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GOVERNMENT SOCIAL RESEARCH

Analysis for Policy

Llywodraeth Cymru
Welsh Government

SOCIAL RESEARCH NUMBER:
13/2021
PUBLICATION DATE:
03/03/2021

Implementation of a Single Transferable Vote (STV) system for local elections in Wales

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.

This document is also available in Welsh.

 Digital ISBN 978-1-80082-866-7

Implementation of a Single Transferable Vote (STV) system for local elections in Wales

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Full Research Report: Devine, Daniel; Larner, Jac; Turnbull-Dugarte, Stuart and Jennings, Will (2021) *Implementation of a Single Transferable Vote (STV) system for local elections in Wales*. Cardiff: Welsh Government, GSR report number 13/2021.

Available at: https://gov.wales/implementation-single-transferable-vote-system-local-elections-wales

Views expressed in this report are those of the researcher and not necessarily those of the Welsh Government

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[1] Alphabetically ordered.

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Glossary

Acronym / Key word	Definition
STV	‘Single Transferable Vote’
FPTP	‘First past the post’
MSP	Member of the Scottish Parliament
MS	Member of the Senedd
AM	Assembly Member

1. Background

1.1 The Local Government and Elections (Wales) Bill, introduced by Julie James MS, Minister for Housing and Local Government, opens the option for 22 principal Welsh councils to choose between 'first past the post' (FPTP) and 'single transferable vote' (STV) systems for council elections after May 2022, in time for May 2027 elections. FPTP has been in use in elections in Wales – for the UK Parliament, National Assembly for Wales[2] and councils – since the 19th century.

1.2 FPTP is a plurality voting system. In single member districts, one representative is elected per voting district if that representative achieves one vote or more than the other candidates; in multi member districts, the candidates with the most votes win up to the number of seats to be filled. For instance, if there are five seats to be filled, the five candidates with the highest number of votes are elected. Voters may choose as many candidates as seats need to be filled, identified by a mark next to the candidate's name (typically but not only an X). Instead, in STV systems, voters rank candidates in order of preference, and more than one representative may be elected in each district. The proposed Welsh legislation allows no fewer than three but no more than six representatives per district. STV is seen as a proportional system where the percentage of votes reflect seats. A change from FPTP to STV, a system different in both principle and practice, therefore presents a potentially significant change to Welsh politics.

1.3 However, STV systems currently in place in other countries (most significantly in Australia, Malta, Republic of Ireland, Northern Ireland, and New Zealand)[3] differ substantially. For instance, voters may have to rank all candidates, or as many as they want; votes may be counted manually or electronically; a different number of representatives may be elected, and so on. This raises a number of questions about how STV may be best implemented in the Welsh context.

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[2] Now known as Senedd Cymru or the Welsh Parliament. The Senedd comprises 60 members elected through an additional member system: 40 elected via FPTP and 20 elected via the D'Hondt method of proportional representation.

[3] STV is also used in a number of non-national elections, such as within organisations and political parties.

1.4 The Welsh Government commissioned a team of researchers from the Universities of Cardiff, Oxford and Southampton, led by the University of Southampton, to combine the technical and design aspects of STV with lessons learned from implementation in other countries and jurisdictions to inform the design of STV in future Welsh local elections.

Aims and objectives

1.5 The fundamental aim of the research was to understand the relative merits of options for quotas, surplus transfers, and other aspects of STV to inform the design and application of STV in Wales.

1.6 The specific objectives were to:

(i) explore the relative advantages and disadvantages of different options for quota formulae, including how the divisors are calculated;

(ii) explore the relative advantages and disadvantages of different options for transfer of surplus formulae;

(iii) understand the impact of these options on the choice of electronic or manual counting methods and election outcomes;

(iv) make recommendations on which mix of options would be best suited to implementing an STV system for local elections in Wales.

1.7 In the remainder of the report, we describe our methodology and then our quantitative and qualitative findings. We then discuss our conclusions and specific recommendations for the design and implementation of a new STV electoral system for local elections in Wales.

2. Methodology

2.1 The analysis in this report is based on secondary analysis of existing literature, semi-structured interviews with leading stakeholders and experts in STV, and quantitative simulations of election results under different configurations of STV.

2.2 This mixed methods approach allows us to build on previous research which has studied the implementation and functioning of STV systems around the world whilst providing context-specific recommendations for the implementation of the electoral system for local elections in Wales. Building on this academic knowledge, we provide a configuration of STV and advice for its implementation in the Welsh context.

Literature review

2.3 The literature review consisted of an audit of the existing empirical evidence and theoretical literature on the qualities of different variations in models of STV in countries where the system is in use.

2.4 Our secondary analysis of the literature focused on issues related to the design of STV (district size; quotas, transfer rules and ballot design) as well as issues related to implementation (stakeholder knowledge and understanding, counting, and other concerns). To identify the literature of interest, we first focused on surveying the primary academic journals orientated towards the assessment of electoral systems and electoral politics (for instance, *Electoral Studies*). This survey provided the bulk of the literature source material. We expanded on this by seeking out the relevant referenced material within these articles – effectively relying on the existing literature we were aware of, to identify cited texts of interest. Beyond the academic texts, we engaged in a search of publicly accessible reports from independent research organisations and electoral institutions that had analysed and assessed the implementation of STV in those countries where it has been adopted. Our review of the literature identified 52 relevant publications that inform the findings presented in the report.

Qualitative analysis

2.5 The qualitative analysis consisted of seven semi-structured interviews lasting approximately 30 to 45 minutes, conducted online between July and September 2020 via Microsoft Teams. The interviews followed a topic guide developed with the Welsh Government before interviews began, which was lightly amended to fit the expertise of the interviewees and in light of previous interviews. The interviews followed two main topics: the technical aspects of STV (such as surplus transfers and district magnitude) and the implementation of STV (such as ballot structure and counting method).

2.6 Participants were broadly defined as stakeholders, including election officials, academics, former politicians and lobbying groups. Interviewees were chosen based on their knowledge or experience of STV systems in the UK and elsewhere. Most interviewees were chosen prior to the research being conducted. Two, however, were chosen following recommendations from other interviewees ('snowball sampling').

2.7 Interviewees were contacted by email. The introductory email set out the purpose of the research and included details on the ethics of the research, their rights regarding the interview data, and who to contact should they wish to withdraw from the research. If no response was received, the interviewee was contacted once more, not less than a week later. If no response was received again, they were not recontacted. Only one of those contacted did not reply; three declined, one of which suggested an additional two colleagues who were subsequently interviewed; one contact agreed to be interviewed but no subsequent interview was conducted.

2.8 Interviews were recorded (visual and audio) and transcribed by a professional transcription service. Quotes, where used, are lightly edited for readability. Verbal consent was also recorded before the interview. All transcripts were held anonymously and securely and will remain with the Welsh Government.

2.9 The interviews were analysed in a broadly thematic approach, identifying common patterns and potential conflicts between interviewees. The similar topic guide between interviewees meant that answers could be compared.

2.10 Where these are discussed and quoted below, we refer to them by the primary role we were interested in interviewing them for (e.g. ‘Academic’).

Result simulations

2.11 To simulate the outcomes of an election under different variations of STV, we constructed three fictitious local authorities; one based on an urban local authority, one on a rural local authority, and one which has a mix of urban/rural sized wards (further details are available in the annex).

2.12 Using these profiles, we ran election simulations to examine the effect of varying; 1) the quota formula and 2) the system for used for transferring preferences from one candidate to another.

2.13 For the quota analysis, we compared results using the Droop and the Hare formula.

2.14 For our analysis of preference transfer system, we compared the effect of four transfer methods: a random transfer method such as that used in the Republic of Ireland, the Simple Gregory Method used in Northern Ireland, the Inclusive Gregory Method used in several Australian elections, and finally the Weighted Inclusive Gregory Method which is currently used in Scottish local elections.

2.15 The vote distributions and number of parties and candidate used in the simulations are taken from real STV elections in Scotland between 2014 and 2017 to better replicate how parties might be expected to behave. The parties have been anonymised and the transfer preferences between them are fictional but consistent across wards.

2.16 The district magnitude – i.e. the number of seats available in each ward – has been changed to reflect the allowances for a greater range of district sizes outlined in the Local Government and Elections (Wales) Bill. The number of seats available is correlated to number of eligible votes cast.

