decisions*. Table 1 displays the four levels of norms regulating the redistricting process in Mexico as rows. Each column in the table characterizes how that level dictates – respectively – goals, criteria, and operational requirements.

²¹ INE's Cartography department has made an important effort to make the latest electoral cartography to the public (see: <https://cartografia.ife.org.mx/sige7/?distrizacion>). From the online publicly available information, however, it would be impossible to understand, replicate, or evaluate how redistricting processes in Mexico have been carried out, as well as their key similarities and differences.

²² In 2005, the EMB published a memoir of the 2004 redistricting process. This document is informative and helpful for an external actor to understand the main stages of the process and which actors were involved. The document, however, was published *ex-post* (once the process had concluded) and does not offer an explanation of why criteria and rules were operationalized in certain ways or the description of how partisan interaction during the process affected the final plans approved by the EMB. For the English version see: <https://portalanterior.ine.mx/archivos3/portal/historico/recursos/IFE-v2/DERFE/DERFE-DistritosElectores/DERFE-ProductosGeoElecDesc-docs/MexicanElectoralDistricting.pdf>

Table 1. Documentation of Goals, Criteria, & Operationalization of the Process
(Auditable processes and outputs are shaded).

Normative Framework	Goals Stated	Criteria Specified (Measures)	Process Requirements
<i>Constitution (Article 53)</i>	Formation of <i>electoral districts</i> linked to population	300 single member majority districts 2 district state minimum Representation of indigenous communities (Article 2)	Must be based on last census Must consider the location of indigenous communities and their opinion
<i>Electoral Law</i>	Delegates administrative responsibility Establishes EMB's attributes	Does not specify any criteria Redistricting completed /approved before election	The responsibility of approving and implementing the process relies on specific areas of the EMB's bureaucracy
<i>EMB's Regulation (Acuerdos del Consejo General)</i>	Defines criteria Delegates the process to the TC Defines hierarchy of criteria and offers justification	Defines criteria and its hierarchy Rationale - relation to goals	Enumerates the bureaucratic/administrative actors who are permitted to participate Defines the different phases of process
<i>EMB and TC's Administrative Agreements</i>	Operationalization of criteria Definition of the process Information and systems to be used Justification of decision-making process	How to measure each criteria Optimization and weighting formula Rationale for optimization and for weighting	Specifies which actors are permitted make or evaluate proposals each stage gets to make proposals Specifies rules for rejecting a proposal as invalid. Specifies how valid proposals are evaluated at each stage; and how proposals are selected to progress to the next stage

The information presented in Table 1 shows the complexity of the different rules governing the redistricting process. Each level can be summarized as follows. Article 53 of Mexico's Constitution is the *first level* and highest hierarchical norm regulating

redistricting and it is the only article explicitly referring to electoral boundary delimitation. It offers a brief and general description of how Mexico's electoral geography should be constituted.²³ The two criteria affecting redistricting in this article refer to the total number of *single member majority districts* (300) and to the minimum number of electoral districts (2) states should have, regardless of its population. In terms of the process, it links redistricting to the “*one person, one vote principle*” by establishing that the apportionment of districts across states should be based on the last population census. A separate article of the Constitution (Article 2), however, establishes the obligation to consider indigenous communities in any process affecting their political representation.

The Electoral Law in Mexico is the *second level* regulating redistricting (described in the second row of Table 1).²⁴ It is as vague as the Constitution and its goal is to define the instances within the electoral commission responsible for overseeing, implementing, and approving the electoral cartography. Article 118 of this law (2013), for instance, establishes that the EMB's executive board – *el Consejo General* – is responsible of establishing the guidelines for redistricting to be followed by the Registry of Voters – *el Registro Federal de Electores* – and of instructing the EMB's administrative board – *la Junta General Ejecutiva* – to conduct the necessary studies to carry out this process. Article 128 (2013), delegates to the Registry of Voters the responsibility of formulating the project to renovate the country's electoral geography.

