

# The Blockchain-Based on E-Voting In The Local Elections System; An Effort to Realize E-Democracy

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**Submission date:** 12-Apr-2023 11:52AM (UTC+0800)

**Submission ID:** 2062221906

**File name:** The\_Local\_Elections\_System\_An\_Effort\_to\_Realize\_E-Democracy.pdf (494.4K)

**Word count:** 7024

**Character count:** 40406

## THE BLOCKCHAIN-BASED ON E-VOTING IN THE LOCAL ELECTIONS SYSTEM: AN EFFORT TO REALIZE E-DEMOCRACY

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### **Abstract**

*E-voting in post-conflict local elections is still a long debate. One of the reasons is related to the security problem e-voting. Over time, system blockchain born which is known unhackable. Therefore, will analyze, first, urgency using e-voting in post-conflict local election system and secondly the formulation use of blockchain-based e-voting in the post-conflict local election system. The method research is legal research with statute approach, conceptual approach, and case approach. As for the results of the study: first, urgency using blockchain in regional head election system, because there are still many problems, namely: 1) Multiple voter data which results in voters being able to vote more than one time, 2) There are still ballots that have been voted, due irresponsible persons, 3) Distribution of ballot boxes and ballots have problems both before and after voting, and 4) Many post-conflict local election officers died and got sick due to fatigue while on duty, and secondly, the formulation use blockchain in electronic-based regional head election system, must considered: 1) review readiness of districts/cities, 2) Making rules with stakeholders, 3) Resource training humans, 4) Socialization to the community, 5) The implementation is carried out systematically tiered, 6) Implement pilot project before implemented.*

**Keyword:** Blockchain; E-Democracy; E-Voting; Election.

### **A. INTRODUCTION**

Mahfud MD stated that people's sovereignty implies the existence of a government from, by, and for the people so that the government is legitimate and recognized by the people.<sup>1</sup> Concerning the concept of

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<sup>1</sup> Moh. Mahfud MD, *Pergulatan Politik dan Hukum*, Yogyakarta, Gama Media, 1999, page.32.

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people's government, Indonesia is one of the countries that adheres to such a concept, as enshrined in the provisions of Article 1 Paragraph (2) and Paragraph (3) of The 1945 Constitution of the Republic of Indonesia, which states that sovereignty is in the hands of the people and is implemented according to this Constitution, and The State of Indonesia shall be a state based on the rule of law.<sup>2</sup> As for the manifestation of popular sovereignty based on the constitution, it can be seen from the opinion of M. Guntur Hamzah:<sup>3</sup> "Currently, democracy has entered a very good process; one of the clear evidence is that there is a direct election by the people that have been carried out in the State of Indonesia." Thus, it can be understood that people's sovereignty is implemented according to the applicable constitution so that the implementation of popular sovereignty is based on constitutionalism, one of which is the election of leaders based on general elections.<sup>4</sup>

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One of the elections for leaders using the general election mechanism is manifested in the election of Governors, Regents, and Mayors, respectively, as heads of provincial, regency, and city governments who are democratically elected as regulated in Article 18 Paragraph (4) of the 1945 Constitution of the Republic of Indonesia.<sup>5</sup> At the same time, local heads and deputy local heads (elections) are important and strategic instruments for building a democratic regional government. The term post-conflict local election was used after the Constitutional Court Decision Number 072-073/PUU-II/2004, which placed the election of local heads and deputy local heads as part of the electoral regime, meaning that the process and implementation of post-conflict local elections refers to Article 22E of the 1945 Constitution, namely that general election are held in a direct, general, free, secret, honest and fair manner once every five years; and implemented by a national, permanent and independent commission.<sup>6</sup>

The implementation of local elections still causes problems, injuring the realization of a democratic local government. **First**, at the local elections held in December 2020, The General Election Supervisory Agency (BAWASLU) said that there were several problems, such as double voting; for example in Bandung, there were around 4,000 thousand double voters,<sup>7</sup>

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2 Pasal 1 Ayat (2) jo. Ayat (3) Undang-Undang Dasar Negara Republik Indonesia Tahun 1945.

3 Mahkamah Konstitusi, *MK Gelar Sosialisasi Pemahaman Hak Konstitusi Warga Negara bagi Leimena*, <https://www.mkri.id/index.php?page=web.Berita&id=13008>, accessed on 21 April 2022.

4 Ria Casmi Arrsa, *Pemilu Serentak dan Masa Depan Konsolidasi Demokrasi*, *Jurnal Konstitusi*, Vol. 11, No. 3, 2014, page. 55.