2.17 The simulations do not account for incomplete ballots and therefore assume that voters provide a complete ranking of their preferences. In practice this is unlikely to happen unless made compulsory (as in Australia, for example). However, as we are only interested in comparing the outcomes of different quota and transfer systems, we do not foresee this being an issue.

2.18 The simulations also assume that aggregated preference rankings are the same for each ward. Again, this is unlikely to be the case in real world elections as local dynamics and candidates shape voters' preferences (see the appendix for more information).

3. Findings

3.1 In this section, we present our findings. First, we provide the literature review, then the analysis of the interviews, and finally the simulations. Both the literature review and the interviews aim to address the key aspects of the design of electoral systems: on the technical side, the district magnitude, quota and transfers; on implementation, ballot design, counting of ballots and voter understanding.

Literature review

District magnitude

3.2 STV is often adopted as an electoral system because of its ability to distribute seats among political parties and candidates that is proportional to the distribution of votes received by each party. It is worth emphasising that the capacity of STV to reduce disproportion outcomes is largely a function of the number of seats available within individual electoral districts. In short: the larger the district magnitude, the greater the level of proportionality. Increase district magnitude, however, comes at the cost of reduced sense of locality and candidate-orientated campaigns (Farrell and Katz, 2014).

3.3 In a system where there are only three or four seats available, a party gaining a majority of the seats with less than 50% of the vote is still a possible (if not probable) outcome. Analysis based on simulations in Scotland show that in some Scottish wards, one of Scotland's main parties would bank a majority of seats with less than 45% of the vote (Curtice and Herbert, 2005).

3.4 There is a point at which a low district magnitude does not impart the benefits of proportionality. A district magnitude of three or four, as adopted by the Scottish Government via their introduction of STV, produced a relatively small reduction in disproportionality (Bennie and Clark, 2008).

3.5 Curtice (2007), relying on the Gallagher measure of disproportionality, shows that relying on districts of only 3 to 4 members meant that the reduction in proportionality brought about by moving away from the FPTP system to STV in local elections in Scotland was markedly smaller than that observed in Australia, Malta and the Republic of Ireland.

3.6 Farrell (1997: 128) recommends that the number of elected representatives per STV constituency is “at least” five. This recommendation is also echoed in Taagepera and Shugart (1984). In Northern Ireland and the Republic of Ireland where STV is used for different elections, the district magnitude employed is notably larger than that introduced in Scotland. The Northern Ireland Assembly was originally constituted by constituencies that elect six representatives. After a series of boundary changes, this was reduced to five as of the 2017 elections. In the Republic of Ireland, constituencies of the lower house of parliament (Daíl) elect between three and five representations with the majority electing three. Malta employs 5-member districts and, among countries that use STV, that is where the highest level of proportionality is observed. In other words, assuming that the desired outcome of implementing STV is to distribute seats in a way that most closely approximates the distribution of voter preferences, the five member district magnitude adopted in Malta is that which does this best (Farrell et al., 1996).

Transfers

3.7 One of the largest aspects of cross-national variation in the implementation of STV is regarding the question of how surplus votes (those excess preference votes received by candidates above those required by the quota threshold) are to be transferred to from elected and excluded candidates to subsequent candidates. We focus on assessing the role of different quotas and transfers in section 3.86 onwards.

Ballot design

3.8 Ballot papers should be designed in a way that does not induce any undue electoral advantage to a particular party or candidate over another. There are a number of alternative means of regulating the order of candidates for voters to express their electoral preferences in STV elections, each with their own knock-on effects.

3.9 The most common, and that currently exercised in Scotland, Northern Ireland, the Republic of Ireland and New Zealand, is to order the collection of candidates alphabetically by their surname. The primary complaint against this ordering approach is that it can result in a first-candidate bias (primacy effects) whereby those candidates whose name is ranked higher because of their position in the

alphabet, enjoy a significantly greater probability of being marked as a voter's first preference in comparison to the other candidates.

3.10 These ordering effects are not trivial and, as evidenced by the amount of attention the issue of ordering and primacy effects receives in the literature, is clearly an important concern. Ordering effects have been observed in all countries where STV is in practice (Bennie & Clark, 2008; de Miño & Lane, 1996; Marsh, 1987; Reidy & Buckely, 2015; Robson & Walsh, 1974).

3.11 Ordering effects occur when ballots are presented as a running list of all candidates *and* when candidates are presented within party blocks. Primacy effects favour candidates placed at the top of a party block's list.

3.12 The discontent amongst candidates can, therefore, come from (i) parties who feel that their candidates are disadvantaged because candidates from a rival party enjoys a primacy effect, as well as (ii) individual candidates who feel that their peers from the same party enjoy an advantage over them.

3.13 In terms of the magnitude of the primacy effect, the empirical evidence suggests that it is not insignificant. Most quantitative assessment point towards ordering effects in the range of two percentage points but this can be as large as four percentage points (Blom-Hansen et al., 2016). In competitive races, primacy effects can be decisive and their potential role in the design of ballots should be considered with care.

3.14 The evidence of alphabetical ordering effects, however, is not uncontested. Villodres and de la Puerta (2004), analysing voter STV preferences in the 2002 and 2003 elections in Ireland and Malta, respectively, finds that "the number of preferences votes received by candidates of the same party is unrelated to their alphabetical placement on the ballot". Despite the conflicting evidence, the consensus view among scholars of STV is that ballot ordering matters: "[…] the balance of academic research is persuasive. There are strong indications that ballot position has an impact. It follows directly then that candidates and parties might be likely to take advantage of these effects." (Reidy and Buckley, 2015: 624)

3.15 STV candidate order in Maltese elections was originally structured in a similar way to that in practice in Scotland with candidates fully ordered alphabetically by their surname. Following an electoral reform in 1976, however, this process has been changed. Candidates are now presented in party-clustered blocks, within which candidates are presented in alphabetical order by their surname. In the case of Malta, where this party-clustered ordering is in operation, we observe less evidence of alphabet-ordering biases in electoral preferences (de Miño & Lane, 1996). Ballots that rely on party clusters alphabetise the presentation of these parties. For example, in the case of Malta, on the 2013 General Election ballot paper there were three political parties. The presentation of these parties on the ballot paper are ordered alphabetically - (i) *Alternattiva Demokratika*, (ii) *Partit Laburista*, (iii) *Partit Nazzjonalista*. Should an independent candidate run, in Malta this candidate would appear alphabetically. In Australia, where party clustered blocks are also used, independent candidates are placed at the end of the ballot paper.

3.16 A recurring theme across assessments of ordering effects in the Republic of Ireland, Scotland and Malta (prior to reform) is the potential that political parties strategically select candidates with surnames that appear earlier in the alphabet in order to front-load ballot papers that rely on alphabetised ordering on complete candidate lists (de Miño & Lane, 1996). Mackeras (1970) shows, for example, that in Australian elections, political parties have opted to select candidates whose name comes earlier in the alphabet as a means of increasing their electoral prospects. Such "front-loading" strategies, however, are less viable when alphabetisation occurs within the slates of party candidates.

3.17 One particular extract from a study on ballot paper design and ordering effects in Irish elections is worth citing:

> *It is entirely logical that political parties and candidates will alter their direct behaviours in response to the clear evidence of primacy effects. Irish election lore is littered with examples of candidates changing their names to get a position higher up the ballot. Beverly Cooper Flynn (Mayo TD 1997–2011) is a recent example. She opted for a double barrelled name upon marriage but unusually decided to put her own surname last as her husband's surname*

placed her on a higher point on the ballot. Nicknames have been incorporated into family names such as in the case of Pat 'the Cope' Gallagher and Sean 'Dublin Bay Rockall' Loftus. Loftus was a Dublin based councillor who changed his name to highlight political causes but the change had the added advantage of raising his position on the ballot paper. Changing surnames from English to Irish language versions and vice versa for ballot position advantage is also present in popular memory of Irish politics. (Reidy & Buckley, 2015: 624)

3.18 One potential remedy to the issue of ordering effects would be to rely on randomisation in the allocation of candidates' position on the ballot paper. This is, for example, the recommendation communicated by Reidy and Buckley (2015) in their report on the role of primacy effects in Ireland local elections.

3.19 Randomisation would involve the production of a number of individual ballot papers equal to the total number of potential outcomes from the different permutations of randomised assignment.

3.20 Having a potentially infinite number of ballot designs would complicate the already complex process of manual counting, beyond what we might consider reasonable for manual counters. Randomisation, as a result, is only viable should electronic means of counting ballots be considered.