The regulation established by the EMB's executive board (*los Acuerdos del Consejo General* – the *third level*) sets the overarching guidelines governing the redistricting process. These agreements define the general criteria and the hierarchy that should prevail, as well as the appointment and general rules of operation for the TC. The EMB's executive board agreement establishing the criteria for the 2013 redistricting, for

²³ Article 53 of Mexico's Constitution is embedded within the section defining the division of powers, the legislative branch, and the composition of Congress. See:

http://www.diputados.gob.mx/LeyesBiblio/pdf_mov/Constitucion_Politica.pdf

²⁴ *Código Federal de Instituciones y Procedimientos Electorales for the 2013 Process*. See: http://ieepco.org.mx/biblioteca_digital/legislacion/COFIPE.pdf; *Ley General de Instituciones y Procedimientos Electorales for the 2017 process*. See:

http://www.diputados.gob.mx/LeyesBiblio/pdf/LGIPE_270117.pdf

instance, is comprised of three sections: a) *Antecedentes* (historical account offering a background narrative); b) *Considerando* (legal justification of the agreement); and c) *Acuerdo* (regulation governing the redistricting process).²⁵

These guidelines establish that redistricting should be based on the last population census (2010) and mandates the EMB's bureaucracy (*la Dirección del Registro Federal de Electores*) to take the necessary administrative decisions to renew the electoral geography. The guidelines break down into ten criteria following a hierarchical order and grouped in the following way: a) *Apportionment rules*; b) *Population balance and deviation allowed across districts* (this is the most relevant dimension); c) *Indigenous minority districts*; d) *Geographic and administrative continuity*; e) *Geometric compactness*; f) *Municipal integrity*; g) *Traveling time within districts*, and h) *Optimization and definition of a cost function*.

Lastly EMB's bureaucracy and TC's administrative decisions are the *fourth-level* normative framework governing most of the operationalization, implementation, and interaction phases of the redistricting process. This is where the EMB's bureaucracy and the TC have ample maneuvering and decision-making power affecting how electoral districts are generated. It is through these set of rules, for instance, where the operationalization of criteria is defined (e.g., how the measures of compactness and traveling time will be defined or the weighting system that will be used to ponder differently the four restrictions of the cost function), where the rules of partisan strategic interaction are established, and where the rules of plan evaluation for the TC are defined.

The rules at the *first two levels* are for the most part highly abstract. The vast majority of rules, criteria, stages, and actors are defined in the tertiary and fourth-levels of the normative framework (the third and fourth rows of Table 1). That is, most of the procedural details are established by the regulation approved by the EMB's executive

²⁵ IFE's Executive Board Agreement Establishing the Criteria and Operation Rules for the 2013 Redistricting Process (CG50/2013) Available here: <https://portalanterior.ine.mx/archivos3/portal/historico/recursos/IFE-v2/DERFE/DERFE-CNV/2013/Redistribucion/CGe60213ap4.pdf>. INE's Executive Board Agreement Establishing the Criteria and Operation Rules for the 2016-2017 Redistricting Process (*Acuerdo* INE/CG165/2016). Available here: https://repositoriodocumental.ine.mx/xmlui/discover?scope=/&rpp=10&page=1&query=dc.identifier.govdoc:INE/CG165/2016&group_by=none&etal=0. English translation available online.

board (*Acuerdos del Consejo General*), as well as by the administrative agreements approved by the EMB's bureaucracy (*Junta General Ejecutiva, la Dirección Ejecutiva del Registro Federal de Electores, and la Dirección de Cartografía*) and the external committee of experts known as *el Comité Técnico para el Seguimiento y Evaluación de los Trabajos de Redistribución* (described as the TC here). Thus, most of our analysis focuses on these levels.²⁶

²⁶ The rules used by parties when formulating a counterproposal and the evaluation criteria for the TC, for instance, can be found in the document “Rules for Formulating a Partisan Counter Proposal and Evaluation Criteria for the EMB’s TC in 2017” (See CGex201712-8-ip_2_a02.zip file available here: <https://repositoriodocumental.ine.mx/xmlui/handle/123456789/94251>). On one hand, this set of rules establish which political actors can formulate a counterproposal (parties that are registered to compete in national elections), as well as the level (federal or local), and stages of the redistricting process (first or second round) in which parties can formulate a plan.

