

## **Local Government Elections – Some Personal Perspectives**

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### **Abstract**

The Constitution of South Africa requires that both national and local government elections be held every five years. These elections are not held simultaneously; currently, the local government elections are held two years after the national elections. In 2011, the 4<sup>th</sup> general local government elections took place. These were possibly the most hotly-contested elections since 1994, when South Africa became a democracy. As is the case in many national elections, a forecasting model has been developed to predict the ultimate outcome of the elections, based on early voting results. Such a forecasting model was developed by the Council for Scientific and Industrial Research (CSIR) for the 1999 national elections and has since been used to predict the results for all the national and local government elections to date. Each election poses its own challenges that need to be addressed in the forecasting model. Predictions are computed at national level (“the race for votes”), provincial level and also in the eight metros in the country. Local elections are different from national ones in that there is more than one ballot paper - individuals vote for a candidate in a ward as well as a party; these votes are used for candidates elected through proportional representation. In cases where municipalities fall within districts, there is a third vote for candidates to be elected for district councils. As predictions are computed, these need to be shared through the national public broadcast system, including radio and television stations and the broadcaster’s website. Subsequently, other media houses also request specific explanations or analysis. This, in itself, poses challenges. This paper will briefly outline the forecasting model used in the elections, what the expectations were, discuss the predictions as these unfolded over time as well as the challenges, the experiences and the interactions in dealing with the media.

### **Introduction**

US President Abraham Lincoln (1809-1865) defined democracy as: “Government of the people, by the people, for the people” (Lincoln, 1865). In most democracies - at least in representative democracies - regular elections are held to elect new governments. This is one of the most visible and true cornerstones of a democracy. Since the newly-established democracy in 1994, South Africa has held regular elections every five years at both the national and local levels. To date, these elections have not coincided and are held two years apart. The last national elections took place in 2009, while the most recent local elections were held in May 2011.

A team of operations researchers from the CSIR has been involved on contract to the SABC, the national public service and commercial broadcasting corporation, in predicting the election results through a forecasting model developed in the '90s. This model has been used since 1999 to predict results for all the national and local elections held in the country. The predictions need to be communicated to the media in different forms namely digitally, by radio and by television. Operations researchers are trained primarily to understand and address difficult decision-making problems and then to construct and develop models to solve these. Communication skills in interacting and explaining the results to clients are very important. In this specific instance, one of the most critical aspects that contributes significantly to the success of the prediction model is the ability to interact with the different types of media to convey the predicted results on a continuous basis as these become

available. The author has been privileged to be the main spokesperson of the operations research (OR) team of the CSIR since the 1999 national elections and shares his personal perspectives and insights gained from these experiences.

The paper briefly describes different types of elections and election-forecasting methodologies. A short outline of the forecasting model developed for the South African elections is presented. The experiences during the run-up to the elections, on election day itself and the predicted results compared to the final results are discussed for the recent local elections, with reference to some of the previous election results as well. Finally, a fairly extensive section is devoted to the interaction with the different types of media and the experiences gained and the lessons learnt are presented. It is hoped that operations researchers can gain new insight from this and realise the importance of appropriate communication to ensure the message reaches the target audience, in this instance, the public at large.

### **Election forecasting**

Elections create enormous interest worldwide. The media report on election campaigns months beforehand, while there is continuous speculations about the possible outcomes. In this regard, the final outcomes of any elections are not only of importance to the politicians involved, but have a huge influence on how countries will be managed and ruled, on the future economy of a country, etc. The policies of the party elected into power will play the strongest role in government policy and decision-making until the next elections.

Various forms of election forecasts exist and are being used in most elections (Brown, *et al* 1999; Greben, *et al* 2005; Karandikar, *et al* 1998; Lichtman, *et al* 1990; Morton 1988; Samuelson 2011 and Thedeen 1990). Before an election, market surveys - or opinion polls - are conducted to establish how eligible citizens will vote. This is one way of getting a sense of what the ultimate outcome of the elections may be. Representative sampling methods are used for these surveys and, although efforts are made to ensure accuracy, the element of the "lie factor" must always be taken into account. People are not always totally honest about who they would vote for. Another type of forecast is conducted through exit polls. Here voters are asked - again through sampling methods - for which candidate or party they had voted as they leave the voting station. This method has its own drawbacks and challenges but it is used in countries such as the UK. A third way of forecasting elections is to use the early results as these are received to forecast the final outcomes. Various methods and models have been developed to enable operations researchers to predict the results in this manner. The last approach is the one used by the CSIR team.