3.21 We do not recommend the use of randomised ordering in the absence of electronic counting. In line with the evidence regarding the potential for ordering bias to provide some candidates (and parties) with an unfair advantage, our recommendation would be to structure ballots with candidates grouped together in blocks by their partisan affiliation. Within these blocks we recommend either i) the ordering of candidates within parties be determined by intra-party processes, or ii) candidates be ordered alphabetically. Independent candidates could appear at the end of the ballot paper after party blocks have been presented, as is the case in Australia

3.22 Darcy and Marsh (1994), however, show that ordering candidates within these party blocks may reduce the "split-ticket" voting whereby a voter's ordered preferences

"split" party lines. We do not view split-ticket voting to be either necessarily desirable or particularly problematic.

3.23 It is worth noting that evidence on the response of political parties to the implementation of STV in Scotland, points towards parties developing their own tools to combat ordering effects. Gilmour (2015, 2018), for example, shows that parties develop and deploy "supporter instructions" and "How to vote" guides that aim at mediating the potential bias against down-ballot candidates that may emerge. These formative pieces of partisan communications, examples of which are reproduced in Gilmour (2015), give area-specific instructions to party sympathisers on the strategic ordering of preferences in order to achieve an optimal amount of support for all the party's candidates.

3.24 Ballots can also be structured landscape or portrait. The Electoral Commission recommend portrait ballots based on its effects on voter understanding and ease of counting. Ballots in Malta, New Zealand and Republic of Ireland are structured in portrait whilst Australian ballots are landscape.

3.25 Finally, it is uncommon for countries that employ STV to place a minimum number of preferences required for ballots to be viewed as valid but this is the case in Australia where *all* candidates must be assigned a preference. In Australia, where voting is compulsory, voters are required to provide a complete list of preferences in order to ensure that those candidates that are elected after numerous and subsequent rounds of counting do so after having reached the necessary quota. Requiring preference allocations for all candidates tends to lead to "donkey voting" (Bowler & Grofman, 200) which essentially results in voters consequentially ordering preferences on the ballot in the order they appear until the ballot is full. *Requiring* preferences for all candidates also has the negative effect of (i) reducing choice for voters (they cannot limit their preferences to only those candidates for which they actually have a preference) and, (ii) increases the 'costs' associated with the voting process as completing the ballot becomes more cumbersome. Moreover, there is also evidence that requiring all candidates review an ordered preference, as in Australia, leads to more spoilt ballots: there is an increasing probability that voters will repeat a number or make a mistake (McAllister and Makkau, 1993).

Stakeholder understanding and knowledge

3.26 Evidence from the implementation of STV in the local elections in Scotland provides some evidence of the potential complexities of STV for voters that have been socialised to participate in the FPTP system in use in general elections.

3.27 The first piece of evidence is provided by the number of spoilt ballots returned during STV's maiden use at the Scottish local elections polls. Denver and Bochel (2007), compare the proportion of rejected ballots in the 2007 local elections, during which STV was used for the first time, and compare this to the proportion observed in the previous two local elections that took place beforehand.

3.28 In 1999 and 2003, only 13,597 (0.59%) and 14,579 (0.77%) of ballots were rejected, respectively. This proportion almost doubled with the introduction of STV, with 36,351 (1.83%) of ballots being rejected. Given the high level of unfamiliarity with the new voting system, the authors argue that a ballot rejection rate of 1.83% should be considered a successful level of implementation with the vast majority of those voters who wished to cast a valid STV voting ballot able to do so. Moreover, the introduction of STV in the Scottish local elections coincided with the Scottish Parliamentary elections and involved a number of innovations such as the presented of the two mixed-member parliamentary votes on the same ballot paper (Electoral Commission, 2008). These additional innovations are likely to have played an additive effect in explaining the spoilt ballots observed in the local elections. The higher level of rejected ballots continued in 2012. Whilst a lower percentage were rejected (1.71%) this was still higher than that observed in either 2003 and 1999 when FPTP was still used (Curtice, 2012).

3.29 The higher level of rejected ballots compared to local elections when FPTP was in use was observed in the 2017 Scottish local elections. In 2017, 37,492 ballots were rejected: 1.95% of the ballots cast. The primary reason for ballot rejection was because of the presence of more than one first preference. Of the 37,492 rejected ballots in 2017, 82.2% of these were rejected because of multiple first preferences. The second largest reason was lack of a first preference (12%). This suggests that whilst the 2017 local election was the third iteration of STV in the local elections, a lack of voter understanding remains as the rejection rate is still significantly higher

that the pre-STV period (Bochel and Denver, 2017). In the Scottish local elections of 2017, there is also a positive correlation between the number of candidates presented on the ballot of the rate of ballot rejection. In other words, the more candidates' voters have to choose from, the greater the likelihood that a ballot will be rejected. Among ballots with four candidates the average rejection rate was 1.25% and this rate increases to 2.62% among those ballot papers that present ten candidates or more (Bochel and Denver, 2017).

3.30 The rise of around one percentage-point in spoilt ballots observed in Scotland's maiden use of STV echoes the rise in rejected ballots observed in those localities in New Zealand who also adopted the system. Vowles (2007) shows that, compared to FPTP, there was between a 0.7 and 1 percentage point rise in spoilt ballots during 2004 when STV was adopted by some local authorities.

3.31 Complexity in completing the ballot appears to be one of the primary causes of ballot rejection in the transition to STV. Of the 38,351 ballots rejection during STV's pilot use in 2007, two in five ballots (39.9%) were rejected because voters had marked more than one first preference (1) choice on the ballot paper (Denver et al., 2009). The majority of ballots (59.6%) were rejected because counters were unable to ascertain voters' intentions from the marks (or absence of) on the ballot.

3.32 Comparing the rejection rate of STV ballots in Scotland to that of Northern Ireland, Curtice (2007) argues that the proportion of invalid ballots is comparable so "voters in Scotland coped just as well with STV as well as voters in Northern Ireland" even if the rate of rejection is significantly larger than that observed previously non-STV voting. This sentiment is echoed by a report from the Electoral Reform Society (2008), which highlighted the successful implementation of STV.

3.33 The generally low level of ballot rejection coincides with voters' subjective claims of ballot complexity. Relying on post-electoral survey data from the Scottish Election Study, Denver and Bochel (2007) show that some 84% of respondents claimed that the new STV ballot was "not very" or "not at all" difficult.

3.34 It is worth noting, however, that evidence from the transition to STV in the Scottish local elections demonstrates that voter understanding was weaker in deprived areas. Taking the proportion of rejected ballots as a measure of voter understanding

of the new process, Denver et al. (2009) show that council wards experiencing greater levels of economic deprivation reported a significantly higher proportion of rejected ballots.

3.35 Evidence from the introduction on STV in certain local elections in New Zealand does not point towards any issues of voter understanding of note. Taking the level of participation in those districts that rely on FPTP and STV, Zulum (2014) reports that there was no significant difference in turnout among STV-adopting areas and concludes that the introduction of a new electoral system did not necessarily deter individuals from taking part in the electoral process.

3.36 In Estonia, where STV was only used once at the local level in 1989 and once again at the national level in 1990, there were no reported issues regarding the understanding of how the complete the ballots. There was, however, a lack of understanding amongst voters on how their votes would actually be changed into seats (Taagepera, 1996), an issue echoed later in our interviews

3.37 The literature does not provide any evidence that political party stakeholders suffer from any problems relating to the transition to STV. On the contrary, evidence points towards political parties being a core medium of informing the public as how to complete their ballot. Literature produced by political parties, largely focused on rallying electoral support, provided instructions to supporters on how to vote (Gilmour 2015, 2017).

3.38 In the lead up to the novel use of STV in 2007, the Electoral Reform Society also published a guide, “Campaigning under the single transferable vote: a guide for agents and parties in Scotland” (2008), for political organisations in which it provided publicly accessible advice regarding some of the considerations parties may consider.

Counting

3.39 Scotland, New Zealand and Malta (as of 2019) rely on electronic counting methods to count ballots. The physical task of counting ballots under the STV system can be more arduous and labour-intensive than that of the FPTP system where election

officials count the number of ballots that have an “X” next to the name of each candidate.

3.40 There is a large consensus in the literature regarding a preference for electronic counting over manual counts. In many instances, and in systems where there are a large number of candidates (as in the case in Malta), the assumption taken by scholars is that the *only* viable means of counting STV ballots is by electronic counting.

