Date Printed: 01/05/2009

JTS Box Number: IFES_22

Tab Number: 47

Document Title: ELECTORAL DISTRICT REDRAWING IN MEXICO, 1996

Document Date: 1996

Document Country: USA

Document Language: ENG

IFES ID: EL00304

5B1D4D91-98CE-49D1-BE50-2D5C7F529CC6

Electoral District Redrawing in Mexico, 1996

English

ELECTORAL DISTRICT REDRAWING IN MEXICO, 1996

In the 20th. century, Mexico has undergone transcendental demographic changes. There was first limited growth; fifty years later, the population had increased threefold, and since the 1970s the rythm of increase has tended to diminish.

These changes undergone by the country's whole population, together with internal migration, make it imperative to update all things involving population figures. The country's division in electoral districts -i.e. constituencies- is one of such cases where changes experienced should be taken into account.

The objective of dividing the country into constituencies or electoral districts is to locate in a certain geographical area a certain number of inhabitants (and thus of voters), so that they may elect a representative before parliament, congress or a legislative body. In this sense, dividing into districts is a political-territorial problem which implies the periodic redrawing of electoral boundaries.

In order to operate changes in constituency boundaries it is necessary to define the geographical space, which means meeting a series of challenges and facing various problems.

The legal procedure to undertake such process of a new division of constituencies, i.e. a redrawing of districts, has its bases in the Constitution and the Federal Code of Electoral Institutions and Procedures.

The aim of the present document is to put forward some aspects of the work done this year on electoral district redrawing in Mexico, underscoring four fundamental elements: the inputs required, the distribution of the constituencies, their creation and the adjustments that may seem necessary.

I. INPUTS

The information required for a redrawing of districts is sometimes vast and complicated, and thus the first stage consisted in defining the existing information in order to establish the strategy and methodology to be followed, always taking into account the time available for the project's development. Therefore, the main inputs were:

In the first place, a population base had to be defined, taking as direct source the Eleventh General Population and Housing Census (1990) at state and municipal level (which is the second political-administrative division in the country) and an estimate at constituency level (which is the smallest political division).

Later, both a System of Geographic-Electoral Information (SIGE) and a Cartographic Electoral System (SICE) were devised, where the 63,600 electoral districts of the country were digitalized as polygons.

In order to have digitalized cartography, the necessary research was undertaken to determine which would be the most adequate informatic infrastructure so as to be able to use information with ease and, above all, efficiently.

As to the theoretical-methodological aspects, studies were done which showed the following basic results:

a) The techniques used to solve this kind of problems go from the traditional -which means having a map and the number of inhabitants of the geographical units and doing the exercise manually- to the most sophisticated, based on mathematical programming and which are capable of optimum solutions. A midway point between these two extremes would be the heuristic models.

b) The criteria adopted, independently of the technique to be applied, respond invariably to contiguity, compactability and the deviation of the population mean.

2. DISTRICT DISTRIBUTION

According to the census information of 1990, the population for the whole national territory is 81.249,645 inhabitants, and the number of districts to be alloted equals 300; if we divide total population between 300 districts, we will get approximately 270,832 inhabitants per district.

When finding the quotient of the total 1990 population per state between the 270,832, we obtain the number of electoral districts which should exist within each of the states of the country.

Once the division done, it was observed that in four cases the result was less than two, but one should bear in mind that in each state there should be at least two electoral districts, so Baja California Sur, Campeche, Colima and Quintana Roo should be alloted two districts.

There are various techniques used to allot the number of districts: figures can be made into a round sum to the highest whole number (Adams' technique), the nearest whole (St. Laguë) or the lesser whole (D'Hont).

Applying all three, whe obtained the following:

+With Adams' technique, the sum total of districts was 315, so the population mean would have to adjust to 283,900.

+Using St. Laguë's technique, the number of districts is 300, and no adjustment is required.

+Finally, when applying D'Hont's technique the districts totalled 287, and the population mean had to be adjusted to 250,000.

Which is the best of the three techniques?

The results of their application show small differences, and it is not easy to point out which technique is the best. It depends on the criterion adopted.

If we take as criteria the current distribution, the most appropriate technique would be D'Hont's; but if the ruling criterion is to be the most equitable, then preferences should go to Adams'.

But if we consider the difference between the highest overrepresentation and the highest underrepresentation, the choice must go to St. Laguë, which is the technique finally adopted for the allotment of electoral districts.

3. CREATING DISTRICTS

Once having performed the documental analysis of techniques such as entire programming, taboo, simulated annealing and heuristic, it was decided to try the annealing and heuristic techniques. The choice was made on the bases that annealing is more complete than taboo and entire. As for the heuristic technique, it was chosen because, as we said before, it is a midpoint.

Mathematical programming algorythms are aimed at finding a redrawing of districts capable of giving the function-objective top capacity in the sense of maintainig as far as possible the equality of the population of the various districts. These algorythms operate with a series of restrictions.

The function-objective can be expressed in quadratic form and the restrictions in lineal form, except for certain criteria which can be set forth through a non-lineal restriction. The variables are wholes.

When solving the problem through techniques of entire programming, such as ramification and boundary marking, or section plans, the optimum achieved is not necessarily the global optimum. Therefore, we analyzed simulated annealing and taboo; we chose annealing since we had greater experience both on the theoretical plan and in its application to district redrawing problems.

