

# **Appendix 5B**

## **Comparative Assessment: Assessment of Risks**



**Risk Assessment**

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison	
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV			Unique in EV
R.1	Machine failure (small scale)	Zero	Low	None	Tiny					✓	A machine simply stops working, or starts to misbehave in some manner and has to be shut down.	There is no comparable problem in the current paper-based system.
R.2	Power failure at a polling station	Low	Low	Tiny	Tiny		✓				Power fails at a polling station.	Neutral. The risk here is similar in both systems.
R.3	Loss of ballots (small scale)	High	Very low	Tiny	Large	✓					A vote is lost between ballot and final count.	This is highly improbable with electronic voting and close to certain in the current paper-based system, but the impact in the chosen electronic system, should this occur, would be much more significant.
R.4	Accidental damage to voting machines (small scale)	Zero	Low	None	Small					✓	A machine is damaged at a polling station (for example by being knocked over or dropped).	There is no comparable event in the current paper-based system.
R.5	Single ballot not recorded	Zero	Very low	None	Small					✓	A ballot is cast by the voter, but not recorded on the ballot module.	A small risk in the chosen electronic system, which does not exist in the paper-based system.
R.6	No ballots recorded on a ballot module	Zero	Very low	None	Large					✓	No votes are recorded on the ballot module due to a fault in the voting machine. It should be noted that if this were to happen, there would also be no votes recorded on the backup ballot module.	A small risk in the chosen electronic system, which does not exist in the paper-based system.

Risk Assessment, continued

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison	
		Paper Voting ((PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV			Unique in EV
R.7	Ballot recorded incorrectly (small scale)	Zero	Very low	None	Tiny						✓	A small risk in the chosen electronic system, which does not exist in the paper-based system.
R.8	Accidental damage to ballots during transportation (small scale)	Low	Very low	Mod.*	Mod.*	✓						The existence of a backup module makes this risk slightly lower in the chosen electronic system.
R.9	Accidental electromagnetic interference (small scale)	Zero	Very low	None	Small						✓	A bit or bits in the machine are altered by electromagnetic radiation (called a single event upset or SEU). There are other possible ways this could happen which range from a machine in a polling booth being placed close to a transformer, to radioactive decay in a silicon chip, or even cosmic rays.
R.10	Error in translocation/uploading of ballots (small scale)	Very high	Very low	Tiny	Small	✓						This is a small risk in the chosen electronic system, but a near certainty in the paper-based system although in the latter, it can normally be resolved to an acceptable margin of error.

\* Moderate

Risk Assessment, continued

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison	
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV			Unique in EV
R.11	Accidental miscounting of ballots (small scale)	Certain	Very low	Small	Cat.*	✓					Votes are counted incorrectly at a centre.	This is a much greater probability in the paper-based system than in the chosen electronic system. However the impact of an electronic count error, should one occur, would be much greater.
R.12	Accidental voter identification (small scale)	Very low	Low	Tiny	Mod.*		✓				An individual voter's vote becomes known to others.	This could be a moderate risk with the chosen electronic system, but it can be almost eliminated with good procedures. There is a slight, but insignificant, risk in the paper-based system.
R.13	Postal voter identified (small scale)	Very low	Low	Small	Small		✓				The vote of a postal voter is identified.	This is a slightly greater risk in electronic voting, but the risk is not material in either case.
R.14	Disabled voter identified (small scale)	Low	Mod.*	None	Tiny		✓				A disabled voter's vote is identified.	This is marginally less of a risk in the current paper-based system than it is with the chosen electronic system.
R.15	Software error in voting machines (small scale)	Zero	Low	None	Large					✓	Each machine has to be configured for a specific constituency. It is possible that in doing this, a software error could give an incorrect result.	This is a risk in the chosen electronic system, which does not exist in the paper-based system.

\* Catastrophic

\* Moderate

**Risk Assessment, continued**

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison	
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV			Unique in EV
R.16	Abstaining voter identification (spoiled, null or blank ballot) (small scale)	Zero	High	None	Mod.*						✓	This is a risk in the chosen electronic voting system, which does not exist in the paper-based system.
R.17	Ballot module accidentally overwritten at service centre	Zero	Low	None	Small						✓	This is a small risk in the chosen electronic system, which does not exist in the paper-based system.
R.18	Inadvertently spoiled ballot	Certain	Zero	Small	None					✓		This is a risk in the paper-based system that does not exist with the chosen electronic system.
R.19	Deliberately spoiled ballot	Certain	Zero	Small	None						✓	This is a risk in the paper-based system that does not exist with the chosen electronic system. Note: Whether this is a risk is a matter of perspective. If it is the view that a voter does not have a 'right' to spoil a vote, this is a risk. Otherwise, it is not.