3.41 Electronic counting comes with substantive start-up costs. Notable costs include the necessary hardware to count ballots, software to compute the count and provide results and the requisite training needed to operate the systems. These costs should not be considered trivial.

3.42 Electronic counting is used in the UK to count votes in Scottish elections as well as the in the Mayor of London and London Assembly elections. Data from these counts provide an insight into the relative cost of electronic counting.

For example, the contract for electronic counting in the 2020 London mayoral elections and the assembly elections was contracted to cost £8,991,132 (Greater London Authority, 2018).

In Scotland, the costs of local elections are covered by the local authority. The only exception to this is costs incurred from the electronic count. The cost of the electronic count in the Scottish local elections of 2012 was £5,600,000 (Scottish Government, 2018). Of this total sum, £3,693,759 was paid directly to local authorities in order to cover the electronic counting costs. The funds received by each individual authority for the electronic count ranged from £90,301 (Orkney Islands) to £193,599 (Glasgow City Council). The remaining costs were incurred directly by the Scottish Government.

The costs of electronic counting increased in the most recent local elections held in Scotland (2017) increased to a total sum of £5,887,008 although the value allocated to individual local authorities decreased to £3,247,714. These local authority costs ranged from £13,499 (Orkney Islands) to £368,668 (Glasgow City Council).

3.43 Whilst electronic counting is deemed desirable because of its capability to deal with a more complex counting process and reduce the chance of error, it is worth noting that electronic counting does not erase risk and there are also potential issues that may arise from digitising the process. Denver and Bochel's (2007) account of the implementation of STV in Scotland, for example, highlights that the introduction of electronic counting was not without error and during a number of the pre-election trials the system employed by the Scottish Government crashed.

3.44 Counting delays and errors may occur because of the issues with third party contractors. In New Zealand, for example, counting of STV ballots in 2004 was carried out by two external organisations (Datamail and Elextionz.com). The announcement of the result from these elections was delayed by more than three weeks because of a "technical glitch" (Zvulum, 2012). These errors arose because the ballot-reading software was unable to translate ballot preferences into the spreadsheet format necessary to begin counts. The decision to use electronic counting also plays a role in ballot design. In Malta, for example, the dimensions of the ballot paper are legislated so they comply with the electronic voting equipment.

3.45 As part of the Electoral Commission's independent review of the adoption of electronic counting in Scotland which coincided with the adoption of STV, the report highlighted that this led to substantial delays in the production and receipts of ballot papers. Since ballots for electronic counting must conform with technical requirements, the Returning Officers had to delegate the production of ballots to the electronic counting contractor. A number of ballots were rejected after printing because they failed to provide clear authentication marks.

3.46 The Electoral Commission's report also highlights the potential for ballot paper instructions designed to facilitate electronic reading to be detrimental to the principal of a secret ballot. Folding ballot papers was considered to slow down the efficacy of the scanners involved in the electronic count. As a result, voters are required to carry their marked ballot paper from the polling booth to the ballot box unfolded which may allow others to observe who they voted for.

3.47 One additional potential drawback from the use of electronic counting is the potential lack of public trust in the voting and counting process. Digitising the count

of ballots requires that necessary cyber and network security procedures are implemented to ensure the integrity (and public perception of integrity) of the counting process (IDEA 2011).

Qualitative analysis

3.48 As mentioned, qualitative analysis was conducted with expert interviewees. In what follows, we build on the literature review to elicit the views of key stakeholders on the broad categories of the previous section.

District size magnitude

3.49 Generally speaking, interviewees did not consider district magnitude a major issue, and only one raised it without being prompted. The interviewee that did only raised the issue of having a district magnitude larger than five, which puts a burden on voters and leads to overly long ballot papers:

> *District magnitude is a huge feature of proportional systems; the higher the district magnitude, the fairer the outcome, but with single transferable vote the trade-off problem is the larger the number of candidates, the larger the ballot paper, the more you exhaust the voters and the more confused they get as to where the constituency boundaries end. And so the sort of rule of thumb of maybe around five seems to work particularly well in the case of STV.* (Academic, Ireland)

3.50 However, when prompted, some interviewees commented that larger district magnitudes (three or more) posed problems for more rural areas that might not have a large number of candidates or have 'natural boundaries' larger than towns and cities. For instance:

> *I personally think they should have gone up the way to five and six, for what you might call medium-sized towns where the identity is of the town. But I think two is essential for some areas, and my own council amongst others has lobbied for that freedom, recognising that it reduces proportionality.* (Election Official, Scotland)

3.51 The interviewee went on to praise the Boundary Commission being allowed to create two-member wards to 'allow for appropriate local representation', though

again acknowledging that this comes at a cost of proportionality. Nonetheless, they also pointed out that in rural areas, many candidates are independents, and so the proportional representation of parties is less important than facilitating community representation.

3.52 This trade-off arises in the case where representatives may cover vast areas that are not actually similar, unlike in towns or cities where the community is defined by the urban boundaries. By having smaller wards, those in rural areas can be represented on a smaller magnitude. As one interviewee said: ‘that’s the balance between proportionality and the locality: the larger your wards get, the more proportional it gets, but the less there’s an identification locally’.

3.53 All being said, whilst district magnitude is of course a decision to be made, there is no great need to amend the current plan to allow for a district magnitude of three to six.

Ballot design

3.54 Interviewees were in agreement that ballot design was a fundamental consideration. The primary concern is how ballots are structured and candidates are ordered. Interviewees did not raise other design issues, such as colour, font, and so on, given that these are not controversial issues and which are backed by considerable research by bodies such as the Electoral Commission.

3.55 One of the more contentious areas was candidate (and party) ordering on the ballot. This varies across countries, where in some (Scotland) candidates are listed alphabetically and others, at the opposite end of the scale, use Robson Rotation, which randomises the order at a certain number of ballots. The issue, as highlighted in the literature review, is that alphabetical ordering of candidates leads candidates with names earlier in the alphabet being disproportionately elected.

3.56 This arises particularly in systems with strong party voting, and may be an issue for candidates rather than party performance, though can also undermine how parties strategically position candidates. As one of the interviewees said:

> *[Voters] show up with an intention, by and large, to vote for a party. They come to the first name on the ballot paper for that party, they put a first*

preference next to it, then they put a second preference next to the second one from that party. So, ballot order is immeasurably important, not at deciding which party does best, but who does best within each party (Former Minister and MSP)

3.57 Whilst candidate (and party) ordering should be first and foremost decided by fairness in the electoral process, this also needs to be weighed against possible costs. If one were to randomise candidates in some way, this leads to issues of costs and accessibility. One interviewee raised both of these issues together:

You then get into the question of how [randomisation] affects voters with disabilities; how does that fit with the tactile voting device that's used to support voters with a visual impairment? As soon as you go into randomising the ballot paper, you are effectively having to do an electronic count, [as it] becomes very difficult to do a manual count. (Election Official, Scotland)

Randomisation, complete randomisation, would have – I accept – been a total nightmare for electoral administrators. (Election Official, Scotland)

3.58 Another interviewee also involved in election administration put this more strongly, though again highlighted how this conflicts with a latent desire for randomisation:

I think [randomisation] is discriminatory against voters with particular special needs, a lot of whom memorise the ballot paper and then will go to a polling station, and they work off a memorised paper. But I do think there is an argument for randomisation of that paper. (Election Official, Scotland)

3.59 Overall, any randomisation would lead to a necessity for electronic counting and require extreme care as regards how voters with visual and other impairments are assisted to vote.

3.60 A related decision is the structure of the ballot, which varies considerably between countries that use STV. In Ireland and Scotland, the ballot is essentially the same as Westminster elections, with candidates listed alphabetically. However, in Malta, for instance, candidates are grouped by party then, within that, listed alphabetically; in parts of Australia, candidates are also grouped by party and parties decide the ordering of candidates.

3.61 Although many interviewees, given their positions, were not comfortable with providing policy recommendations, those that did suggested either the Maltese or Australian systems as a way of overcoming alphabetical bias and giving more power to parties to order their candidates.