5 Sayyidatul Insiyah, Xavier Nugraha, Shevierra Danmadiyah, *Pemilihan Kepala Daerah Oleh Dewan Perwakilan Rakyat Daerah: Sebuah Komparasi Dengan Pemilihan Secara Langsung Oleh Rakyat*, *Supremasi Hukum: Jurnal Penelitian Hukum*, Vol. 28, No. 2, 2019, page.167.

6 Constitutional Court Decision Number 97/PUU-XI/2013, page.28.

7 Media Indonesia, *Ribuan Pemilih Ganda Ditemukan di DPT Pilkada Kabupaten Bandung*, [https://m.mediaindonesia.com/infografis/detail\\_infografis/353399-ribuan-pemilih-ganda-ditemukan-di-dpt-pilkada-kabupaten-bandung](https://m.mediaindonesia.com/infografis/detail_infografis/353399-ribuan-pemilih-ganda-ditemukan-di-dpt-pilkada-kabupaten-bandung), accessed on 21 April 2022.

In Medan, North Sumatra, 36,398 data on multiple voters were found,<sup>8</sup> In Jember, there were 85,848 double voter data,<sup>9</sup> in Boyolali found 1,736 double voter data,<sup>10</sup> and in polling stations elsewhere, there are still a lot of duplicate data. **Second**, there is double data which results in voters being able to vote more than 1 (one) time, for example, in the post-conflict local election in Teluk Wondama Regency, where 8 (eight) people were proven to have used their right to vote more than once at Polling Station 05 Kampung Wasior II, Polling Station 04 Kampung Manuwak, Polling Station 09 Kampung Maniwak, and Polling Station 14 Kampung Maniwak, Wasior District, so that the Constitutional Court Judge ordered a re-voting as stated in the Constitutional Court Decision Number 32/PHP.BUP-XIX/2021.<sup>11</sup> **Third**, the problem of damaged ballot boxes and impeding voting and vote counting. 21 out of 48 polling stations in the urban village of Payo Selincah, Paal Merah district, Jambi City were forced to carry out the H+1 Follow-up Voting in the 2019 Election because the duplex ballot box was badly damaged in the logistics distribution process due to flooding. For example, in Baling Regency, Bali Province, several months before the voting was held, it was found that 2,065 ballot boxes were damaged by flooding, while in Bogor Regency, West Java Province, 682 ballot boxes were found damaged due to flooding, as well as the same incident occurred in Jambi City, about 105 ballot boxes in the logistics distribution process were not able to withstand the flood which resulted in the delay of the voting process.<sup>12</sup> **Fourth**, Data from the Ministry of Health through the health offices of each province recorded that 11,239 sick Voting Organizer Group (KPPS) officers and 527 people died in the 2019 simultaneous elections.<sup>13</sup> Furthermore, Chairman of the General Elections Commission (KPU), Arief Budiman, said that many Voting Organizer Group officers died and were sick in the 2019 simultaneous elections due to fatigue while on duty. Fatigue occurs because the work assigned to the Voting Organizer Group officers is too much and too heavy. The working hours are also erratic. Officers almost work for 24 hours, especially before the vote, until the vote count is done.<sup>14</sup> This can

- 8 Antaranews, *Bawaslu temukan 36.398 data ganda pemilih jelang Pilkada Medan*, <https://www.antaranews.com/berita/1768257/bawaslu-temukan-36398-data-ganda-pemilih-jelang-pilkada-medan>, accessed on 21 April 2022.
- 9 Harian Suara.com, *Dugaan Kuat Ada 85.848 Data Ganda di DPT Pilkada Jember 2020*, <https://www.hariansuara.com/news/politik/21442/dugaan-kuat-ada-85-848-data-ganda-di-dpt-pilkada-jember-2020>, accessed on 21 April 2022.
- 10 Solopos, *Data Ganda di DPS Pilkada Boyolali masih 1.736*, <https://www.solopos.com/data-ganda-di-dps-pilkada-boyolali-masih-1-736-1086316>, accessed on 21 April 2022.
- 11 Putusan Mahkamah Konstitusi Nomor 32/PHP.BUP-XIX/2021.
- 12 Adi Susanto, Mardiana, *Evaluasi Penggunaan Kotak Suara Duplex dalam Proses Distribusi Logistik Pemilu 2019 di KPU Kota Jambi*, *Electoral Governance Jurnal Tata Kelola Pemilu Indonesia*, Vol. 2, No. 1, 2020, page.85.
- 13 Kompas.com, *Data Kemenkes: 527 Petugas KPPS Meninggal, 11.239 Orang Sakit*, <https://nasional.kompas.com/read/2019/05/16/17073701/data-kemenkes-527-petugas-kpps-meninggal-11239-orang-sakit?page=all>, accessed on 21 April 2022.
- 14 Katadata, *Fenomena Kelelahan Petugas KPPS yang Berujung Kematian*, <https://katadata.co.id/hariwidowati/berita/5e9a5194615ad/fenomena-kelelahan-petugas-kpps-yang-berujung-kematian>, accessed on 21 April 2022.