On the other hand, the evaluation criteria for the TC establishes that counter proposals that minimize municipal splits will be preferred to those dividing existing municipalities, and that the TC will evaluate these proposals based on the cost function. Those plans with the lowest value associated with the cost function should be selected when compared to plans with a higher cost, assuming all plans comply with the rules and criteria approved by the EMB’s *Consejo General*. It is also here where the tie-breaking rules are established in case two different partisan rules have the same cost, based on the hierarchy granted to each restriction (e.g., population balance should prevail over any other restriction).

Appendix 3. Evaluating Inconsistencies in Redistricting

Table 2: Inconsistencies in Mexico's Redistricting Rules²⁷

Normative Framework	Inconsistency with higher level goal, criteria or process	Unresolved ambiguity in criteria or process
<i>Constitution</i>	None	Not applicable – establishes apportionment rules and boundary division based on last population census
<i>Electoral Law</i>	None	Not applicable – delegates criteria and process to lower levels
<i>EMB's Regulation</i>	Hierarchization Actors allowed to participate	Priority change in hierarchy (e.g., difference in how municipal integrity, compactness, traveling time, and socioeconomic accidents have been prioritized in relation to the main criteria – population balance). Restricted to political parties, amended to include the opinion of indigenous groups in 2017 (with restricted capabilities)
<i>Administrative Agreements</i>	Operationalization Evaluation rules Decision-making & Partisan Interaction	Pre-selection of indivisible units, weighting of criteria, and optimization (e.g., definition of the cost function). Minimization of municipal splits vs population balance. Unavailable information to understand, replicate, or evaluate bureaucratic behavior during and after the process.

Despite the first two levels being consistent with each other – e.g., second level rules do not contradict rules in the first order, they do not establish the number of dimensions that should be included in the process or how they should be prioritized. It is the EMB's *executive board*, through its regulation (*Acuerdos de Consejo General*), the administrative instance that has traditionally defined which dimensions should be measured by specific redistricting criteria and the priority that each dimension should receive.²⁸

²⁷ Table 2 provides an overview of the inconsistencies we identify across different levels.

²⁸ See online appendix 2 (table 2).

A first problem is that from an outsider's perspective, it is difficult to clearly identify a connection between the first and second levels – *the Constitution* and *the Electoral Law*, and the third and fourth orders – *the EMB's regulation* and *the EMB and TC's agreements*. In the former two, the rules are broadly defined and are intentionally ambiguous with respect to most criteria and operationalization. In contrast, the latter two levels established what dimensions should be prioritized, who is able to participate in the process, or how the decisions will be made to renew the electoral boundaries.

This gap –or level of ambiguity– between the first and last orders and the changing of redistricting rules over time has introduced uncertainty to the process because it is unclear how the different prioritization, operationalization, and evaluation of criteria have impacted the electoral cartography (e.g., third column of and last two rows of Table 2). Without observing any change in the first and second levels, for instance, the EMB has prioritized criteria slightly differently in 2004, 2013, and 2017 without publicly justifying this decision.²⁹

For example, while redistricting criteria (IFE 2004; 2013b) set population as the only first-order and most important criterion, the EMB gave it a weight of only 40%, compared to the 60% aggregated value it gave to the other three components.³⁰ It is in these details where we believe there is an important gap and an opportunity for the board

²⁹ The most evident decision has to do with the number of restrictions that have been included within the optimization process and the way in which they have been weighted in order to improve algorithmic performance. Population equilibria and geometric compactness across districts have been used in all processes since the 1990s. In 2013, however, the weighting order of these variables changed – e.g., geometric compactness had a higher hierarchy than municipal integrity – compared to the 2004 process. Subsequently, the optimization phase in 2017 used only two – instead of four – restrictions (population balance and compactness). The inclusion of indigenous municipalities or the use of public consultations to minority communities was not adopted until the 2004 and 2017 processes, respectively (Trelles 2017).