3.62 A final consideration regarding the ballot is how many candidates voters are obligated to vote for: whether they must provide a preference for all candidates, or a minimum number, and so on. Most interviewees justified their beliefs on first principles, that an electoral system should improve choice and fairness, and as such were broadly against making a number of preferences compulsory:

> *I think that you need to maintain choice. So choosing not to vote is a choice, choosing not to rank all the candidates, that is a choice too.* (Campaigner)

3.63 However, one interviewee pointed out that whilst they were in favour of 'optional preference voting' – i.e. not being obligated to rank all candidates – there was a justification for compulsory ranking, since without it some candidates may be elected without reaching the quota, and this may undermine the legitimacy of the elections, which is why one reason for the Australian policy:

> *But then there is another side to the coin, which is if a lot of voters don't complete a lot of preferences then in the final stages of the election count you will end up with politicians who are being elected without reaching the quota, which happens quite a lot in Irish elections* (Academic, Ireland)

3.64 However, as our simulations indicate, this is unlikely to be an issue in Welsh elections.

Voter and Stakeholder Understanding

3.65 Interviewees were not concerned that moving from FPTP to STV, with the former being a uniquely simple system, would be a major problem for either voters or stakeholders, such as party agents or politicians. Given the answers provided below, what goes on 'under the hood' of the voting system is irrelevant for voter understanding. If anything, interviewees suggested that stakeholder understanding was more of a problem than voter understanding since parties need to know the technical aspects to campaign, and can mistakenly inform voters.

3.66 All interviewees said that understanding is best obtained by keeping things simple, and that voters did not need to understand the mechanics behind the system, only how to use their ballot and that they were now voting preferentially and with numbers, rather than just with an 'X'.

> *It's never been perceived here [Scotland] as a problem in that sense because it's just about telling them what they need to do.* (Election Official, Scotland)

> *[We tried to explain] STV and how you did it and all the rest of it. It totally panned with the electorate, because it was too complicated […] stick to one, two, three, four and so on.* (Election Official, Scotland)

> *Voters don't need to know Droop or Gregory or any of that kind of malarkey, they just need to know 'how do I use my ballot paper' and roughly how does this translate into an electoral outcome* (Academic, Ireland)

> *We do find that just 1 beside your first choice, 2 beside your second choice, is easy enough for people to understand […] voters never really grasp the actual calculation method and I think trying to explain the calculation method is a bad idea because you see the eyes glazing over if you try.* (Former Minister and MSP, Scotland)

3.67 It was often brought up that countries which use STV – in this case, Ireland, Scotland and New Zealand – have a range of successful educational materials on all platforms, and that the Welsh Government should, at a national level, learn from these best practices.

3.68 Of relatively more concern, as noted, was stakeholder understanding, and that this may feed into widespread misunderstanding if polling clerks, presiding officers and candidates attempt to explain the details to voters but express themselves incorrectly or get the details wrong:

> *We try and discourage, for example, presiding officers and poll clerks, in polling places, from explaining it to people. Because they will invariably get it wrong, and then it just adds to the confusion.* (Election official, Scotland)

3.69 As such, considerable effort went into educating stakeholders, especially those public-facing, in how the system works in Scotland. This is important not just for voter understanding, but also so parties can organise and campaign appropriately:

That means that you try and ensure that the candidates have got an understanding of the process themselves, so that they can communicate that to voters but also communicate amongst themselves. So we always sit down at a candidates and agents briefing session, before any election, and I've got a presentation that I go through with them that explains how the system works, where the quota is, how we transfer surpluses when people are excluded
(Election official, Scotland)

3.70 Interviewees did not believe that there were no mistakes, and acknowledged that some voters will, for instance, mark many Xs, or put a 'three in box number three', but felt that that was the cost for a more proportional system. As the literature indicates, there is not a disproportionate number of failed ballots in STV systems as opposed to FPTP systems.

3.71 Interviewees were also keen to highlight that a blanket approach would not be appropriate. Some areas, particularly those that are deprived or with low educational attainment, would need greater resources to ensure accurate ballots. One interviewee from Scotland illustrated the difference between the worst ward for spoiled ballots (Canal, Glasgow) and a middle-class ward in Edinburgh (Colinton/Fairmilehead), with the former having a spoiled rate of 6% and the latter 1% at the 2017 elections. It is worth noting that this disparity between areas based on deprivation is the case for all voting systems, and that areas should converge over time. The Returning Officer in a given ward should be responsible for supporting voter education, with support from the relevant Electoral Commission.

3.72 Drawing on past experience, some interviewees raised particular points that they would like the Welsh Government to be aware of.

1. That there will need to be a concerted effort to explain *why* a change in electoral system is occurring;
2. Crucially, interviewees in high-level electoral management in Scotland were pessimistic with regard to the Welsh proposal of allowing councils to choose the system. As one put it: 'I think that the potential for voter confusion is huge; [it's] one element of the Welsh proposal I always felt is unwise'.

3.73 To expand on the final point, often interviewees were more focused on the principles of the system rather than the technicalities, and that selective switching to STV would undermine the principle of the change: to improve democratic outcomes. Instead, it would feed the potential for conspiracy theories or that the change was mere politicking.

Manual counting and E-counting

3.74 Consistent with the literature review, interviewees were in broad agreement of the benefits of e-counting over manual counting, though all recognised the increased cost associated with electronic counts. However, many highlighted that there is also a financial cost associated with training and employing staff for manual counts.

3.75 Interviewees' arguments for opting for e-counting can be summarised as *legitimacy* and *efficiency.*

3.76 Views regarding legitimacy were often made by comparing the situation in Scotland (which uses e-counting) and Ireland and Northern Ireland (which use manual counting). As a senior official who is closely involved in e-counting in Scotland commented:

> *In delivering an election count, our concern is always for traceability and for every paper to be accounted for. In the manual STV system, moving around large piles of paper makes everything a lot harder to trace and to account for; whereas in an electronic count, there are checks and balances and it is relatively straightforward to deliver.* (Election Official, Scotland)

3.77 Another senior Scottish election official who visited a count in North Antrim, a highly contested seat with strong community tensions, pointed both to the perceived legitimacy of the election and the length of time it took (efficiency). Whilst the political situation in Wales is unlikely to lead to the same type of legitimacy concerns, one interviewee also warned against complacency in accepting the election results, particularly with a new system.

> *I marvel at those officials who manage to deliver a result that people accepted as accurate, but that count [in North Antrim] took nearly two days […] if there was a feeling for a new system, you don't want it to start like this* (Election Official, Scotland)

3.78 The same concerns were echoed in Malta following their 2019 transition from manual to e-counting, with the Nationalist Party distrusting of the process.[4]

3.79 Whilst the gains in legitimacy are important, this also provides benefits to election agents and parties. An interviewee, a former Scottish Minister and MSP, said of the counts: 'you get a live tally of the bar charts appearing, so early on you get sight of how the preferences are distributing. You also get data afterwards, that's 100% accurate to polling place.' This serves as a legitimacy check but also as a benefit to politicians.

3.80 A clear benefit of electronic over manual counting is *efficiency.* All interviewees brought up the issue of how long manual counts take, as noted in the quote above. A by-election count, says one interviewee, will take about an hour with electronic counting once the ballot boxes are in. However, one interviewee, commenting again on general elections in Ireland, said: 'they were taking three days - three or four days - to process'. Interviewees were also keen to stress that manual counting, due to the time taken, limits ballot structure and the type of quota formulas to only the simplest.

3.81 One interviewee, who has long been involved in election administration in Scotland, summarised the decision in Scotland to adopt e-counting as follows, which also summarises the views of all interviewees:

> *we were all not just convinced logically but convinced emotionally, as it were, that this system, when demonstrated to candidates, agents, parties, would inspire confidence. It was to get the system off on a good start by having a count that was no slower than the manual counting, and a lot quicker in most cases. And there was certainly a desire not to have counts that looked back in time* (Election Official, Scotland)

3.82 Regarding the costs, interviewees were sympathetic, but ultimately stressed that if there was desire to make the system work, then it was worth the investment; failing to finance it properly would, in one interviewees' opinion, be a political decision:

[4] No more manual counting: is Malta justified in joining the voting future?

You've got to be careful not to make the ideal the enemy of a first step and trying something that might evolve over time. But I think there is a danger in getting it wrong as well, because it discredits it and it will never go any further (Campaigner)

3.83 This needs to be seen in the context of the Welsh legislation that permits councils to choose, in which e-counting may be too burdensome for individual councils. Our view is consistent with the interviewees who suggested that e-counting would be the best start for a new system. To mitigate the cost and increase uptake, some interviewees suggested the Scottish system of a central Government fund that Councils can then draw down from; and whilst expensive, it was necessary to get off to a good start.