happen because the conventional voting system based on voting using paper or ballots itself does not have a proper security system base because the ballots are very easy to be rigged by certain elements, and require management from officers which requires a lot of money, time, and energy.<sup>15</sup>

From the problems mentioned above, there has been no concrete effort to overcome them to prepare for local elections in 2022, 2023, and 2024. This presumably is inversely proportional to the implementation of village head elections, which try to solve problems by implementing e-voting as a form of legal progressivity in responding to problems related to the voting system in Indonesia.<sup>16</sup> The biggest concern is as stated by the Minister of Home Affairs, Tito Karnavian, who stated that e-voting for village heads is good because it covers a small area, while for regional and national elections, e-voting is prone to be hacked by certain parties to change data.<sup>17</sup>

In its development, there is a technology, namely blockchain which has several features that ensure security and consistency in transactions and data storage which incidentally is starting to be expected to be used in e-voting.<sup>18</sup> However, this tends to be new, and there are still many who are unfamiliar with blockchain technology, so it needs to be analyzed more deeply whether the use of blockchain in the regional head election system is in line with the cumulative requirements in the Constitutional Court Decision Number 147/PUU-VII/2009, which does not violate the principle direct, public, free, confidential, honest and fair. In addition, the provision of blockchain technology in collaboration with third parties is constitutional and meets the cumulative requirements in the Constitutional Court Decision Number 147/PUU-VII/2009, namely that areas that apply the e-voting method are ready in terms of technology, financing, human resources, and the software, the readiness of the community in the area concerned, as well as other requirements.

Problems and dilemmas related to using e-voting in post-conflict local elections, especially with this blockchain system, will always exist. Even when implemented, new problems will be found. However, this does not mean that this will erase the discourse on the potential use of e-voting in this post-conflict local election. In fact, the actual use of e-voting in this post-conflict local election is a manifestation of human rights related to the use of technology which is guaranteed in Article 288C of the 1945 Constitution of the Republic of Indonesia and is a state obligation as stated

15 Suparto Wijoyo, Bagus Oktafian Abrianto, M Syaiful Aris, Xavier Nugraha, Digital Supply Chain Mechanism In Indonesian Society And Industrialization, *International Journal of Supply Chain Management*, Vol. 9, No. 4, 2021, page.510.

16 Zulfikri Suleman, Yoyok Hendarso, Gita Isyanawulan, dan Ryan Trisna Adyatma, Mekanisme E-Voting dalam Pemilihan Kepala Desa, *Jurnal Analisis Sosial Politik*, Vol. 2, No. 1, 2018, page.75.

17 Kumparan, Mendagri: Negara Besar Tak Mau Pakai e-Voting karena Rawan Di-hack, <https://kumparan.com/kumparannews/mendagri-negara-besar-tak-mau-pakai-e-voting-karena-rawan-di-hack-1xpACUmeiXM/full>, accessed on 22 April 2022.

18 Nopendri, Rio Aurachman, Muhammad Rafid Amrullah, Rancangan Simulasi Penerapan Blockchain dalam Pemilihan Presiden Indonesia, *Jurnal Rekayasa Sistem dan Industri*, Vol. 7, No. 1, 2020, page.12.

in Article 31 of the 1945 Constitution of the Republic of Indonesia. A mechanism for the creation of e-democracy in society. In order to ensure the novelty of this article, several similar articles and the differences between them will be described. First, an article from Lubna entitled: "Implementation of the E-Voting System to Improve the Quality of Democracy in Indonesia" was published in the Journal of Governance and Policy Volume 1, Number 1, in 2019. The article focuses on the discussion related to SWOT from the implementation of E-voting in Indonesia in the context of elections, while in this article, the focus of the discussion is on local elections, and the mechanism used is blockchain.<sup>19</sup> Second, an article from Yulfitno Wingga Pratama and Denny Kurniadi entitled: "Implementation of Blockchain in General Election Applications." which was published in the *Voteteknika* Journal Volume 9, Number 3, in 2021. The article discusses the blockchain system in elections which incidentally uses the Solidity programming language and uses the local ethereum blockchain database (Ganache). From the focus of the discussion, it can be seen that the focus is on the technical perspective, while in this article we use a legal perspective and also in the context of post-conflict local elections instead of general elections.<sup>20</sup>