The forecasting methods are all very dependent on the political representative model and electoral system being used in a country. The key components of political representation, on almost any account, will exhibit the following four components (SEP, 2006):

- **some party that is represented** (the representative, an organisation, movement, state agency, etc.);
- **some party that is being represented** (the constituents, the clients, etc.);
- **something that is being represented** (opinions, perspectives, interests, discourses, etc.); and
- **a setting within which the activity of representation is taking place** (the political context).

In 1994, South Africa changed its electoral system to that of proportional representation whereas previously it was based on constituencies (Alvarez-Rivera, 2004). In a system of proportional representation, citizens vote for a party; from the number of votes received by

the party, the number of seats is allocated to the party. Upfront, the party provides a list of candidates and seats are allocated from the top of this list - in this way, the individuals who will represent the party are determined. This holds true for national elections, while for local elections one finds individual representation as well as proportional representation, and the number of voting papers required differs for municipal and districts councils (IEC, 2011). In both cases there are wards where the citizens vote for a candidate (of a specific party, typically) and also cast votes for a party, which are used for proportional representation. Some areas of the country have district councils - in those areas, citizens cast a third vote, which is used to determine the proportional representation in district councils - again, the individual needs to vote for a political party.

## Forecasting models

As indicated earlier, various approaches are followed to predict the outcome of an election in a country and this is dependent on the election system. In the UK, a constituency system is used and because of the homogeneous voter make-up of a constituency, exit polls are used as well as previous election results to determine the "share of vote" in making predictions (Brown and Chappell, 1999). In the USA, the election of the next president is possibly of greatest interest during the elections held there every four years. Lichtman and DeCell (1990) have correctly predicted the popular vote outcome of every US presidential election since 1984. These predictions are based on 13 questions, each with a "yes" or "no" answer (Samuelson, 2008). The "yes" answers favour the incumbent party candidate. If five or fewer answers are "no", the incumbent party retains the presidency, while if six or more are "no", the challenger wins. This method is based on a statistical pattern recognition algorithm that incorporates "a test of competing theories of politics", which closely resembles kernel discriminant function analysis. The prediction results validate some of the theories and contradict others. Although the next US presidential election is still 18 months away, Lichtman predicts President Obama to win (Samuelson, 2011). Election-night forecasting approaches for other countries have been developed, inter alia for New Zealand (Morton, 1988), India (Karandikar *et al*, 2002) and Sweden (Thedeen, 1990).

The model developed for the South African elections is described in detail in Greben, *et al* (2005) as well as Greben, *et al* (2006). The method used is firstly to formulate a cluster model, which aims to divide the population/electorate into groups, or clusters, with similar voting behaviours. The clusters are determined before the elections and are then used during the elections to extrapolate the initial partial results to the whole cluster and thereby for the whole electorate. Initially, the clusters were determined by using demographic data, but after the 1999 elections these were based on those election results. In following this approach, the one major assumption that drives this approach is that voters in the various voting districts belonging to the same cluster would vote according to the same patterns in future elections.

The formal method used in determining the clusters is called the fuzzy clustering approach, or C-means method (Bezdek, 1981). As explained by Greben, *et al* (2005), the fuzzy clustering process was carried out for the 1999 election results, using 20 clusters. As a result, there was a compromise between a large number of clusters, about 40, to allow for sufficient discrimination between different cluster centroids and a smaller number, say five, allowing predictions on a minimum of results. Having obtained these clusters, they are then used as the results come in from specific voting districts, of which the model "knows" the cluster membership, to calculate the predictions by extrapolating these for the entire electorate. The results are obtained from the Independent Electoral Commission (IEC) via the SABC's information system that is linked to the IEC system. The forecasting system also endeavours to predict voter turnout, which is another interesting statistic associated with elections.

## Run-up to the elections

Operations researchers know that it is only possible to develop a model, or represent reality in mathematical terms, if the researcher has an in-depth knowledge and understanding of the real problem situation. Whether the problem to be solved is in the forestry area, health or airline industry, it is important to understand that specific domain. In this case, the domain is the political environment. Although a forecasting model has been developed to predict the election results, the spokesperson needs to have more than a superficial knowledge of the political scene and political developments. In addition, the political environment is different for each election and this also needs to be understood. When interacting with the media, e.g. during interviews, it is impossible to have pre-prepared written notes or answers that can be used during interactions.