Another example is how the opinion of parties has been evaluated differently across processes. While in 2004 and 2013 the value associated with the cost function of every plan was key for a map to be adopted, in 2017 a rule (“criteria 8”) was introduced that facilitated the EMB to approve partisan plans with a higher cost when all parties endorsed that proposal. For the 2004 redistricting rules see “IFE’s executive board agreement to approve the criteria and operational considerations to be used in the 2004 redistricting process (IFE CG104/2004),” available here:

<https://repositoriodocumental.ine.mx/xmlui/bitstream/handle/123456789/91413/150704ap10.pdf?sequence=1>.

³⁰ As described by Trelles and Martínez (2007), an alternative weighing system for the same four components could have been used (e.g. population balance (.7), district compactness (.2), municipal boundary preservation (.06), and traveling times within the district’s municipal headquarters (.04).

to significantly increase the levels of public awareness, eliminate areas of opacity, and improve the technical justification around the different stages of the process. If a clear prioritization of criteria is enlisted in the first or second level, it would allow the EMB to consistently apply the same hierarchization across processes.

Furthermore, the components of the cost function have not been normalized, making it impossible for the algorithm to weigh them properly and for the technical committee to compare the cost contributed by each component. In 2004, for instance, the technical committee decided that whenever the cost function for two counter proposals was the same, population growth at the district level would be considered in order to determine which map should prevail.³¹

A second inconsistency we identify is related to the way in which indigenous groups have been included in the redistricting process over the years. These groups were initially considered in 2004 – as a consequence of the 2001 constitutional reform – by introducing indigenous minority districts. Similarly, in 2013 the EMB established these minority districts based on census results. In 2016, however, Mexico's Electoral Tribunal forced the EMB to organize a public consultation in order to include the preference of these groups during the elaboration of plans (Trelles 2017). For the tribunal, this right was clearly established in the constitution and should have been prioritized to partisan interest. The EMB only incorporated the opinion of indigenous communities after automated plans were created. It did not consider, however, the input of these communities in subsequent stages, gave them access to the redistricting software, or explained how their opinions would be pondered by the TC *vis-à-vis* a partisan plan.

Third, the way in which the EMB and TC have prioritized and weighted criteria during the optimization phase has been inconsistent over time. The tradeoff between population balance and maximizing municipal integrity, for instance, has been operationalized differently and explains the wide deviations observed in population across districts (Magar et al., 2017). In 2013 municipal splits were calculated *a priori* by the

³¹ This criterion — population growth — had no legal basis and it was used in the 2004 redistricting process in Mexico City (DF) to determine that the municipality of Coyoacán should receive an additional district, instead of Iztapalapa (IFE 2005).

EMB and were included as part of the cost function. In 2017, however, municipal integrity was excluded from the cost function and only considered *a priori* by the EMB. That is, despite municipal integrity having a lower hierarchy than population balance, in the 2017 process this dimension became an equally relevant constraint – through the EMB’s operationalization – affecting the margin of possible change in the confirmation of districts.