Tests made took into account basic criteria such as equality of population, contiguity and compactability, plus an extra criterion related to municipal boundaries. This criterion was added since experience shows that in Mexico the population considers the municipal level as an element of geographical identity, and also because such addition considerably reduced the technical problem of the number of units to be combined.

Nonetheless, complexity grew when other elements such as roads, travelling times or certain socio-economic features were added.

It was deemed convenient, simultaneously to the stages of analysis and development of tests on the selected techniques, to have a tool permitting to interact dynamically with the machines in order to modify scenarios. When doing research on this, we found that we could use a tool called Dynamo, which although it was not designed for redrawing districts could prove useful to do dynamic spacial analysis.

It was decided that taking advantage of the three techniques (heuristic, annealing and dynamo) was a good strategy, and so we could complement the solutions generated. The strategy consisted in generating a first solution through the heuristic model which at the same time would be the initial solution required by the annealing model, and then eventually using dynamo to make adjustments.

The following aspects were always kept in mind:

+Solutions presented should be capable of being reproduced.
+The model and its applications should be transparent.
+The information required by the chosen model should be made available.
+Compliance with the legal framework.
+Factibility according to available resources and time.

With the incorporation of points one, two and five we gave up using the annealing model, since it is greatly dependent on probabilistic functions, which makes reproduction and follow-up rather difficult. Thus it was decided to work with the heuristic model.

The heuristic model proved the most adequate -despite acknowledging that it is not an optimizing model- since it is systematic, reproductible and efficient in the sense that it generates good solutions. Its technical features allow executing the work of district redrawing with transparency, which helps to obtain a consensus of the various political forces and actors.

Once the decision taken, we began developing the programming of the heuristic model, which in its first versions contained a series of alternatives permitting to operationalize the established criteria, in particular those related to compactability, contiguity and deviation from the mean. Many of the options were also related to the model's own functioning, such as defining the initial area.

The alternatives are:

-Vicinity by point or vicinity by boundary:

This refers to two ways of defining the neighboring units of a geographical unit; vicinity by point means they touch each other at one point, and vicinity by boundary means they share a common point. The first one was rejected since it produced apparently disconnected districts and with highly irregular forms.

-Form of growth:

Starting from the initial geographical unit (seed), the algorythm incorporates other units one by one, and new units go on being added to the group thus formed, with various options.

At the beginning we considered using for all forms of growth the parameter called epsilon, which is a percentage of the target population used to give the district the possibility of growing and to better the population balance. The various forms of growth are the following:

+Central growth: for all units we conform a list of units (municipalities or sections, according to each case), ordered by decreasing population. We take the district's seed (zero element on the list) and add all the neighboring units one by one, keeping the unit added and maintaining the order. Once we finish adding all the neighbors to the given unit, we take the next element following the allotment order and repeat the procedure, as long as adding one more element to the district does not make the group's population depart from the mean in absolute value.

+Growth by best neighbor: having the seed for the district, we consider a list of all the district-in-the-making's neighboring units and look for the unit having the largest quantity of vicinities with the said district, and we add it to the district; in the case when there is the same number of vicinities, we choose the first one found and update the list of the district's vicinities every time a unit is added. We continue doing this until adding one more element to the district would make the population of the group depart from the mean in absolute value, or until there are no neighbors to be added.

+Mixed growth: it starts in the form of central growth and reaching the point when we have run out of seed's neighbors, it allows the district to grow only once under the criterion of best neighbor, to return then to central growth. If we find ourselves in such a situation again, we adopt the best neighbor criterion once more. We continue thus until there is no option, or until adding one more element to the district makes the resulting group's population depart from the mean in absolute value. In short, mixed growth is the combination of both previous types of growth.

-Order of neighbors

Among the inputs of the algorythm there is a list of the geographical units to which we join a list of each of the neighboring units; after a series of internal discussions of the work team, we concluded that ordering lists by decreasing population was the most adequate, since it favors compactability and makes it easier for the algorythm to achieve population balance.

-Defining seeds

It was established that seeds would be defined manually and according to that located in the north.

4. ADJUSTMENTS

Once the heuristic model is put to work, the next stage involves using the dynamo program and assessing and adjusting if necessary the redrawing proposals.

This stage takes place on the drawing board and assesses the proposed scenarios according to the criteria of respecting geographical features, important roadworks, villages, quarters, colonies and Indian communities conformed along socio-cultural lines.

This responds to the fact that the aforementioned criteria are difficult to include in the heuristic model.

At this stage we take into account both the geographical knowledge of the states and the operational experience in electoral procedures, using support maps in order to modify (if need be) the proposed scenarios.

Those proposals are formulated through the dynamo tool, where we obtain the new values according to which the scenario will be assessed and which include:

+Considering possible geographical features and roadworks, respecting them as far as possible.
+Considering infrastructure and travelling times: roads and times should be taken into account between the electoral sections and the district's designed headquarters.
+Considering the communities' integrity: preferably the units should encompass the whole village, quarter, Indian community and so forth.
+Headquarters: there will not be predefined district headquarters; they should be determined applying criteria such as higher population, roadworks and public services.