Duckworth and Lewis (2011), arguably cricket's most modern and well-known partnership, were the formulators of the mathematically-based method that is currently used to ensure fairness to the problem of how to adjust targets if rain interferes in one-day, or limited over's, cricket matches. They very soon realised, in explaining their method, *"interviews don't work like that. Whereas you will certainly have the gist of responses to likely questions embedded in the mind it's a mistake to try to use pat responses. For a start a response read from notes sounds very unnatural and the way the questions are varyingly phrased requires a different emphasis and hence different wording from anything that has been prepared in advance. In other words it is important to be spontaneous – and also not overly complicated"*. Not only is it essential that one knows the forecasting method used very well but, more importantly, one needs to be able to explain this in easily understandable, "digestible" terms and language to the public!

What complicates matters even more is that elections take place every few years and one needs to keep updated with each election regarding the methodology as well as the current political situation in the country. For the latter, one needs to stay on top of developments in the political arena by tracking these in the media, for example by reading a variety of newspapers, listening to the radio and watching television. It is critical to know what the "hot spot" areas are with the highest interest in terms of the possible outcomes. These are situations where the outcomes could be very close such as, in the case of South Africa, prior to the 2011 elections, some local communities had severe protests due to poor service delivery, which could have affected the outcomes of the elections in those municipalities. All of this is included in preparation and research that need to be done consciously before the elections. Obviously, it is not appropriate to act or be seen to act as a political analyst. However, one needs to be prepared to answer political-type questions and one should have an opinion! The media do not understand, and don't care, what the difference is between an operations researcher, a results analyst or modeller, and a political analyst.

Background material on elections is also available on the website of the IEC. This includes information on the number of registered voters, the number of voting stations, number of wards and number of candidates. All of this is very valuable for any spokesperson. Before the recent local elections, the SABC news journalists had a briefing session, which proved to be very informative and interesting to the author as the forecasting team's spokesperson. Journalists in all nine provinces gave their views on what could happen in the different provinces.

The CSIR team needs to do quite a bit of preparatory work before election day. All the models/programs need to be loaded on the computer and these needs to be tested - at least whether the data sent from the SABC system are read correctly. Communication between the various systems also needs to be tested. Any last minute changes or additions, if and as required, need to be made. In all cases the number of parties needs to be entered into the

model, as well as the demographic data, etc. Because of the number of parties involved, the model does not predict the results for all of these but only for the 10 to 12 largest. Examples of new challenges encountered for the prediction model were, for example, in 2009, COPE was a new entrant into the elections, while in 2011, independent candidates - people not on the ANC lists but actually representing the ANC – caused some real concern whether the model would be able to handle them correctly. Significant tasks usually need to be performed in this regard.

Lastly, one cannot underestimate the experience gained during previous elections, also in media interaction, and this proved again to be invaluable in all aspects.

### **Election day and the results event**

Election day is a normal day for an operations researcher or results analyst, for whom it is important to vote and get a feel for the vibe of the elections. The work of the researchers and results analysts starts only after the elections when the first results start coming in. It is with trepidation and excitement that one goes to the IEC results centre at the Pretoria show grounds. To experience this is possibly one of the most exciting involvements the author has had in any project over many years. The experience may be short-lived – it lasts for a day or two, but it is extremely intense. During that time the adrenaline is pumping, one interacts and mingles with the media and also with well-known politicians and personalities while the election outcomes unfold. Initially there is also the unspoken but constant concern, in all the analysts' minds, about whether the model will perform as one would expect or not! Although the model did work in the past, one is still concerned as it has not been tested fully with the real data before a specific election.

The SABC news team was going to report on the results of the elections around four specific topics, namely:

- (i) The race for votes – this is an indication of the percentage voter support for each political party at national level, provincial level as well as for metros;
- (ii) The race for wards – the number of wards that each party would get in the various municipalities;
- (iii) The race for seats – the proportional representation of each party in the municipality and/or district council. These are determined from the support a party receives as well as the number of wards. The IEC has a number of formulas which are applied to determine this; and
- (iv) Seat allocation – the allocation of seats for the municipalities and district councils when all the results are in.

The forecasting model contributed mainly to predicting the race for votes.

### **The predictions and final results – a comparison**

The forecasting model described here was used, as indicated, during the previous five South African elections, namely the 1999 National Elections, the 2000 Municipal Elections, the 2004 National Elections, the 2006 Municipal Elections and the 2009 National Elections. The model used in these five elections proved to be very robust and achieved a high degree of accuracy. During the 2000 municipal elections, the ANC's final result was predicted to within 1% after only 10% of the votes were counted - this was at 02:45 in the early morning hours after voting on the previous day. At that time, the actual results still showed a 20% deviation from the final results. For the DA, a 1% accuracy was achieved after 20% of the votes were counted and released by the IEC.

