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Application of Decision Tree Technique in Selecting Visionary Leaders for Technological and Economic Development in Nigeria

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Abstract: Visionary leadership is a dynamic blend of heterogeneous qualities such as: integrity, ability to set achievable goals, empowering the masses to achieving the goals, being courageous in making proper decisions for tackling challenging problems, being creative in bringing out innovative ideas for economic and technological transformations, etc. Regrettably, Nigeria has been facing a lot of technological and economic challenges due to lack of visionary leaders ever since the inception of the fourth republic from 1999 to date. The root of this problem is due to improper screening of candidates vying for various political offices during party primary elections which are marred with money-politics whereby the highest bidder always emerges as the party's representative for a given political office. This work therefore developed a statistical formula that uses the Decision Tree technique - which is a machine learning model - as a veritable tool for screening and selecting credible candidates during party primaries so that visionary leaders can be elected to contribute positively towards the technological and economic well-being of the masses. The variables used by the Decision Tree technique for screening candidates are: integrity, interpersonal skills, leadership experience, exposure, and academic qualification. The probability of success of a candidate based on the first two variables were determined through an online opinion poll collected from the party members (using simulation as a hypothetical example), while the probability of success of a candidate based on the last three variables were obtained from the candidate's CV and certificates. The various probabilities of successes for each candidate were analyzed by the developed statistical formula. The candidate whose overall probability of success is closest to one (1), becomes the most visionary leader selected as the party's flag bearer for a given political office.

Key Words: Decision Tree, Visionary Leader, Party Primary, Probability, Nigeria, Technological and Economic Development

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Introduction

Article 1 of the regulations for the conduct of political party primaries in Nigeria as stipulated bv Independent National Electoral Commission (INEC), required that every eligible member of a party must equal opportunity given participate in the party primary elections for the purpose of selecting candidates for elective positions (INEC, article1, 2019). Regrettably, this provision is being undermined by party elites who always adopt the primary election indirect party method instead of the direct method so as to deploy money to easily influence the choices of the party delegates during party primary elections (Aisha, 2019). Such dirty politics adversely affects emergence of credible candidates (Sadeeque & Dele, 2017; Odukoya, Ugorji, Ehibor, Osimen, Ifijeh, Abasilim, Owolabi, Eyisi, Adesiyan, Abiodun-Eniayekan, Igbinoba, Chimuanya, Oduola Odo, & Agberotimi, 2024).

Consequently, what always turns out from the election is the emergence of non-visionary leaders who have practically nothing to offer towards national development. Worse still, article 2 of the INEC party regulations stipulated that political parties must not create rules or impose conditions or set high expression of

interest or nomination fees that could exclude aspirants on the basis of sex, religion, ethnicity, circumstance of birth or wealth (INEC, article 2, 2019). But this provision is blatantly ignored by the prominent parties in Nigeria whose nomination fee for any elective position runs into millions of naira. This therefore makes party elections in Nigeria exclusively for the rich thereby preventing some technocrats from contesting in the elections due to financial constraints.

As a result of this, bad governance continues to rear its ugly head from year to year in Nigeria (Durowaiye & Muzughurga, 2024; Abasilim & Adekunle, 2024). All these challenges with party primaries in Nigeria are the bedrock of the continued lack of visionary leaders ever since the inception of Nigeria's fourth republic from 1999 to date. To address these challenges, the use of Decision Tree technique – which is a learning machine classification system – was applied in this work as an effective tool for screening and selecting credible candidates during party primaries. This technique works by outlining, in a tree-like manner, all the critical attributes required of a visionary leader so that a candidate can be assessed based on each of those attributes which forms a branch of the tree.

