New Voting Method Adapted to Developing Countries (NoMePaVD)

Zoïnabo SAVADOGO, Sougoursi Jean Yves ZARE, Wambie ZONGO, Blaise SOME

Laboratory of Numerical Analysis of Computer Science and Biomathematics (LANIBIO), Joseph Ki-Zerbo University, Ouagadougou, Burkina Faso

Email address:

sougoursi@hotmail.com (Sougoursi Jean Yves Zare), serezenab@yahoo.fr (Zoïnabo Savadogo), blaisesome@gmail.com (Blaise Some)

Abstract: Elections are the heart of democracy. The choices made by a social group generally affect all the individuals in that group. So social choice is about the selection of options by a group of individuals. Many voting methods exist in the literature but these methods are not necessarily adapted to the situation of low-income countries, forcing these countries to go into debt to organize elections that sometimes do not express the will of the people. In our case we seek to elect a president of the republic by indirect suffrage. To do this we first organize a coupled election (legislative and municipal) in which mayors and deputies are elected. Then, the latter will in turn constitute the electors responsible for designating a president of the republic. The weight of the votes of these electors in the choice of the president is therefore a function of the schooling rate of the region where they were designated. Thus, by applying the vote by score and considering the weight of the votes of the electors, a winner is designated. The winner of the election is the one who obtains the most points. This voting method has the advantage of being less costly.

Keywords: Social Choice, Voting, Community Conflict Resolution

1. Introduction

The organization of elections is difficult to bear for low-income countries, which is not without consequences for democracy. These countries are very often obliged to turn to technical and financial partners (TFPs) who in return impose conditions that quite often constitute a brake on development. Recent experimental research has found that, along with the electoral outcome and elite cues, voting experience is one of the primary influences on how voters perceive electoral integrity and form opinions about elections [8]. Elections are at the heart of democracy [1], a means of avoiding conflict.

However, it has been observed that votes in certain countries lead to social fracture, wars, etc. This situation is sometimes due to corruption.

This situation is sometimes due to electoral corruption, low level of education of voters, poverty, etc. leading to widespread corruption in the services after the elections. Thus a more economical electoral system that is sustainable by these states could be an effective way to avoid conflict. The variety of electoral systems used in the world shows that this theme is still relevant [2].

During the 1950s, the work of Arrow (1963), Black (1958) and May (1952) on this issue gave rise to a huge literature constituting what is now called social choice theory [3]. So, a voting method (or Aggregation Function or Social Choice Function) is an application of a set of voters' preferences or evaluations into the set of winner(s) of an election [4]. In this chapter, we propose a new voting method based on indirect suffrage and approval voting [9] by coupling legislative and municipal elections that result in a presidential election taking into account the educational level of voters at the base.

2. Literature Review

Approval voting is used in two places in the United States, and momentum is building for its expansion. In 2018, Fargo, North Dakota was the first city in the United States to pass approval voting for government elections (The Center for Election Science 2018). Fargo was previously plagued with vote splitting, as candidates claimed wins with less than 30% of the vote (Reform Fargo). The Fargo commission created a

task force to study the issue. After six months, the task force recommended approval voting. The commission then ignored the task force for over a year, which eventually triggered Fargo citizens to file a ballot initiative (Reform Fargo). In the 2018 ballot initiative, Fargo residents overwhelmingly supported the reform nearly two to one [10]. It cost the city no money to implement approval voting from a technical standpoint, as their voting technology was already equipped to handle approval voting. While approval voting's first use was to simultaneously elect two candidates to the commission, both candidates had over 50% approval (Center for Election Studies 2020c). St. Louis is the most recent city to implement approval voting, having passed a ballot initiative by 68% in 2020 [11]. Its first use was in 2021, in the form of a nonpartisan open primary by approval, with a top-two general election where the primary election leader went on to win in the general election [12]. According to St. Louis election officials, the transition from plurality voting to approval voting was smooth and only required "a bit more education" and "changing the wording on the ballot and in the programming" [13]. Beyond its use in Fargo and St. Louis, approval voting has been used in several private organizations for many years. Currently, it is used by political organizations such as the Texas Libertarian Party, the Texas Green Party, the Reform Party, as well as by the United Nations to elect the general secretary. Private organizations that use approval voting include the Mathematical Association of America, the American Statistical Association, the National Academy of Sciences, and the Institute for Operations Research and Management Sciences. [8]

3. Description of the Method

In a combined legislative and municipal universal suffrage, deputies and mayors are elected, who in turn elect the president of the republic.