In the 2004 elections, the prediction for the ANC's final percentage result (69%) was within 1% when only 5% of the votes had come in. In the municipal elections of 2006, the model predicted the overall ANC result (65.8%) with a relative error of 1% (66.5%) when 10% of the

votes had come in, at 02:23 in the morning following the elections. At that point-in-time, the actual results (62.6%) still deviated about 5% from the final results. For the smaller parties, the relative errors were larger, however, the relative error for the DA (5%) was dramatically smaller than that of the actual results at that time (38% over-estimate). Similar levels of accuracy were achieved during the 2006 and 2009 elections. The national elections of 2009 were very interesting, since the main discussion point at the results centre, and in the entire country for that matter, was whether the ANC would obtain a two-thirds majority. Early the morning after elections, around 07:00, the model predicted that the ANC would get 65.6%, whereas the party ultimately obtained 65.9% of the votes casted! However there was a point when the actual numbers on the results scoreboard at the IEC results centre showed that the ANC had secured just over 70% of the votes. Not all votes were counted yet at that stage, and since the prediction model “knew” which voting station results were still outstanding and took this into consideration, it predicted – correctly - that the ANC would not get the two-thirds majority! The CSIR team was adamant that the model was correct and the spokesperson had to “stick to his guns” and ensure the nation that the team was confident of the outcome – this prediction was, of course, not popular, especially with the ruling party and its supporters!

For the 2011 elections, there was huge interest in the contest between the ANC and the DA - the two main parties at national level, at provincial level (mainly in the Western Cape), and in the case of a number of the metros. With these elections it became very obvious, however, that the country is moving towards a two-party state. The smaller parties did not really feature and most of them received very limited support. The model predicted in “the race for votes” at the national level, with 1.8% of voting districts counted, that the ANC would get 62.8% and the DA 27%, respectively. This was the prediction at 23:30, late on the night of the elections. Ultimately, the ANC got 62.93% and the DA 24.08%. Early the morning after the elections, at 07:52, with 30% of the voting districts counted, the prediction given on radio was 62.8% and 24.27%, respectively, for the ANC and the DA.

A number of predicted results are shown in Table 1 for only the ANC and the DA. These are for the main areas of interest and the percentage voting district results that were out, formally released by the IEC, is also shown.

As can be seen from Table 1, the predictions were fairly accurate even when very few of the results had been available. It is noticeable that, especially in the metros, the early-predicted results were not that close to the final results. The main reason for this is the fact that the clustering is done at national level but for metros the voting trends in clusters are used at a much lower level where the representation is not that well distributed. This is very noticeable in the City of Cape Town metro where the predictions only started to converge to the final results after 50% of the voting district results were received. Nevertheless, from the results shown in Table 1 it is very clear that the predictions were excellent with very few results known at that stage.

**Table 1: The race for voter predictions**

<b>National</b>			
<b>Party</b>	<b>% Voting district results out</b>	<b>Prediction in %</b>	<b>Final result in %</b>
ANC	1.8	62.80	62.93
DA	1.8	27.00	24.08
ANC	30	62.80	62.93
DA	30	24.27	24.08
<b>Provincial – Western Cape</b>			

ANC	16.5	37.65	34.1
DA	16.5	53.15	58.1
<b>Metros</b>			
<b>(i) City of Tshwane</b>			
ANC	0	56.39	56.46
DA	0	37.06	38.74
<b>(ii) City of Cape Town</b>			
ANC	2.3	36.64	33.17
DA	2.3	53.94	61.15
<b>(iii) City of Johannesburg</b>			
ANC	0	56.77	59.29
DA	0	33.96	34.35
<b>(iv) Nelson Mandela Bay</b>			
ANC	9.8	54.49	52.13
DA	9.8	39.12	40.24

### Communication challenges

The author was the sole spokesperson of the CSIR team during the initial years, with a colleague joining him in that role since the national elections in 2009. Over the past two decades, the author has had experience of media interviews during the course of his other work, including OR, not relating to election forecasting. With election forecasting being a very specific topic of interest to all in South Africa during elections, the author had a two-hour “training session” with a television presenter before the elections in 1999. Some general communication skills were discussed and shared with him, while he picked up subsequent skills through experience during the five elections since 1999. A good foundation and understanding of quantitative methods are essential. This section, however, describes personal perspectives of what is required in conveying the results of a mathematical model to the general public, generally regarded as lay people in this sphere. Some anecdotes are used for illustrative purposes. This is by no means a comprehensive view on requirements to communicate with the media.