\* Moderate

**Risk Assessment, continued**

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV		
R.20	Ballot paper not stamped	Low	Zero	Small	None				✓		This is a risk in the paper-based system that does not exist in the chosen electronic system.
R.21	Accidental misreading of ballot papers	Very high	Zero	Small	None				✓		This is a risk in the paper-based system that does not exist in the chosen electronic system.
R.22	Alteration of ballots (small scale)	Very low	Zero	Small	None				✓		While it is theoretically possible to alter a small number of ballots in the chosen electronic system, the chance of this is a close to zero as makes no difference. It is easier to do this in a paper-based system.
R.23	Impersonation (small scale)	Mod.*	Mod.*	Small	Small			✓			A voter claims to be somebody else and casts more than one vote.
R.24	Deliberate voter identification (small scale)	Very low	Very low	Small	Small			✓			A person seeks to find out how a specific voter has voted.

\* Moderate

**Risk Assessment, continued**

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV		
R.25	Interference with ballots during storage or transportation (small scale)	Low	Low	Mod.*	Mod.*			✓			This type of malpractice is possible under both systems.
R.26	Deliberate damage to ballots during storage or transportation (small scale)	Low	Very low	Mod.*	Mod.*	✓					This is a slightly greater problem with an electronic system given the greater vulnerability of electronic components. However, the backup module more or less eliminates the risk thus making the risk slightly higher with a paper-based system.
R.27	Deliberate damage to voting machines (small scale)	Zero	Low	None	Small					✓	This is a risk in the chosen electronic system that does not exist in the paper-based system.

\* Moderate



Risk Assessment, continued

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV		
R.28	Voter coercion or bribery	Very low	Low	Mod.*	Mod.*		✓				Save in the case of “chain voting” under the paper system (which is difficult to achieve in practice on any significant scale), the problem here is verification that the voter has voted as instructed or has cast the ballot. For a large-scale operation, the risk is slightly greater with an electronic system. For small scale, the situation is comparable in both systems.
R.29	Substitution of ballot box/ballot module	Very low	Low	Mod.*	Mod.*		✓				A ballot module or modules is switched for a pre-setup module, either at the polling station or at a service centre. Doing this is theoretically possible in both cases. Doing it with a paper-based system would require careful observation, suborning several officials and a certain amount of luck. This is a theoretical possibility with the current system, but impractical in reality.
R.30	Substitution of ballots in CD	Zero	Very low	None	Large					✓	The CD with the votes generated at the service centre is switched with a CD prepared earlier or with another CD written subsequently.

\* Moderate

**Risk Assessment, continued**

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison
		Paper Voting ((PV))	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV		
R.31	Adding votes before opening of poll	Low	Low	Small	Small			✓			There is less chance of getting caught in paper-based fraud, especially if done on a small scale. Also, with a paper-based system, it might be possible to prepare the false votes during the course of a day whereas an electronic fraud would have to be done outside polling hours.
R.32	Deliberate miscounting of ballots by staff	Low	Zero	Small	None				✓		Count staff may deliberately put ballots in incorrect pigeonholes.
R.33	Deliberate alteration of ballots by staff	Low	Zero	Tiny	None				✓		Count staff may deliberately alter a ballot.
R.34	Deliberate spoiling of ballots by staff	Very low	Zero	Tiny	None				✓		Count staff might try to invalidate a ballot by deliberately defacing it.
R.35	Deliberate destruction of ballots by staff	Very low	Zero	Tiny	None				✓		Count staff destroy or remove a ballot.

Risk Assessment, continued

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV		
R.36	Deliberate substitution of ballots by staff	Very low	Zero	Small	None				✓		This would be risky and could only be done on a small scale.
R.37	Machine failure (wide scale)	Zero	Low	None	Cat.*					✓	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.38	Loss of ballots (wide scale)	Zero	Very low	None	Cat.*					✓	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.39	Ballot recorded incorrectly (wide scale)	Zero	Very low	None	Cat.*					✓	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.40	Accidental electromagnetic interference (wide scale)	Zero	Zero	None	Cat.*					✓	This is a theoretical risk in the chosen electronic system that does not exist in the paper-based system, but the chance of it happening in the chosen electronic system are so low that it can be regarded as zero.