3.84 Whilst electronic counting was the preference, most interviewees also emphasised necessity for caution and to conduct rigorous testing. Reflecting on Ireland's experience, one interviewee said:

We had a rather rancorous debate here in Ireland 15 or 20 years ago, where a government tried to introduce computer voting and it hit them in the face because they hadn't built into the system proper checks to make sure that if any hacking had occurred you could double check things (Academic, Ireland)

3.85 Nonetheless, we are very aware that electronic counting and with a central fund may not be possible. What this does, as we will return to in the concluding sections, is reduce the range of options open regarding the type of formula:

I would probably say, from the administrative point of view, if you're going to choose a system, you'd probably want to choose one which is do-able manually as well as electronically. (Election Official, Scotland)

3.86 If electronic counting is to be adopted, which is the consensus, there should also be finance available to pay for it. Councils may not opt for STV if it incurs significant costs or may attempt to do so without appropriate funding, increasing the potential for failure. The option must be backed by political will.

Quantitative analysis

3.87 Our final analysis compared viable quotas and transfers to understand how these decisions impact political outcomes.

Comparison of quotas

3.88 To compare the effect of quotas, we simulate results for three fictional local authorities under the Inclusive Gregory Method using the Droop and Hare quota formulas.

3.89 The Hare quota is calculated using the formula:

$$\frac{total\ number\ of\ valid\ votes}{number\ of\ seats\ to\ be\ filled\ at\ election}$$

3.90 The Droop quota is calculated using the formula:

$$\left(\frac{total\ number\ of\ valid\ votes}{number\ of\ seats\ to\ be\ filled\ at\ election + 1}\right) + 1$$

3.91 Table 1 illustrates how the two quota formulae differ in practice: the Droop quota produces a lower threshold for candidates to meet compared to the Hare quota. In the example given, Candidates 1 and 2 first preference votes exceed the Droop quota and would therefore be elected prior to the transfer of any preferences. However, if the Hare quota were used, none of the candidates' vote totals meet the electoral threshold required. In this scenario, candidate 6 would be excluded, and their votes transferred according to secondary preferences.

Table 1. Example calculation of Hare vs Droop Quotas

Party	**Candidate**	**FPv%**	**First Pref Votes**
Party B	1	30.52%	1397
Party C	2	27.09%	1240
Party B	3	24.43%	1118
Party C	4	9.02%	413
Party A	5	4.50%	206
Party D	6	4.44%	203
Seats	3		
Hare Quota	1,526		
Droop Quota	1145		

3.92 Results of the simulations are presented in Tables 2 to 4. The district magnitude for each ward was between 3 and 6 seats, with magnitude correlated with the number of votes cast in each ward (I.e. larger wards had a greater district magnitude).

Table 2. Simulation results for County A

	FP Vote Share	*# of* Candidates	Droop Seat Share	Hare Seat Share
Party A	16.96%	12	11%	11%
Party B	28.12%	13	24%	24%
Party C	26.34%	16	31%	31%
Party D	15.30%	14	22%	22%
Party E	11.89%	11	11%	11%
Party F	0.15%	3	-	-
Party G	0.17%	3	-	-
Party H	1.01%	6	-	-
Party I	0.05%	1	-	-

Table 3. Simulation results for County B

	FP Vote Share	*# of* Candidates	Droop Seat Share	Hare Seat Share
Party A	12.97%	10	13%	13%
Party B	15.16%	10	13%	15%
Party C	22.66%	12	28%	28%
Party D	6.55%	9	3%	3%
Party E	2.64%	3	3%	3%
Party F	0.08%	1	-	-
Party G	21.92%	10	23%	23%
Party H	12.86%	9	15%	13%
Party I	3.33%	7	3%	3%
Party J	1.29%	4	-	-
Party K	0.53%	1	-	-

Table 4. Simulation results for County C

	FP Vote Share	*# of* Candidates	Droop Seat Share	Hare Seat Share
Party A	4.38%	8	6.90%	3.45%
Party B	33.85%	9	31.03%	31.03%
Party C	30.43%	14	27.59%	27.59%
Party D	5.37%	7	3.45%	3.45%
Party E	-	0	-	-
Party F	-	0	-	-
Party G	14.06%	6	20.69%	20.69%
Party H	8.27%	5	10.34%	13.79%
Party I	3.40%	4	-	-

3.93 The different quota systems produced almost identical outcomes in terms of seats allocated to each party. Only on two occasions did the use of the Hare quota produce a result different to the Droop quota. These differences occurred in the final round of counting where the larger Hare quota had ensured that more preferences were taken into account. This is only likely to happen in wards with a large district magnitude and many candidates standing for election.

3.94 Under the Droop formula, each candidate elected met the quota. However, the larger Hare formula meant that multiple candidates in every ward were elected without meeting the quota. Rather, they were elected as the ‘last candidate standing’ once all other candidates had been eliminated. As such, the Hare quota may lead to some confusion among voters when results are reported: under the Hare quota it is possible for candidates to be elected despite only obtaining a small

fraction of the votes required by the quota even after all preference have been allocated. As such, the Hare quota is no longer used in any STV elections of note.[5]

Comparison of Transfer Rules

3.95 The method of transferring preferences is another key consideration in STV electoral systems. Different methods can produce small but significant differences in which candidates are elected.

3.96 In our simulations we focused on four methods of transferring preferences between candidates: 1) random transfer of ballots, 2) simple Gregory method, 3) inclusive Gregory method, and 4) weighted inclusive Gregory method.

3.97 **Random transfer method:** This system is used in the Republic of Ireland's lower house (*Dáil*) and was used in the Australian Senate until 1984. It can be counted by hand relatively straightforwardly without the aid of computer or electronic counting.

3.98 Ballots are sorted into 'bundles' of votes for each candidate standing, according to the first preference marked on each ballot. Once all ballots for a district have been sorted and the total number of votes counted, the quota is then calculated. Any candidates that exceed the quota are elected. If no candidates exceed the quota, then the candidate with the fewest votes is eliminated and all of their ballots are transferred according to given preferences

3.99 When a candidate is elected using this method, the number of ballots transferred to other candidates is equal to the surplus (calculated as number of ballots received minus the quota). So, if a candidate has a surplus of 100 votes, 100 ballots are taken from the elected candidate's bundle of votes and sorted into the remaining candidates bundles according to preferences stated on the ballot. At the first round of counting, all of the elected candidates votes are examined and a sample of these votes is distributed proportionally to reflect the preferences (the 'initial surplus').

3.100 However, it is in subsequent rounds where an element of randomness is introduced to the transfer system. After the first round, only the last parcel of ballots added to an elected candidate's bundle is examined when choosing the sample of votes to

[5] The Hare quota is still used for certain elections in Brazil, where seats are allocated via the D'Hondt method, not STV.

be transferred. This parcel will necessarily have been received from an elected or eliminated candidate (the ‘secondary surplus’). The sample taken from this will therefore be unlikely to be representative of the first preference ballots of the elected candidate.

3.101 Ballots with a lower preference for candidates elected in later counting rounds will therefore take preference over ballots with a higher preference for those candidates (Weeks, 2011).

3.102 This can have implications for which candidates are elected later on in the count, particularly in very close contests. As Farrell and McAllister highlight ‘Depending on which ballot papers were selected from the pile at an earlier stage in the counting process, in a close finish the fate of a candidate could be sealed by the particular pattern of preferences that predominated in those ballot papers’ (p. 482). Whilst the probability of the ‘incorrect’ candidate being elected in any given contest are slim, analysis has repeatedly shown that this has happened (see Gallagher & Unwin, 1986; Coakley & O’Neill, 1984; Meek, 1994; Farrell & McAllister, 2003).

3.103 This is often referred to as ‘Bonner Syndrome’ named after 1974 Australian Liberal Party candidate Neville Bonner who was elected as a result of votes transferred from another candidate. In the next round of counting, only these transferred ballots, and none of the second preferences from Bonner’s first-preference votes, were distributed in the next round of counting, skewing the preferences and resulting in the ‘wrong’ candidate being elected in a later round.

3.104 In our analysis, we simulate this random element by introducing variation in the fictional preference orderings of each party. This variation was greater when a small number of votes was being transferred, and smaller when a larger number of votes was to be transferred.