Lastly, after the 2004 and 2013 processes, the EMB realized socioeconomic and geographic accidents were among the main considerations brought up by political parties during the interaction phase with political parties. Both of these dimensions, however, were excluded from the optimization phase.³² This resulted in violations to the rule caused by the acceptance of scenarios that had a higher cost when compared to the original plans. That is, the main reason in 2017 INE decided to introduce “*criteria number 8*,” which allowed parties to formulate counter proposals with a higher cost function. As long as the proposal had the consensus of all parties represented within the CNV, the TC would be able to validate that plan without incurring into a violation of its own rules (see table 4 below).³³

This example illustrates that rules described in the fourth level have not always been exhaustive and have been ambiguous. Even when *partisan interaction* and its

³² As it occurs in most administrative processes, mistakes took place during the assessment process. In both 2004 and 2013 redistricting rounds, miscommunication between board and parties was evident. Most parties — especially at the local level — submitted counter-proposals with the idea that plans that did not improve the cost function, but that had a social or communitarian justification, were going to be considered by the committee. In 2004, for instance, the private secretary of the governor of Oaxaca (a state ruled back then by the PRI), through its party representative at the CNV, sent a petition to consider an alternative map to the committee asking not to consider the cost function.

In the state of Michoacán, the governor sent a similar petition, signed by all political parties, asking the technical committee to consider a plan with a much higher cost function value, but that was more “reasonable” in terms of representing community interests in the state’s capital. In the 2013 round, political parties presented a significant number of counter-proposals with a higher cost than the one obtained for the first and second scenarios arguing in favor of community interests. In the vast majority of cases, the technical committee decided to consider only those counter-proposals that were equal or decreased the value of the cost function.

³³ Interview of the leading author with René Miranda, INE’s Executive Director of the Federal Registry of Voters and Miguel Rojano, INE’s Director of Cartography. Mexico City, June 2019.

evaluation should have been based exclusively considering the cost function, the way in which parties justified their counter proposals included a wide range of *socio-cultural* arguments – including the increasing levels of violence related to drug cartel activity in certain regions – that are not clearly described in the normative framework.

In sum, despite some of the criteria have a connection with the first level – constitutional – order, most of the criteria used in redistricting do not. While population balance and the configuration of indigenous minority districts, for instance, can be clearly identified in the first level order, other criteria defined at the third level by the EMB – the INE's *executive board* agreements – such as compactness, traveling time, or the use of optimization algorithms and partisan strategic interaction in multiple rounds, cannot be traced back to either the Constitution or the Electoral Law.

Figure 2b. Redistricting Process Stages and Winners³⁴



Note: Figure created by the authors. Source: IFE/INE reported scores during the 2013 and 2017 redistricting processes.

³⁴ Figure 2b displays competitions in all thirty-two states in both years. The figure reveals that actors – both partisan and bureaucratic – engaged differently in 2013 and 2017.

Figure 3. Algorithmic Score Efficiency by State and Year

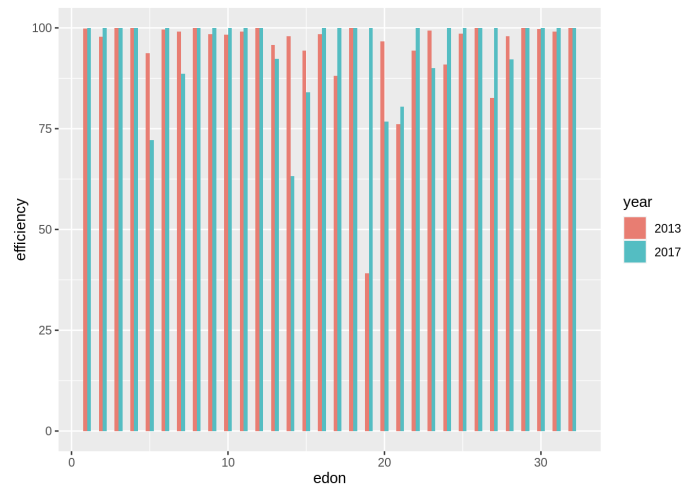


Table 6. Unexpected Winners

	BEST SCORE LOST	ALGORITHM LOST	UNANIMOUS - NOT BEST	NO AGREEMENT & NOT BEST
2013				
	28.12%	84.38%	3.12%	18.75%
2017				
	71.88%	71.88%	21.88%	31.25%

Note:N=32 per year.