Each branch of the tree measures the level of success or failure of a candidate for that attribute. After analyzing all the branches of the tree for the various rate of successes made by each of the candidates for all the attributes required of them, the candidate with the highest probability of success becomes the best candidate for the elective position. A decision tree works like a Binary Search tree because each of the two techniques is searching for something always [which in this context is the candidate with the highest probability of success at the poll] in logarithmic time (Greenwell, 2020). The decision tree technique works best if the direct method of party primaries is adopted and conducted online for a guaranteed transparent election.

The use of direct primaries for electing party flag bearers has always been criticized as being too costly, and that is why most political parties always opted for the indirect method in order to save cost by electing some delegates who are empowered to elect the party's flag bearers. But the indirect primaries has never yielded any positive results due to its total abuse by the party leaders, delegates, and the aspirants themselves who mess up the whole process with money politics. This work therefore advocated the use of direct method for party primaries. This is because it paves way for a transparent party election. Furthermore, it makes the screening of candidates through the use of decision tree technique applied

in this work seemingly easy to implement online. Again, the cost of conducting the online poll would be drastically reduced when compared with the cost of holding a party's national convention for electing delegates during the indirect primaries.

Review of Related Literature

The most critical challenge today confronting Nigeria Leadership problems. The present and past leaders of Nigeria seem to have failed to provide quality leadership capable of addressing numerous challenges confronting the country (Anekwe, 2020). These challenges were mentioned by Albert (2011) as political corruption, selfishness and hunger for political power, wide gap between the rich and the poor, tribalism. massive vouth unemployment, abject poverty, etc. Adedeji (2019) traced the leadership failure to lack of visionary leaders. He stressed that visionary leadership is the rudder that directs the spinning wheel of national development. A visionary leader was defined by Indeed Editorial team (2024) as, an individual with a clear idea of how to envision the future, and then sets endgoals [such as technological and economic development of a country] and finally creates a strategic plan to achieving the goal.

The lack of visionary leadership in Nigeria was emphasized by Adefarasin (2020) who lamented

bitterly that it was quite pathetic and unfortunate that after sixty years (60 years) of Nigeria's independence, the country is still a sleeping giant of Africa. The use of party primaries by INEC to forestall good governance in Nigeria was considered by many as the right step in the right direction (Olu-Owolabi. Gberevbie Abasilim. 2021). According to Godknows (2022),in historical realism, one of the greatest events that attract common human interest for future generations is the process by which political leaders are selected, and the course of the events of their lives. Regrettably, the party primaries have been marred, right from its inception, with massive corruption in both high and low places thereby sabotaging the efforts being made towards good governance in Nigeria.

Such ugly party primaries in Nigeria was simply described by Olu (2022) as "garbage in, garbage out politicking" whereby low quality of party primaries candidates for together with the hanky panky in the party primaries produces mediocre as leaders to the detriment of the nation at large. The solution to the problems with party primaries can be achieved the use of decision trees. According to Coursera (2023), a decision tree is a machine learning algorithm that provides an effective method for making decisions because it lays out a problem and all of its possible outcomes visually for easy analysis. Continuing, the author stated that, a decision tree is so named

because it starts at the root, like an upside-down tree, and branches off to demonstrate various outcomes.

Emphasizing on the relevance of decision trees, Greenwell (2020) described a decision tree as a kind of machine learning algorithm that can help with a wide variety of tasks. The tree-like nature of the technique is quite easy to use and understand. It also showcases transparency when traversing the tree from its root down to its terminal point at the leaves where the final results are determined. Thus, any of its branches can easily be isolated and analyzed for authenticity (Coursera, 2023). The decision tree technique was therefore applied in this work for total transparency and visionary selection of effective leaders at party primary elections for good governance.