The candidates for the presidential elections are also chosen from among these local elected officials, taking into account certain criteria set by the electoral code.

In this electoral process we will also take into account the schooling rate of each province.

In a presidential election, let $G(A_j)$ be the overall performance of candidate A_j, α_i the enrolment rate of province i; $g_j^k(a_i)$ the score of voter k (locally elected) from province i assigned to candidate j.

Here, we also apply approval voting, i.e. each voter is obliged to give a mark to each candidate. The number of voters is therefore greater than or equal to the number of candidates because the candidates for the presidential elections come from the local elected officials responsible for electing the president of the republic.

Thus, each voter will assign one and only one score from the set $\theta = \left\{ \frac{1}{\mu}, \frac{2}{\mu}, \ldots, \frac{\mu}{\mu} \right\}$ with μ the total number of voters.

So:

$$G(A_j) = \sum_{i=1}^n \alpha_i \cdot g^k_j(a_i)$$

n: being the number of provinces
k: being the number of voters per province
j: the number of candidates in the presidential elections

Then the candidates are ranked from first to last according to their overall performance. The winner should then be the candidate who is most appreciated by the 'majority' [5]. The elected candidate is the one with the highest score and becomes the new president of the republic.

4. Conceptual Model

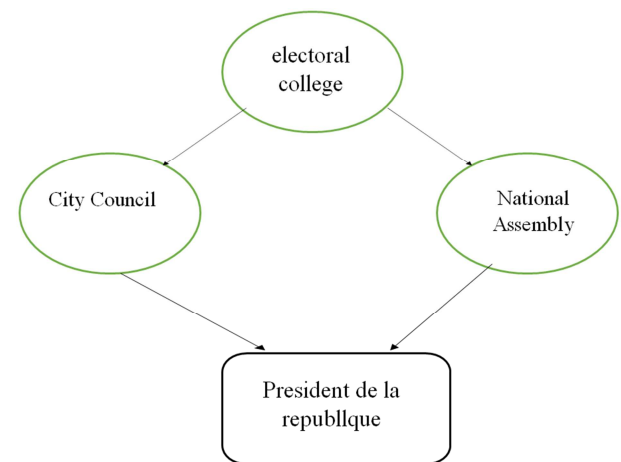The conceptual model of our method is as follows:

Figure 1. Conceptual Model.

In this model, the people represent the electoral college that appoints mayors and deputies. The latter are in turn responsible for electing the president of the republic.

5. Properties of the Method

Dagsputa and Maskin maintain the traditional model and require that a good voting method must satisfy certain fundamental principles and be difficult to manipulate [6].

Our method verifies all of the following properties:
a) Neutrality
Définition 9.3.1 [7]

An aggregation function f is neutral if the winner between two or more candidates changes as soon as all voters reverse their preferences (or evaluations).

The idea of neutrality is that if the preferences change radically, the winner of the election must also change.
b) Anonymity
Definition 9.3.2 [7]

An aggregation function f is anonymous if the winner between two or more candidates does not change as soon as voters are swapped. This definition indicates that if two voters swap their ballots, the function must return the same result in both situations.
c) Unanimity or Pareto-consistent
Definition 9.3.3 [7]

An aggregation function f is unanimous if it always returns as the winner between two or more candidates a candidate who is judged to be the best of all by all voters.

This definition suggests that when all voters prefer one candidate to the others in the race, that candidate should not, under any circumstances, lose.

d) Monotonicity

Definition 9.3.4 [7]

An aggregation function f is monotonic if it returns a candidate with profile p as the winner and keeps it as the winner with profile p knowing that in the latter profile at least one voter has improved his score for that candidate.