3.105 **Simple Gregory method:** This system is used in elections to the Northern Irish Assembly, as well as the Irish Upper House (Seanad). As such it is also sometimes referred to as ‘Senatorial Rules’. Like the random transfer method, it can be counted by hand with relative ease and does not require computer assisted counting.

3.106 In this system, transfers still only consider the last parcel of votes received by an elected candidate. It is more inclusive than the random transfer system however as it considers the entirety of the last parcel received, not just a sample.

3.107 This is done by transferring all of the votes in the last parcel received but at a fraction of their value. This is called the transfer value.

3.108 The transfer value is calculated thus:

Transfer value = Surplus/Last bundle of ballot papers received.

3.109 This method reduces the probability of Bonner syndrome occurring, but does not eliminate it.

3.110 **Inclusive Gregory Method:** This system is used for elections in Australia to the Senate and Legislative Councils in Victoria and South Australia.

3.111 In this system, ballots are again sorted into piles, the quota calculated, and the preferences of voters for elected candidate (those with more votes than the quota) are distributed.

3.112 Similar to the simple Gregory method, the inclusive Gregory method transfers votes at a fraction of their value. However, all ballots in an elected candidate's bundle are transferred this time rather than just those in the last parcel received.

3.113 The transfer value of a ballot is calculated thus:

Transfer value = Surplus/total number of ballots in bundle.

3.114 So, for example, if an elected candidate has a surplus of 100 from 1000 votes, those 100 votes will be transferred to remaining candidates at a value of 0.1. The transfer value is usually capped between two and five decimal places, rounded down. Eliminated candidates' ballots are transferred at full value.

3.115 This system removes the problem of 'Bonner Syndrome' as all preferences are taken into account. It also retains the ability to still be carried out by hand without the use of electronic counting of voting equipment (with the exception of a calculator).

3.116 The Inclusive Gregory Method introduces a new potential problem however, whereby a single ballot paper can *increase* in value in later stages of a count as

subsequent transfer values are applied. This leads to the possibility that the weight of a single ballot has an eventual value of greater than one. The probability of this affecting an individual electoral contest in a substantive way is small, but not negligible (see Farrell and McAllister, 2003). In very competitive contests in districts with many candidates standing and a high number of seats, this increasing transfer value has the possibility to have an impact on the eventual outcome.

3.117 This also raises substantial philosophical questions of fairness. As it is the larger parties who tend to win seats in the first round/s of counting, it is invariably these ballots which increase in value over the course of a count, meaning that supporters of larger parties will have the biggest influence over an electoral contest.

3.118 **Weighted Inclusive Gregory:** This system is designed to avoid the pitfalls of both Bonner Syndrome and the possibility of ballots increasing in value. This system is currently employed in Scottish local elections and is a method considered to be the fairest of those analysed in this report (Farrell, 2011).[6]

3.119 It differs from Inclusive Gregory in that ballots received in transfers from other candidates retain their original transfer value (see Dummet, 1997, p. 129). So, for votes that a candidate has received at full value, the transfer value is:

Transfer value = Surplus/total vote

3.120 For votes that a candidate has received via transfer from another candidate's surplus, the transfer value is calculated as:

Transfer value = (Surplus/total vote) x transfer value of votes gained from surplus votes to the previous candidate

3.121 The method therefore guarantees that the weight of a single ballot cannot exceed a value of one.

3.122 The added complexity in this method necessitates computer assisted counting (as employed in Scottish local elections). Whilst it is technically possible to calculate the results of an election using Weighted Inclusive Gregory by hand, in practice the

[6] The Meeks system, used in New Zealand, is generally accepted to produce the fairest electoral outcomes, but is more complex again than Weighted Inclusive Gregory (Weeks, 2011).

process becomes increasingly complex with each round of counting and would be extremely difficult to calculate without the assistance of computer software. As such, it may not be a viable option when only used in a small number of local authorities in Wales.

Simulation Results

3.123 The simulation results are presented in Tables 5, 6, and 7 for each of our fictional local authorities.

3.124 The different transfer methods produced largely the same outcomes with little variation. For example, in County B (Table Y2), our simulations produced the same outcomes under each transfer method.

3.125 This is likely a result of County B's smaller average district magnitude than the other two local authorities (being based on a rural local authority). In only 2 of the 10 wards modelled was a candidate elected who would not have been elected under a plurality system such as multi-member first past the post.

3.126 In County A and County C, there were very small differences in the outcomes produced by different transfer methods, yet it is these small differences in outcomes which can have a substantive effect on the overall results of an electoral contest.

3.127 The differences observed between the four systems are a result of the issues discussed above. The simulations for the random transfer method and Weighted Inclusive Gregory produced results that were most different from each other. Given that we know Weighted Inclusive Gregory produces the most 'fair' results, we can assume that the different results produced by the random transfer were a result of the non-representative way that preferences are transferred.

3.128 Inclusive Gregory Method only produced one result that differed from the Weighted Inclusive Gregory, yet ballots frequently increased in value in different stages. While this had a minimal impact on the final electoral outcomes, it is perhaps more worrying from an ethical standpoint that some ballots were consistently worth more than others.

3.129 Simple Gregory method produced two different results to the Weighted Inclusive Gregory, likely as a result of preferences only being taken from the last parcel of

votes received by an elected candidate. However, as it keeps much of the simplicity in counting of the random transfer method and does not have the problem of ballots increasing in value, we feel that it is the strongest option for hand-counting.

Table 5. Simulation results for County A under different transfer rules

	FP Vote Share	Random Seat Share	Simple Seat Share	IGM Seat Share	WIG Seat Share
Party A	16.96%	11%	11%	11%	11%
Party B	28.12%	27%	24%	24%	24%
Party C	26.34%	27%	29%	31%	31%
Party D	15.30%	18%	22%	22%	22%
Party E	11.89%	18%	13%	11%	11%
Party F	0.15%	0%	0%	0%	0%
Party G	0.17%	0%	0%	0%	0%
Party H	1.01%	0%	0%	0%	0%
Party I	0.05%	0%	0%	0%	0%

Table 6. Simulation results for County B under different transfer rules

	FP Vote Share	Random seat share	Simple Seat Share	Droop Seat Share	WIG Seat Share
Party A	12.97%	13%	13%	13%	13%
Party B	15.16%	13%	13%	13%	13%
Party C	22.66%	28%	28%	28%	26%
Party D	6.55%	3%	3%	3%	5%
Party E	2.64%	3%	3%	3%	3%
Party F	0.08%	0%	0%	0%	0%
Party G	21.92%	23%	23%	23%	23%
Party H	12.86%	15%	15%	15%	15%
Party I	3.33%	3%	3%	3%	3%
Party J	1.29%	0%	0%	0%	0%
Party K	0.53%	0%	0%	0%	0%

Table 7. Simulation results for County C under different transfer rules

	FP Vote Share	Random seat share	Simple Seat Share	ICM Seat Share	WIG Seat Share
Party A	4.38%	6.90%	6.90%	6.90%	6.90%
Party B	33.85%	31.03%	31.03%	31.03%	31.03%
Party C	30.43%	24.14%	27.59%	27.59%	31.03%
Party D	5.37%	3.45%	3.45%	3.45%	3.45%
Party G	14.06%	20.69%	20.69%	20.69%	20.69%
Party H	8.27%	13.79%	10.34%	10.34%	6.90%
Party I	3.40%	0.00%	0.00%	0.00%	0.00%

Table 8. Summary table of transfer rules

Transfer Method	Advantages	Disadvantages
Random transfer method	• Very simple to count; can be done by hand with little specific training	• Bonner Syndrome – element of randomness selecting which ballots are transfers leads to real possibility of 'wring' candidates being elected.
Simple Gregory Method	• Can be counted by hand with relative ease • Reduces probability of Bonner syndrome compared to random transfer method • Already used in UK (multiple Northern Ireland elections)	• Bonner syndrome still possible due to last parcel rule
Inclusive Gregory Method	• Can be counted by hand, but more complex • Transfers *all* preferences of elected candidates, eliminating the problem of Bonner Syndrome	• Possibility that the weight of a single ballot increases to a value of greater than one.
Weighted Inclusive Gregory	• Eliminates problem of Bonner Syndrome • Ballots cannot increase in value throughout the count. • Produces outcomes most representative of preferences • Already used in UK (Scottish Local Elections)	• Too complex to be counted by hand. • Computer assisted counting may be prohibitively expensive if STV only adopted by a very small number of local authorities.