\* Catastrophic

**Risk Assessment, continued**

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison	
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV			Unique in EV
R.41	Error in translocation/uploading of ballots (wide scale)	Zero	Very low	None	Cat.*					✓	A software or hardware error means that while the votes are correctly recorded on ballot modules, they are read incorrectly into the PCs prior to counting. The same comments made for non-systemic errors of this type apply here, though the implications are more serious.	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.42	Accidental miscounting of ballots (wide scale)	Certain	Very low	Small	Cat.*	✓					An error in the count software or in the manual count.	This is a higher risk in the paper-based system than in the chosen electronic system.
R.43	Accidental voter identification (wide scale)	Zero	Very low	None	Small					✓	The votes of large numbers of voters become known to others.	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.44	Postal voter identified (wide scale)	Very low	Low	Small	Small		✓				The votes of a large number of postal voters are identified.	This is slightly higher in the chosen electronic system.
R.45	Disabled voter identified (wide scale)	Very low	Low	Small	Small		✓				The votes of a large number of disabled voters are identified.	This is slightly higher in the chosen electronic system.

\* Catastrophic

Risk Assessment, continued

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison		
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV			Unique in EV	
R.46	System cannot cope with features of an election	Zero	Low	None	Cat.*						✓	The software or hardware cannot handle the particular features of an election (e.g. too many parties, too many candidates, etc.).	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.47	System cannot cope with number of voters	Zero	Very low	None	Small						✓	There are two scenarios where this could happen. Due to the slow pace of voting, voters cannot get to a machine or due to the high volume of votes cast, the system cannot deal with the throughput.	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.48	Votes accidentally lost during counting	Very low	Very low	Small	Large			✓				The vulnerable point here is where votes are read from the ballot modules into the service centre PC and to a lesser extent into the count PC. A loss of votes subsequent to this could arise from a failure in the count software or a hardware failure on the PC.	In theory this could happen in a paper-based count. However this is extremely unlikely and can be disregarded.
R.49	Inherent fault in voting machine hardware	Zero	Very low	None	Cat.*						✓	An error in the hardware design leads to incorrect results being written to ballot modules.	This is a risk in the chosen electronic system that does not exist in the paper-based system.

\* Catastrophic

**Risk Assessment, continued**

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison		
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV			Unique in EV	
R.50	Software error in voting machines (wide scale)	Zero	Very low	None	Cat.*						✓	A bug in the voting machine software causes it to fail or incorrectly record votes.	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.51	Inherent fault in counting process	Certain	Very low	Mod.*	Cat.*					✓		The votes are recorded and transferred correctly, but the count is wrong.	It is virtually certain that there will be errors in a paper-based count. The chances of errors in an electronic count are almost zero and, in any event, the count can be tested using different software if necessary. This is therefore, a higher risk in a paper-based system.
R.52	Inherent fault in counting hardware	Zero	Very low	None	Cat.*						✓	A hardware problem causes an error in the count.	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.53	Different results on recounts	Certain	Zero	Small	None						✓	Repeated recounts produce different results because of recovered ballots, miscounted ballots or changes in classification.	This is a risk in the paper-based system that does not exist in the chosen electronic system.

\* Catastrophic  
\* Moderate

Risk Assessment, continued

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV		
R.54	Incorrect outcome resulting from sampling error	Very low	Very low	Small	Small			✓			Neutral. The risk in both systems is the same. However by modifying the chosen electronic system, this risk can be reduced by full sampling and eliminated by using the Gregory method; neither of these options is practical with the current paper-based system.
R.55	Reinterpretation of ballots by returning officers	Certain	Zero	Small	None				✓		In any election, Returning Officers have to make numerous decisions on problematic ballots, not just spoiled votes, but unclear writing and miscounted ballots, which turn up on later counts.
R.56	Widespread interference with voting machine software or hardware	Zero	Very low	None	Cat.*					✓	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.57	Impersonation (wide scale)	Mod.*	Mod.*	Small	Small			✓			As for local impersonation, but done systematically and on a wide scale.

\* Catastrophic  
\* Moderate

## Risk Assessment, continued

No.	Risk	Probability		Impact		Risk Comparison (Higher / Equal / Unique)				Description	Comparison
		Paper Voting (PV)	Elect. Voting (EV)	Paper Voting (PV)	Elect. Voting (EV)	Higher in PV	Higher in EV	=	Unique in PV		
R.58	Deliberate voter identification (wide scale)	Zero	Zero	None	None			✓			Neutral. There is effectively no risk of this in either system.
R.59	Alteration of ballots (wide scale)	Very low	Low	Large	Large		✓				This is a broadly comparable risk with both systems. It would probably be marginally easier to do electronically given the relative size and manageability of ballot boxes and ballot modules. However, the logistical problems make both frauds improbable.
R.60	Deliberate damage to voting machines (wide scale)	Zero	Very low	None	Small					✓	This is a risk in the chosen electronic system that does not exist in the paper-based system.
R.61	Widespread tampering with count software	Zero	Low	None	Large					✓	This is a risk in the chosen electronic system that does not exist in the paper-based system.

The Policy Institute  
Trinity College Dublin  
July 2005