Research Methods

classification technique was employed in this work for effective determination of the best candidates that would emerge as visionary leaders during party primary elections in Nigeria. classification tree generally involves a series of 'Yes' or 'No' (or if-then) outcomes for a given dataset so that an accurate prediction or classification of cases can be made (Classification & Regression Trees, 2024). The dataset for the decision tree implemented in this work consists of five attributes considered which are by visionary researcher as the key attributes for assessing a candidate for

an elective position. The dataset is as follows, {integrity, leadership experience, exposure, academic qualification, interpersonal skills}

The explanations for each of the attributes in the dataset are as follows

- Integrity: This refers to the quality of a person being honest and having strong principles. The moral following vardstick can be used for measuring a person's leadership integrity: whether the person has stolen any public funds before, (ii) whether the person can be entrusted with public funds, (iii) whether the person is sincere with his/her biodata records (such as: date of birth, academic qualifications, etc.), (iv) whether the person has any previous crime record
- Leadership experience: This refers to any position of authority previously held by someone
- Exposure: This refers to the attendance of meetings, workshops, seminars, conferences, etc. both locally and internationally in order to gain wide experience
- Academic qualification: This refers to a person's formal education from primary school to tertiary institution
- Interpersonal skills: This is the ability and quality a person possesses in communicating

or interacting effectively with other people. The following criteria can be used for measuring person's a interpersonal skills: (i) verbal communication: that is, ability speak clearly and eloquently, (ii) good temperament: that is, being able to control one's emotions and reactions to situations, (iii) active listening: that is, ability to listen attentively to what people say and giving feedbacks to them. empathy: that is, ability to have feelings for the masses, (v) self-confidence: that is, feeling of trust in one's abilities. qualities, and iudgement

Each attribute in the dataset has a weighted score for rating each aspirant, as shown in Table 1.

Table 1. Weighted scores for rating political aspirants

Table 2 shows the instruments that were used for measuring the five attributes in the dataset.

Table 2. Measuring instruments for the attributes of a political aspirant

| Input variable | Scaling factor | Weight | Weighted score | | Input variable | Scaling factor | Weight | Weighted score |
|-------------------|---|--------|-------------------|---|-------------------|---------------------|--------|-------------------|
| | No FSLC | 1 | 1/10 | | | 0 - 10% trust | 1 | 1/10 |
| Academic | Has only FSLC | 2 | 2/10 | | Integrity | 11 - 20% trust | 2 | 2/10 |
| qualification | No 5 O'level credits | 3 | 3/10 | | | 21 - 30% trust | 3 | 3/10 |
| | Has >= 5 O'level credits | 4 | 4/10 | | | 31 - 40% 4 trust | 4/10 | |
| | Has A level/OND/TC II | 5 | 5/10 | | | 41 - 50% trust | 5 | 5/10 |
| | Has 1st degree / HND | 6 | 6/10 | | | 51 - 60% trust | 6 | 6/10 |
| | Has post graduate diploma | 7 | 7/10 | | | 61 - 70% trust | 7 | 7/10 |
| | Has masters degree | 8 | 8/10 | | | 71 - 80% trust | 8 | 8/10 |
| | Has PhD | 9 | 9/10 | | | 81 - 90% trust | 9 | 9/10 |
| | Is a Professor | 9.9 | 9.9/10 | | | 91 - 100% trust | 9.9 | 9.9/10 |
| | No previous experience | 1 | 1/10 | + | | 0 - 10% | 1 | 1/10 |
| | | | | | | skill | | |
| Leadership | Has 1 previous 2 ship experience | _ | 2/10 | | Interpersonal | 11 - 20% skill | 2 | 2/10 |
| experience | Has 2 previous experience | 3 | 3/10 | | skills | 21 - 30% skill | 3 | 3/10 |
| | Has 3 previous experience | 4 | 4/10 | | | 31 - 40% skill | 4 | 4/10 |
| | Has 4 previous experience | 5 | 5/10 | | | 41 - 50% skill | 5 | 5/10 |
| | Has 5 previous experience | 6 | 6/10 | | | 51 - 60% skill | 6 | 6/10 |
| | Has 6 previous experience | 7 | 7/10 | | | 61 - 70% skill | 7 | 7/10 |
| | Has 7 previous experience | 8 | 8/10 | | | 71 – 80% skill | 8 | 8/10 |
| | Has 8 previous experience | 9 | 9/10 | | | 81 – 90% skill | 9 | 9/10 |
| | Has >= 9 previous experienc | 9.9 | 9.9/10 | | | 91 – 100% skill | 9.9 | 9.9/10 |
| | | | | | | | | |
| | No conference/wshop attended | 1 | 1/10 | | | | | |
| Exposure | conference/wshop attended | 2 | 2/10 | | | | | |
| Empositie | 2 conferences/wshop attended | 3 | 3/10 | I | | | | |
| | 3 conferences/wshop attended | 4 | 4/10 | | | | | |
| | 4 conferences/wshop attended | 5 | 5/10 | | | | | |
| | 5 conferences/wshop attended | 6 | 6/10 | | | | | |
| | 6 conferences/wshop attended | 7 | 7/10 | | | | | |
| | 7 conferences/wshop attended | 8 | 8/10 | | | | | |