## B. RESEARCH METHODS

This research is doctrinal research. According to Hutchinson, Doctrinal Research:<sup>21</sup> "research which provides a systematic exposition of the rules governing a particular legal category, analyses the relationship between rules, explains areas of difficulty and, perhaps, predicts future developments." In this doctrinal research, the legal problem that will be analyze in this article is about the application of Blockchain-based E-Voting in the Local Elections System.

In this doctrinal research, the approach that used are statute approach, conceptual approach, and case approach. In statute approach, the regulation that will be analyze are regulation that relate with the application of Blockchain-based E-Voting in the Local Elections System. In conceptual approach, the concept/doctrine that will be analyze are concept/doctrine that relate with the application of Blockchain-based E-Voting in the Local Elections System. In case approach, the cases that will be analyze are cases that relate with the application of Blockchain-based E-Voting in the Local Elections System.

## C. RESULTS AND DISCUSSION

### 1. The Urgency of Using E-Voting in Local Elections

As stated by Robert Dahl, that the ideal democracy always demands various things, so that no actual regime is able to fully

<sup>19</sup> Lubna, Implementasi Sistem E-Voting Untuk Meningkatkan Kualitas Demokrasi di Indonesia, *Jurnal Pemerintahan dan Kebijakan*, Vol. 1, No. 1, 2019, page.51.

<sup>20</sup> Yulfitno Wingga Pratama dan Denny Kurniadi, Implementasi Blockchain dalam Aplikasi Pemilu, *Voteteknika*, Vol. 9, No. 1, 2021, page.124.

<sup>21</sup> Terry Hutchinson, Developing Legal Research Skills : Expanding The Paradigm, *Melbourne University Law Review*, Vol. 32, Number 1, 2008, page. 1068.

understand it.<sup>22</sup> From Robert Dahl's view, it can be understood that the true democratic process will continue to demand continuous change and make improvements in order to create an ideal democracy.<sup>23</sup> Therefore, the process of local elections that have been held will never stop at the point of perfection, so various improvements are needed to achieve a level of maturity in running a democracy. The implementation of the post-conflict local election must also be based on the principles of law and justice that are universally adopted, namely stating that no one may benefit from irregularities and violations committed by oneself and deviations and violations committed by others may harm no one (*nullus/nemo commodum capere potes de injuria sua propria*).<sup>24</sup>

In its implementation, the direct implementation of the post-conflict local election by the people from 2005 to 2020 still causes some problems. These problems are broadly described in the table as follows:

**Table 1.** The Problems of Directly Implementing Local Elections

Year	Area	Problems
2005 <sup>25</sup>	Jambi	The Jambi Local Elections Supervisory Committee found 4,024 voter cards in four urban villages in Jambi. In addition, hundreds of unclear voter cards were also found. The cards are suspected of being duplicated by certain individuals from the successful team and the printing press. This was stated by the Chairman of the Jambi Supervisory Committee, Thabrani M Soleh.
	Ngawi	There are 7,000 double voter cards.
	Jakarta	Violations were found in various regions in determining voters in the form of multiple voters and many people who met the requirements but were not registered.
	Cilegon	The cards received by the Voting Organizer Group (KPPS) do not match the number of voters, there are multiple voters and fictitious voter cards
2010	Medan	Voting Organizer Group (KPPS) officers cast ballots when voters are not present yet at the Polling Station. <sup>26</sup>
2014	Banjarmasin	8 ballot boxes from the results of the voting,

22 Robert A. Dahl, *Dilema Demokrasi Pluralis*, Jakarta, Rajawali, 1982, page.7.

23 Janpatar Simamora, Eksistensi PemiluKada Dalam Rangka Mewujudkan Pemerintahan Daerah Yang Demokratis, *Mimbar Hukum*, Vol. 23, No. 1, 2011, page.222.

24 Hamdan Zoelva, Problematika Penyelesaian Sengketa Hasil PemiluKada oleh Mahkamah Konstitusi, *Jurnal Konstitusi*, Vol. 10, No. 3, 2013, page.389.