4. Conclusions

4.1 This report presented evidence from a comprehensive literature review, semi-structured interviews with a range of stakeholders, and quantitative simulations of election results under different configurations of the Single Transferable Vote. Our findings have shed light on the key objectives and the broader aim of informing the configuration of STV to be adopted in local elections in Wales. In this section, we briefly summarise our conclusions; in the following section, we provide our specific recommendations.

4.2 The first objective concerned understanding the differences between quota formulae. Our conclusion is that this is a minor concern. Our simulations indicate that the difference between Hare and Droop quotas are minimal and only likely to matter in large districts with many candidates. Interviewees rarely brought this up unless prompted.

4.3 The second objective concerned transfer of surplus formulae. Our conclusions regarding transfer rules are more consequential, with the choice potentially resulting in different electoral results. If the intention is to produce the most proportional outcomes, then the Weighted Inclusive Gregory method is the best option; the issue is that this necessitates electronic counting. In lieu of this, the Simple Gregory method is one that both our simulations, literature review and interviewees point to This may provide a suitable intermediate step, and if e-counting were later introduced, the step to the weighted variety would be intuitive.

4.4 Our third objective was to understand how these decisions influenced counting method. As implied in the previous paragraph, the counting method and transfer method are mutually dependent. The most proportional transfer method – Weighted Inclusive Gregory - is not viable with hand counting. As such, hand counting necessitates either Simple Gregory, Inclusive Gregory, or, at worst, the random transfer method as used in the Republic of Ireland.

4.5 Another implication is ballot structure. Although we defer to the Electoral Commission in terms of presentation (for instance, font and colour), there are policy decisions to be made regarding how candidates are ordered. The main concern is that ordering candidates alphabetically provides candidates with names that come

earlier in the alphabet an electoral bonus, with academic research indicating this can be as much as a 4 percentage point increase in vote share in comparison to other candidates (Blom-Hansen et al., 2016). One complete solution to this is full randomisation of candidates, but this can only be done with electronic counting and introduces a range of accessibility concerns. A second partial solution is to cluster the candidates by party, which reduces the alphabetical effect; an additional solution is to let parties order their candidates within those clusters, which puts power into the hands of parties.

4.6 Another consideration with respect to the ballot is whether voters should have to rank all candidates (forced preferences) or can rank as many or few as they want (optional preferences). The former is used to minimise candidates being elected without reaching the quota. We do not consider this such a problem as to outweigh the problems posed by forced preference ranking, such as a loss of choice, increase in spoiled ballots, or ‘running the slate’, where voters arbitrarily number candidates to complete the ballot.

4.7 Finally, neither the literature review nor interviews gives us concern regarding voter understanding. Whilst spoilt ballots do increase between FPTP this is marginal (about a 1 percentage point increase moving from FPTP to STV). Evidence from countries as diverse as Estonia, New Zealand and the Republic of Ireland show that voter understanding is relatively high. Yet we also note that there are large disparities, with more deprived areas having larger numbers of spoiled ballots. We provide recommendations to overcome this.

5. Recommendations

5.1 In this final section, we make clear recommendations, noting their area and evidence base. This is presented in Table 9. In the first column, we indicate which area of STV the recommendations relate to.

Table 9. Summary of recommendations

Area	Recommendation	Primary evidence base
Quota (Objective 1)	1. Adopt Droop quota	Simulations; literature review
Transfer (Objective 2)	1. Weighted inclusive Gregory if e-counting is adopted 2. Simple Gregory if manual counting is adopted	Simulations; Interviews; literature review
Counting Method (Objective 3)	1. Adopt e-counting 2. Allow councils to draw down from a central fund 3. If manual counting is adopted, Simple Gregory should be adopted as the transfer method.	Literature review; interviews
Ballot structure	1. Cluster candidates by party 2. Allow parties to order candidates within their cluster or; 3. Order candidates alphabetically within their cluster 4. Do not adopt randomisation of candidate ordering.	Literature review; interviews
District magnitude	1. A district magnitude of five or six is the ideal point 2. Provision should be made for rural areas to apply for a lower district magnitude.	Literature review; interviews

Voter and stakeholder understanding	1. Significant effort should go into educating *candidates* and *parties,* usually by the Electoral Commission. 2. Returning Officers in deprived areas should be provided with more resources to address misunderstanding in those areas 3. Voter educational material should focus on how to fill in ballots and avoid discussion of transfers.	Literature review; interviews

5.2 We recognise that some of these recommendations are contingent on other decisions – particularly the relationship between transfer rules, counting method, and ballot structure. To make these trade-offs clear, we present what we consider plausible combinations of transfer and counting method in Table 10. We also include our proposed ballot structuring. We assume no randomisation of ballot structure, which would always require electronic counting and in our view has accessibility problems.

Table 10. Combinations of transfer, counting and ballot structures

Transfer System	Counting Method	Ballot structure
Random	Hand *or* e-counting	Candidates clustered by party, with either alphabetical; *or* party-organised ranking within party clusters
Simple Gregory	Hand *or* e-counting	
Inclusive Gregory	E-counting preferable	
Weighted inclusive Gregory	E-counting only	

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Annex A – Topic Guide

The below presents a skeleton version of the topic guide. The topic guide was edited for each interviewee to make the most of their expertise, but the broad structure was kept as consistent as possible in terms of technical and implementation questions.

Overview and introductory questions

1. First, can you briefly talk us through your experience/background with STV (Single Transferable Vote) systems?
2. What would you say is the strongest benefit of STV - with respect to FPTP and other PR systems? Which aspects of STV provide these benefits?

Technical questions

3. One of our main concerns is to get the quota and surplus formulae correct. We have a few questions on this topic. Can you describe the choices of quotas in STV systems? Which would you recommend? Are smaller quotas preferable to larger ones?
4. There are also variations on how the surpluses are distributed, which can impact the election results and implementation. What do you consider the benefits and drawbacks of the various methods (if needed, prompt: such as Hare and Gregory)?
    a. Do you think these could have political consequences, such as changing the election results?
5. A final question relates to how the ballot is constructed. For instance, Australian voters are required to rank a certain number of candidates for their ballot to be considered valid, whereas other systems (like the Republic of Ireland) only require voters to mark a single preference. What consequences do you think this could have?

Implementation

6. We are also interested in implementation. In Scotland, this proved difficult in the 2007 local elections (the first time STV was used). Thinking about your views on the quotas and surpluses as well, how do you think counting should be conducted (if needed, prompt: for instance, manual or electronic counting)?
7. How do you think voters will receive STV? Will they understand it, particularly given the multiple tiers of elections - i.e. MMP at Senedd elections? Which elements of STV add to its complexity?
8. Do you think voters will understand how votes are transferred?
9. How do you think voter engagement/knowledge could be enhanced?

Annex B - Simulations

To simulate the outcomes of an election under different variations of STV, we constructed three fictitious local authorities; one based on an urban local authority, one on a rural local authority, and one which has a mix of urban/rural sized wards.

Vote distributions, the number of parties, and the number of candidates from each party standing in a ward were taken from real-world vote returns at the 2017 and 2014 Scottish local elections. However, as the district magnitude and the preferences are fictitious, the simulations will differ considerably from these results.

District Magnitude

- County A, modelled on a urban local authority, had eleven wards. Of these, one ward was modelled as having six seats, one ward with five seats, seven wards with four seats, and two wards with three seats.
- County B, modelled on a rural local authority, had ten wards. Of these, two wards had five seats, five wards had four seats, and three wards had three seats.
- County C, modelled on a semi-rural local authority, had eight wards. Of these, five had four seats, and three had three seats.

Transfer Preferences

	→ A	→ B	→ C	→ D	→ E	→ F	→ G	→ H	→ I
Party A	.	0.25	0.1	0.3	0.2	0.01	0.1	0.03	0.01
Party B	0.35	.	0.05	0.05	0.15	0.01	0.25	0.1	0.04
Party C	0.1	0.05	.	0.25	0.4	0.02	0.1	0.05	0.03
Party D	0.2	0.05	0.1	.	0.5	0.01	0.1	0.02	0.02
Party E	0.1	0.05	0.35	0.25	.	0.03	0.1	0.1	0.02
Party F	0.125	0.125	0.125	0.125	0.125	.	0.125	0.125	0.125
Party G	0.25	0.3	0.1	0.2	0.1	0	.	0.03	0.02
Party H	0.125	0.125	0.125	0.125	0.125	0.125	0.125	.	0.125
Party I	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	.