| Input | Measur |
|-----------------|------------------|
| variable | ing instrument |
| Academi | Academ |
| c qualification | ic certificate |
| Leadersh | CV |
| ip experience | (curriculum |
| | vitae) |
| Exposure | Certific |
| | ates of |
| | participation at |
| | conferences, |
| | seminars, |
| | workshops, etc. |
| Integrity | Online |
| | survey from |
| | party members |

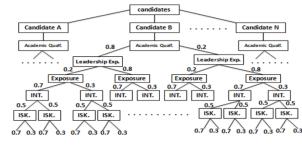
| Interpers | Online | | | |
|------------|---------------|--|--|--|
| onal skill | survey from | | | |
| | party members | | | |

Using the Decision Tree technique

Figure 1 shows the decision tree for assessing and determining the best aspirant for an elective position. The tree was built based on the hypothetical following example whereby amongst all the candidates A, candidate B, (candidate candidate N) that are vying for an elective position, candidate possessed the following assessment scores:

Academic qualification = 8/10= 0.8Leadership experience = 2/10= 0.2Exposure = 7/10 = 0.7Integrity = 5/10 = 0.5Interpersonal skills = 7/10 = 0.7

Figure 1. The decision tree technique for determining the best political aspirant for an elective post



The root of the tree in figure 1 shows all the candidates (candidate A, candidate B, ..., candidate N) vying for an elective position. For each of the candidates, the tree splits into two branches in order to classify the 'success rate' and 'failure rate' of the candidate based on his/her assessment score for each of the attributes in the dataset {academic qualification, experience, leadership exposure, integrity, interpersonal skills}. The left branch of the tree shows the 'success rate' while the right branch shows the 'failure rate'. Each branch of the tree is further split into two branches to also assess the 'success rate' and 'failure rate' of a candidate for another attribute in the dataset. The splitting of the tree continues in this manner until all the candidates have been assessed for all the attributes in the dataset.

Developing Statistical formula for the Decision Tree

In the decision tree of fig.1, the 'success rate' and 'failure rate' of a candidate is determined as,

$$\frac{n}{N}$$
 =

number of successe (or failures)of a candidate

total number of possible successes required of the candidate till. Complement (1)

The expression in (1) is equivalent to the basic probability law which states that, if A is an event of an experiment with sample space S, then the probability of A, written P(A) is expressed as,

$$P(A) = \frac{n(A)}{N} = \frac{n(A)}{N}$$
total number of outcomes in the sample space

(2)

The ratio, $\frac{n(A)}{N}$ in (2) produces a real number between 0 and 1; that is, $0 \le P(A) \le 1$

If P(A) is close to zero (0), it means that the event, A is less likely to occur. On the other hand, if P(A) is close to one (1), it means that the event, A is most likely to occur.

The following basic probability rules are required for deriving our statistical formula.