25 Ismail Fahmi , et al., Daftar Inventaris Berita Media Cetak tentang Pilkada, Centre for Electoral Reform (*CETRO*), 2005, page. 46.

26 Kompas, Pilkada Medan Diduga Curang Terstruktur, <https://amp.kompas.com/entertainment/read/2010/06/24/22080657/pilkada-medan-diduga-curang-terstruktur>, accessed on 22 April 2022.

		from the Mirimanasa District Election Committee (PPK) to Kuala Kurun, overturned while walking along the Kurun River. All the ballot boxes that were transported are scattered, and four of them are missing. <sup>27</sup>
2019	Simultaneous local elections	Cases of ballot boxes received by KPPS were not sealed, which occurred in 6,474 polling stations. In addition, there are also cases of ballots being swapped between Electoral Districts or between Polling Stations. Based on data from The General Election Supervisory Agency (BAWASLU), this case occurred in 3,411 polling stations. In addition, there were 708 cases of recapitulation, mainly related to the C1 data being swapped and the C1 data input error into the General Elections Commission's Calculation System. Data from the Ministry of Health as of May 16, 2019, shows that 527 Voting Organizer Group officers have died, and 11,239 have fallen ill. The large number of Voting Organizer Groups who died and fell ill was allegedly due to the heavy workload of organizing the 2019 Simultaneous General Elections. <sup>28</sup>
	Maluku	Vote bubble and vote manipulation in the sub-district count (PPK) changed the overall composition of the vote (the case for the General Election of the Morotai Regency, North Maluku province), as well as technical violations of voting and counting that were detrimental to certain candidates. <sup>29</sup>
	Kalimantan	Geographical conditions in West Kalimantan, which are crossed by a large river, complicate the distribution of election logistics in West Kalimantan. <sup>30</sup> Which causes the implementation of the election to be postponed.
2020	Central Lombok Regency of	Central Lombok, West Nusa Tenggara found 28 ballots have been punched. Local elections in Teluk Wondama Regency, in

27 Surya.Online, Perahu Terbalik, Kotak Surat Suara Hanyut, <https://surabaya.tribunnews.com/2014/04/17/perahu-terbalik-kotak-surat-suara-hanyut>, accessed on 23 April 2022.

28 Aryojati Ardipandanto, Permasalahan Penyelenggaraan Pemilu Serentak Tahun 2019, Info Singkat: *Kajian Singkat terhadap Isu Aktual dan Strategis*, Vol. 11, No.1, 2019, page.27.

29 Hamdan Zoelva, *Op.Cit.* page. 27.

30 BBC News, Pemilu: Masalah distribusi logistik 'bisa perbesar' potensi kecurangan di daerah terpencil, <https://www.bbc.com/indonesia/indonesia-47850738>, accessed on 24 April 2022.



Teluk Wondama	which 8 (eight) people were proven to have exercised their right to vote more than once at Polling Station 05 Kampung Wasior II, Polling Station 04 Kampung Manuwak, Polling Station 09 Kampung Maniwak, and Polling Station 14 Kampung Maniwak, Wasior District so that the Judges of the Constitutional Court ordered a re-voting as stated in the Decision of the Constitutional Court Number 32/PHP.BUP-XIX/2021.
Whole area	In general, based on data from The General Election Supervisory Agency of the Republic of Indonesia, ballots were swapped at 1,205 Polling Stations, ballots were lacking in 2,324 Polling Stations. <sup>31</sup>

*Source: Author's management results*

The description above shows that in fact the problems related to the post-conflict local election almost have the same thing every year, and the problems that occur in general include:

- Multiple Voter Data which consequently voters can vote more than 1 (one) time.
- The ballots that have been punched are due to the role of irresponsible persons. This can happen during the printing process or on polling day by involving irresponsible officers.<sup>32</sup>
- The distribution of ballot boxes and ballots often encountered problems before and after voting. This is because Indonesia has a variety of geographical conditions, as well as weather conditions or circumstances that are beyond control or force majeure.<sup>33</sup>
- Many election officials died and got sick during the simultaneous elections due to fatigue. Officers worked almost 24 hours, especially before the vote, until the vote count was carried out. This is also because the vote-counting process is done manually.<sup>34</sup>

The number of problems related to this post-conflict local election made a lot of discourse and studies conducted to answer this problem,

31 Kabar24, Bawaslu: Ada 18.668 Laporan Masalah Selama Pilkada Serentak 2020, Bawaslu: Ada 18.668 Laporan Masalah Selama Pilkada Serentak 2020, <https://kabar24.bisnis.com/read/20201209/15/1328774/bawaslu-ada-18668-laporan-masalah-selama-pilkada-serentak-2020>, accessed on 23 April 2022.