Appendix 4. Challenges for the future

Our research applies all information made available to the public to assess the extent to which an independent excerpt observer could use it to a) understand each step in the redistricting process, b) replicate the measurement criteria used by the electoral bureaucracy, c) validate that the rules were followed by political and bureaucratic actors, and d) comment on the process. In all cases, we find that public information is insufficient for all purposes. These are our main findings:

- The rules of the process are incomplete, difficult to interpret, and scattered across multiple sources.
- Information about how the process operated is available only well after the process has ended. And much of the conduct of the operational record, including proposed plans, is never made available.
- The final redistricting plans that come out of the process are more often the result of behind-the-scenes decisions, than the straightforward application of the advertised redistricting criteria.

Lack of Accountability

Using internal records, we analyzed all proposals made by institutional and political actors during the 2013 and 2017 processes. Based on the publicly stated rules of the process, we retrospectively detect apparent violations and evaluate the degree of compliance. Further we analyze if these violations systematically affect a party or group of parties. We found the following:

- The record contains frequent exceptions to the published rules that are not documented, and whose legality cannot be verified. For example, partisan plans with lower cost functions have been frequently rejected because they violate a pre-existing rule (e.g., fragmenting a protected indigenous minority municipality that should not be split).

- The process appears to employ additional *de facto* rules that were not explicitly documented. For example, it is unclear what were the rules and criteria used by the TC to select plans that had a higher cost function, but where parties argued in favor of an alternative plan based on different attributes than the ones considered by the optimization process (e.g., cultural, socio-economic, logistic, geographical, security).
- We observed that inconsistencies (e.g., invalidations made by the EMB/TC and partisan plans adopted despite rule violations) were not distributed evenly across parties. Similarly, we observed that some parties were more effective than others when formulating counter proposals and getting them accepted (e.g., PAN in 2013).
- Redistricting outcomes are inconsistent with how the process is portrayed to the public.

Inconsistencies and Ambiguities in the Rules

We collected the rules governing redistricting expressed in four levels of law (constitutional, statutory, regulation, and administrative agreements), and used these to identify inconsistencies and gaps. This is what we found:

- Although administrative agreements are technically consistent with regulation by stipulation, the processes dictated by these agreements provide no clear operational mechanism for ensuring consistency.
- There are inconsistencies in the way in which criteria are used in practice. For example, population balance has the highest priority in constitutional law, in statute, and in regulation. However, in operation, population equality has the potential to be subordinated to other criteria during the proposal negotiating phase (e.g., number of municipal splits or not explicitly documented attributes that are considered by the TC during the evaluation phase).
- Redistrict regulations and administrative agreements have changed over time although neither the constitution nor statutes have changed. Many of these changes have a substantial potential impact (and possibly differential partisan impact) and lack a detailed rationale. For example, the inclusion of *criteria 8* in the regulation

agreement approved by the EMB's executive board in 2017, allowing parties to endorse plans with a higher cost function, was used to justify decisions that had been classified as "rule violations" in the 2013 process.

Opportunities for the future

The web-based platform was a major innovation made in the 2013 round that allowed parties to participate, interact, and observe in real time the counter-proposals made by other parties and electoral bureaucrats (CNV and LSCs). Party preferences could be inferred while allowing parties influence in the plans to some degree. If the automation algorithm produced the objectively best plan, perhaps these interactions would have been moot. However, with automation the parties' counter-proposals show that humans can improve the cost function over the machine-generated plans (Altman and McDonald 2011). This stage also gave party representatives at the state level, for the first time, the possibility to make explicit demands to incorporate community and local interests in the new plans. We believe that the inclusion of online mapping tools can make the process more inclusive in the near future (Trelles et al., 2016).