Range of probability rule: the possible values for probabilities range from 0 to 1, where:

0 = impossible event

1 = event that is certain tooccur

Thus, given an event A, with sample space S, we have that, $0 \le$ $P(A) \le 1$

ii. Sum of probabilities: the sum of all the probabilities for all possible outcomes in the sample space, S is equal to 1; that is, P(sample space, S) = 1or $\sum_{i}^{s} P(Ai) = 1$

rule: the probability of an event, A not occurring; that is, P(A') is equivalent to (1 - probability)of event, A occurring). In P(A') = 1 other words, P(A)

Therefore, from (2), P(A') = 1 - P(A) =>have that, $P(A') = 1 - \frac{n(A)}{n}$ probability iv. Joint events: Given two independent events, A and B (whereby the outcome of A does not depend on the outcome of B, and vice versa), the joint probability formula for A and B is given $P(A \cap B) = P(A) \cdot P(B)$ by, that is, the probability of both A and B occurring is equal to the probability of A multiplied by the probability of B

Source:

https://study.com/academy/lesson/basic-probability-theory-rules-formulas.html

The decision tree of figure 1 can alternatively be called a probability tree. This is because each branch of the tree (from the root to the leaf) has some probability values attached to it for quantitative analysis (Decision Tree, 2024). For instance, the probability of candidate B, in figure 1, emerging victorious in the primary election can be determined as follows.

P(success of B) = 1 - P(failure of B) from the complement rule of probability

= 1 - P(all the tree branches of B with failure rates)= 1 - [1 - joint P(all the success rates of B)]

= 1 - [1]P(success in academic qualification) * P(success in leadership experience) * P(success in exposure) * 1 P(success in integrity) * P(success in interpersonal skills)] =1-[(1-0.8)]*(1-0.2)*(1-0.7)*(1-0.5)*(1-0.7)] = 1 - [0.2 * 0.8]* 0.3 * 0.5 * 0.31 = 1 - 0.0072 =0.9928 Therefore, P(success

In general, suppose a candidate, k possesses the following assessment scores:

of B) = 0.9928

Academic qualification = α Leadership experience = β Exposure = λ Integrity = ϕ Interpersonal skill = μ

The probability of success for candidate, k in the party primaries can be determined by the following statistical formula:

$$\begin{array}{c} P(success\ of\ K)=1-P[(1-\alpha)(1-\beta)(1-\lambda)(1-\phi)(1-\mu)]\\ (3) \end{array}$$

Equation (3) is our decision tree statistical formula for determining the probability of success

of any candidate in a party primary election

Results and Discussion

Table 3 shows simulated assessment scores and results of 12 contestants vying for an elective position in a party primary election. The weight of a candidate's assessment score lies between 1 and 10 for each of the assessment variables in the dataset, {academic qualification, leadership experience, interpersonal exposure, integrity, skills} and which was generated by the use of the following Java random number function: randomNumber.nextInt(10) (4)