Good communication skills are essential when interacting with the media. Lewis from Duckworth and Lewis (2011) states that after his education, “*useful seeds had therefore been sown in me; an interest in applying quantitative ideas practically and a training in communication skills*”. Other important factors include a good command of the language(s); the ability to think and speak in a logical manner and to convey a difficult concept in an uncomplicated, concise (to-the-point) and understandable way. It is very important to have self-confidence and also confidence in what one is commenting on, with the ability to “think on ones feet” being crucial. One must also not be afraid to present an informed opinion with conviction. One should not get flustered during a radio or television interview or debate. A simple way to handle this is to focus on the questions asked and respond as best as one can or to comment and participate during a discussion - this forces one to never even think about “all the people out there listening to or watching you”. One should try to not even think that one is on radio or television, it is totally immaterial – one could even pretend to be speaking to a family member to be more at ease. What is important, though, is to be sensible in what one says and to convey the results, or facts, as honestly and correctly as possible. For some people it comes more naturally than for others, but practice and experience will help anyone improve. Fortunately in the case of a quantitative model and its results, one is talking about facts and real numbers, which do make things easier.

In presenting the forecast results, this should be done and discussed with absolute conviction and confidence. It should be crystal clear that the team absolutely believes in the model and the results presented by the spokesperson. If that does not come across strongly,

how should the audience (listeners and viewers) believe, accept or take these predictions seriously? One should have faith in the model's results, and never question these. This was the case in 2009 with the general perception of the ANC going to obtain a two-thirds majority, whereas the model consistently predicted that this was not going to happen.

Early-on during any elections, the inevitable question in media interaction is: "now explain the model and how it works". Clearly one cannot say it is a fuzzy clustering method or a C-means method that is used in modelling the voting behaviour! The author typically starts by saying a model is a representation of reality and, in this case, the voting population needs to be represented in a mathematical way. Based on certain grouping criteria, the voting population is combined into a number of groups (maybe use the term "clusters"), and the main assumption is then that those who populate a specific group vote in the same way.

Duckworth and Lewis (2011) decided very early on in developing and testing their method that they would never admit publically if something was wrong with the method. Their argument was that people would immediately lose faith in the method. The same could be said of the prediction model. Two examples are cited: In 2009, due to data communication problems, the voter turnout percentage was very clearly wrong. That specific prediction was just never mentioned or used. In 2011, while being interviewed on radio, the author was passed an unexpected note stating "what do you make of this final result in the Northern Cape province". The final results of the main parties in that province were printed on this piece of paper as well. The model's prediction numbers were totally different from the final results reported in that province. Sweating and blushing, with a sudden increased heart beat, the author just talked around this without the radio presenter even noticing anything! Therefore, if something goes wrong, it should not be obvious to anyone – both on radio and television.

It later turned out that there was a mistake in the printed output from the prediction model: the headings for the predicted results of the Northern Cape and North Western provinces were swapped around! This leads to another very critical point - testing of the system is crucial. That specific SABC report format was added for the 2011 elections, and since the team became involved only two weeks before the elections, this report was not properly scrutinised for correctness beforehand.

A tough but good lesson learnt through experience is that one should always answer or respond to any question. It is even possible to not answer a specific question directly, while providing a response! If a presenter wanted to get an answer to a specific question and it was not answered, (s)he will push for an answer again - by then one has already conveyed ones argument to the audience. Once during a television show, the presenter introduced the two guests as "political analysts" and then proceeded to ask the author a question. The author started his response with: "I am not a political analyst", and before he could continue, the presenter promptly passed the question to the actual political analyst and ignored the author for the rest of the show.

Although one analyses modelled results, it is inevitable that political questions will be asked and one is expected to provide a comment. If one can use predicted results or facts in answering the question, it is ideal. However, this is not always possible and then it is critical that, like in every problem-solving situation that OR people face, there is proper knowledge and understanding of the domain. One should have a view and an opinion. This one formulates and accumulates by reading and listening to the experts! Luckily, in these situations one can never be wrong; however, quantitative people deal with facts! It is thus also important to stay abreast of current terminology or phrases that are being used, as these can even change from one election to another. Obviously, one still needs to be careful what one says and what one is prepared to comment on - one should never make a fool of oneself. In one of the previous national elections, where the New National Party (the old National Party) lost horribly and got only 1.7% of the vote, the author did say on an early-



morning Afrikaans radio show that this “was clearly the end of the road for the National Party” – as a non-political analyst, it was a very dangerous thing to say.