A candidate should therefore not be ranked lower if at least one judge upgrades his or her rating.

e) Independence of irrelevant alternatives

Definition 9.3.5 [7]

An aggregation function f is independent of irrelevant alternatives if it ranks between two candidates only on the basis of voters' preferences (or ratings) of those candidates. The addition or removal of another candidate should not change this ranking in any way.

f) Reduced to approval voting

6. Advantages and Disadvantages of the Method

6.1. Benefits

a) Fight against corruption Politicians sometimes use the misery and lack of education of voters to win elections. However, with our method, the population at the grassroots level will no longer be responsible for directly electing the president of the republic and is therefore less likely to be manipulated.

b) Less budgetary the organization of presidential elections taking into account our method will save a lot of money since the elections will be done on a single site therefore mobilizing less financial and material resources.

c) Fight against political nomadism The local elected officials in charge of electing the president are very often community leaders, they are elected according to their influence and not according to the political party. Thus, it will no longer be necessary to move to a new party to fool the population at the grassroots.

d) Crisis avoidance One of the main purposes of this method is to avoid crises. By organizing less costly elections, the government saves money and could therefore refuse aid from financial partners which will condition the development of the country and reinject the money saved into other development sectors, thus boosting the economy and avoiding crises.

e) Reduction in the number of polling stations will imply a reduction in the number of staff and therefore a reduction in the number of ballots and in the number of polling stations.

f) Our method fulfils its function of selecting a strong winner well. This applies regardless of how one qualifies what a strong winner means, including the ability to elect Condorcet winners under fair conditions [14, 15], as well as under mixed strategy conditions [15, 16].

6.2. Disadvantage

It is very rare to find a completely perfect method. The difficulty encountered here is that the application of our method requires an advanced level of education.

7. Digital Experience

Table 1. Voting matrix.

	A_1	A_2	A_3
V_1	10 10	1 10	5 10
V_2	3 10	9 10	4 10
V_3	2 10	1 10	6 10
V_4	7 10	10 10	2 10
V_5	6 10	5 10	1 10
V_6	3 10	7 10	9 10
V_7	1 10	2 10	3 10
V_8	10 10	1 10	5 10
V_9	8 10	3 10	7 10
V_{10}	4 10	1 10	6 10

That is, a presidential election, preceded by a coupled municipal and legislative election; during which there are 3 presidential candidates from the 10 locally elected officials of 5 provinces.

Voters 1 and 2 are from province 1 with an enrolment rate of 20%.

Voters 3 and 4 are from province 2 with an enrolment rate of 32%.

Voters 5 and 6 are from province 3 with an enrolment rate of 19%.

Voters 7 and 8 are from province 4 with an enrolment rate of 60%.

Voters 9 and 10 are from province 5 with an enrolment rate of 47%.

So: $\mu = 10$

$$n = 5$$

$$k = 2$$

$$j = 3$$

$$\theta = \left\{ \frac{1}{10}, \frac{1}{10}, \dots, \frac{9}{10}, \frac{10}{10} \right\}$$

$$\propto_1 = 20\%$$

$$\propto_2 = 32\%$$

$\propto_3= 19\%$

$\propto_4= 60\%$

$\propto_5= 47\%$

Then knowing the enrolment rate of each province and the preference of each voter then for each candidate we apply the formula:

$$G(A_j) = \sum_{i=1}^{n} \propto_i . g^k_j(a_i)$$

$$G(A_1) = \frac{0.2\times10+0.2\times3+0.32\times2+0.32\times7+0.19\times6+0.19\times3+0.6\times1+0.6\times10+0.47\times8+0.47\times4}{10}=1.567$$

$$G(A_2) = \frac{0.2\times1+0.2\times9+0.32\times1+0.32\times10+0.19\times5+0.19\times7+0.6\times2+0.6\times1+0.47\times3+0.47\times1}{10}=1.148$$

$$G(A_3) = \frac{0.2\times5+0.2\times4+0.32\times6+0.32\times2+0.19\times1+0.19\times9+0.6\times3+0.6\times5+0.47\times7+0.47\times6}{10}=1.717$$

We have: $G(A_3) > G(A_1) > G(A_2)$ so: A_3 P A_1 P A_2

Therefore the winner of the presidential elections is the A_3 candidate.

8. Conclusion

In this article we have developed a voting method for countries in financial difficulties and post-election crises called NoMePaVD. This method limits dependence on external aid, thus enabling countries to cope more effectively and avoid crises of all kinds. This method could very well be applied in the case of Burkina Faso after the state elections of 30 October 2022 for the choice of a transitional president, but by replacing the local elected representatives by the living forces of the nation (religious, political and customary leaders). In our future work, we will test the effectiveness of our method by carrying out the algorithmic study and the computer implementation.

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