Table 3. Simulated assessment scores of 12 contestants and their results

| assessment Variables | rdaj sw | Candidates' weighted scores = assessment score / 10 | | | | | | | | | 0. | | |
|---|----------------|---|------------------------|-------------------------|-----------------------------|------------------------|-------------|--------------------------------|---------------------------|-------------------------------|---------------------------|--------------------------|-----------------------|
| | | C1 | C2 | ငဒ | C4 | CS | 60 | C7 | 83 | 62 | C10 | C11 | C12 |
| Academic qualificatn (from Academic Certificates) | 1 to 9.9 | 0.9 | 0.4 | 0.6 | 8.0 | 8.0 | 0.7 | 8.0 | 0.6 | 0.6 | 0.7 | 8.0 | 0.5 |
| Leadership Experience (from CV) | 1 to 9.9 | 0.3 | 0.6 | 0.5 | 0.4 | 0.2 | 0.3 | 0.5 | 0.2 | 8.0 | 0.6 | 0.5 | 0.4 |
| Exposure (from w/shop, scminar & conference Certificates) | 1 to 9.9 | 0.9 | 8.0 | 0.7 | 0.9 | 0.7 | 0.5 | 0.7 | 0.4 | 0.7 | 0.6 | 0.7 | 0.4 |
| Average Integrity (from online Survey) | 1 to 9.9 | 0.26 | 0.75 | 0.48 | 0.33 | 0.5 | 0.65 | 0.44 | 0.69 | 0.67 | 0.37 | 0.53 | 0.69 |
| Average interperson! Skills (from online Survey) | 1 to 9.9 | 0.35 | 0.61 | 0.57 | 0.22 | 0.68 | 0.64 | 0.57 | 0.48 | 0.65 | 0.53 | 0.72 | 0.77 |
| P(successful Candidate) = $1 - P[(1 - \alpha)(1 - \beta)(1 - \lambda)(1 - \phi)(1 - \omega)]$ | | 0.996 633 Note: a | 0.995 32 = acade | 0.986 584 mic qua | 0.993 7288 lification | 0.992 32 , B=Lea | 0.986 77 | 0.992 776 exp, \lambda = | 0.969 0496 exposure | 0.997 228 $\Phi = inte$ | 0.985 7872 serity µ | 0.996 052 interper | 0.9871 66 sonal |

The probability of success for each of the candidates (C1 to C12), as

shown at the bottom of table 3, were computed by using the formula,

$$P(successful\ candidate) = 1 - P[(1-\alpha)(1-\beta)(1-\lambda)(1-\varphi)(1-\mu)]$$

For instance, P(success for C1) =
$$1 - [(1 - 0.9)*(1 - 0.3)*(1 - 0.9)*(1 - 0.26)*(1 - 0.35)]$$

$$= 1 - [0.1 * 0.7 * 0.1 * 0.74 * 0.65] = 1 - 0.003367 = 0.996633$$

Comparing the results at the bottom of table 3, we can see that, candidate 9 (C9) obtained the highest probability score of 0.997228 which therefore makes him/her the winner of the party primary election. The candidate is thus the best visionary leader for that elective position.

It is interesting to note that mere totaling of each candidate's score in Table 3 does not necessarily produce the winning candidate based on the maximum score, rather it is based squarely on the application of the developed statistical formula. For instance, if we total the scores for candidate 1 (C1) we would get, 0.9 + 0.3 + 0.9 + 0.26 + 0.35 = 2.71. Also if we total the scores for candidate 11 (C11) we would get, 0.8 + 0.5 + 0.7 +0.53 + 0.72 = 3.25. We can see that based on total scores alone, C11 > C1 which should have made C11 to appear before C1 in the winning list. from the table. the total probability score of C1 is 0.996633 while that of C11 is 0.996052 which made C1 to come 2nd while C11 came 3^{rd} . This vindicates the importance of

the developed statistical formula for determining the most suitable candidate for an elective position.

Conclusion

The use of decision tree technique in selecting visionary leaders during party primary elections technological and economic development in Nigeria has been demonstrated in this work as a veritable tool for assessing candidates holistically for various elective positions. The transparency of the decision tree technique in determining the scores of every candidate and the final winner is unquestionable. If this technique is adopted by all parties in Nigeria political conducting their direct party primaries, the endless search for visionary leaders in Nigeria for national development would come to an end.

RECOMMENDATIONS

This work recommends that, the use of 'direct method' of party primary elections in Nigeria should be made compulsory by INEC because it guarantees high level of credibility in the election of party aspirants. Again, the use of Decision Tree technique illustrated in this work should be adopted by INEC for subsequent use by all the political parties in Nigeria. This is because, the technique clearly and fully illustrated how a party aspirant is thoroughly assessed of all

the critical attributes required of him/her for visionary leadership. Lastly, the direct party primaries should be conducted online in order to ensure that very many party members participate fully in the exercise. It saves time and cost drastically, and also totally eradicates travelling risks.

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