Appearing on television has its own frustrations too. The presenters are directed by the producers and as a guest on the show one is not privy to the ‘direction’ to be taken. The implication is that one is in the dark most of the time about how the show will proceed. It happens very often that one had not finished an explanation, but that there was never a chance to return to that point. One also has to be prepared to wait long periods on a show where one basically sits and not say a word. One gets onto a show and the presenter says: “Welcome, you will be with us for the next two hours” - nobody tells one this in advance, and on top of that, one speaks or discusses issues for maybe only 5 or 10 minutes at most, during the two hours!

One should also expect the unexpected and be prepared to respond to questions in a confident, logical way. How does one respond to a question like: “What is the actual purpose of this prediction model and why should one spend money on doing forecasting?” This is the “so what” question that the public is interested in – “what is in it for me?” The author did not have enough time to respond, but nevertheless said: “To get an indication of what the ultimate result would be as soon as possible”. Not bad, but there could have been a whole range of responses.

## **Conclusion**

This paper endeavours to give a very unusual perspective of an aspect that is required in OR during the development of any mathematical model, namely communicating with the public at large as the client. However, this case is unique with the kind of exposure obtained during an election. In this instance, the models or methodology used is very critical since it requires very accurate prediction results, but these then need to be shared with a wide audience. The prediction model, briefly described here, has been very successfully used since 1999 to forecast election results in South Africa. In addition, the election team was able to provide inputs in communicating the predictions to the wider public. From an OR point of view, this is a unique occasion with its own unique experiences, but nevertheless with the same steps required in developing any model. The exception is that the communication of the results rendered by the model through the different media is so crucial.

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## **References**

- Alvarez-Rivera, M, 2004. *Election Resources on the Internet: The Republic of South Africa Electoral System*, <http://electionresources.org/za/system/>
- Bezdek, JC, Trivedi, M, Ehrlich, R and Full, W, 1981. *Fuzzy clustering: a new approach for geostatistical analysis*, Int. J. Systems, Measurement and Decision, Vol 1-2, pp 13-24.
- Brown, L and Chappell, H, 1999. *Forecasting presidential elections using history and polls*, International Journal of Forecasting, Vol 15, pp 127-135.

Duckworth, F and Lewis, T, 2011. *Duckworth Lewis – The method and the men behind it*, Sportsbooks Limited, Cheltenham, UK.

Greben, JM, Elphinstone, C, Holloway, J, De Villiers, R, Ittmann, HW and Schmitz, P, 2005. *Prediction of the 2004 national elections in South Africa*, South African Journal of Science **101**, pp 157-161.

Greben, JM, Elphinstone, C and Holloway, J, 2006. *A Model for Election night forecasting applied to the 2004 South African Elections*, Orion **22**, pp 89-103.

IEC website, [http://www.elections.org.za/content/DynamicDocs.aspx?id=292&BreadcrumbId=292&LeftMenuId=251&name=home&ekmense=c580fa7b\\_100\\_127\\_btnlink](http://www.elections.org.za/content/DynamicDocs.aspx?id=292&BreadcrumbId=292&LeftMenuId=251&name=home&ekmense=c580fa7b_100_127_btnlink)

Karandikar, RI, Payne, C and Yadav, Y, 2002. *Predicting the 1998 India parliamentary election*, Electoral Studies, Vol 21, pp 69-89.

Lichtman, AJ and DeCell, K, 1990. *The Thirteen Keys to the Presidency*, Madison Books, Lanham, Md.

Lincoln, Abraham, 1865. *The Papers of Abraham Lincoln*. Manuscript Division, Library of Congress, Washington, DC.

Morton, RH, 1988. *Election night forecasting in New Zealand*, Electoral Studies, Vol 7(3), pp 269-277.

Samuelson, DA, 2008. *Road to the White House*, OR/MS Today, October 2008, pp 30-33.

Samuelson, DA, 2011. *Elections 2012: The '13 Keys' to the White House*, OR/MS Today, June 2011, pp 26-28.

Stanford Encyclopedia of Philosophy (SEP), 2006. *First published Mon Jan 2, 2006; substantive revision Fri Jun 24, 2011*; <http://plato.stanford.edu/entries/political-representation/>

Thedeen, T, 1990. *Election prognosis and estimates of voter streams in Sweden*, New Zealand Statistician, Vol 25, pp 54-58.