32 Afif Hidayatul Mahmudah, Faisol Mubarak, dan Faiqatul Himmah, Konsep Waliyu Al-Amri Al-Daruri Bisysyaukah sebagai Legalitas Keabsahan Pemilihan Umum di Indonesia, *Rechtenstudent*, Vol. 2, No. 1, 2021, page. 54.

33 Kadek Dwita Apriani dan Ni Made Ras Amanda Gelgel, Tahapan Pemilu 2019 di Tengah Ancaman Bencana Alam: Studi Kasus Erupsi Gunung Agung, *Jurnal Bali Membangun Bali*, Vol. 1, No. 1, 2020, page.51.

34 Aditya Budiman, *Banyak Petugas KPPS Meninggal Jadi Alasan Penolakan Pilkada 2024*, 2020, <https://nasional.tempo.co/read/1430884/banyak-petugas-kpps-meninggal-jadi-alasan-penolakan-pilkada-2024/full&view=ok>

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but no concrete solution has been presented in overcoming the problems in regional head elections. This is different from the village head election, where based on data, the Ministry of Home Affairs noted that from 2013 to 2020, 1,572 villages in 23 regencies/cities had conducted village head elections by voting electronically or by e-mail.<sup>35</sup> With e-voting in village elections, it is hoped that overcoming the problem of ballots having been punched, multiple voters, and voting and vote counting become more effective.

E-Voting according to the International Institute for Democracy and Electoral Assistance is a system where voting in an election will be carried out by involving technology to assist in every process.<sup>36</sup> In line with this understanding, Ikhsan Darmawan defines e-voting as the use of voting rights by voters in an election using the help of electronic technology.<sup>37</sup> The use of e-voting in village head elections has also been implemented in several villages, which is the result of initiation by the Agency for the Assessment and Application of Technology (BPPT) in collaboration with the Ministry of Communication and Information and Local Governments in nine regencies throughout Indonesia.<sup>38</sup>

Based on data, the Ministry of Home Affairs noted, in the period from 2013 to 2020, there were 1,572 villages in 23 regencies/cities that had conducted village head elections by e-voting.<sup>39</sup> With e-voting in the village head election, it is hoped that overcoming the problem of ballots having been punched, multiple voters, and voting and counting votes will be more effective. In line with this, the implementation of E-Voting does not conflict with The 1945 Constitution of the Republic of Indonesia as the highest legal norm. The Constitutional Court agrees this as the guardian of democracy in the Constitutional Court Decision No. 147/PUU-VII/2009, which interprets that e-voting can be used as one of the methods in the general election, in addition to the previous method of voting and ticks, as long as it fulfills two cumulative conditions, namely:

- a. does not violate the principles of direct, general, free, confidential, honest, and fair;
- b. regions that apply the e-voting method are ready in terms of technology, financing, human resources and software, community

35 *Republika*, Hingga 2020, 1.572 Desa Gunakan E-Voting Saat Pilkades, <https://repjabar.republika.co.id/berita/qztxhj428/hingga-2020-1572-desa-gunakan-evoting-saat-pilkades>, accessed on 22 April 2022.

36 International Institute for Democracy and Electoral Assistance, *Keadilan Pemilu: Ringkasan Buku Acuan Internasional IDEA*, Jakarta, Indonesia Printer, 2010, page. 32.

37 Darmawan, Ikhsan, Nurul Nurhandjati, dan Evida Kartini., *Memahami E-voting, Berkaca dari Pengalaman Negara-negara lain dan Jembrana (Bali)*, Jakarta, Yayasan Pustaka Obor Indonesia, 2014, page. 21.

38 Zulfikri Suleman, Yoyok Hendarso, Gita Isyanawulan, dan Ryan Trisna Adyatma, Mekanisme E-Voting Dalam Pemilihan Kepala Desa, *Jurnal Analisis Sosial Politik*, Vol. 2, No. 1, 2018, page.74.

39 *Republika*, Hingga 2020, 1.572 Desa Gunakan E-Voting Saat Pilkades, <https://repjabar.republika.co.id/berita/qztxhj428/hingga-2020-1572-desa-gunakan-evoting-saat-pilkades>, diakses pada tanggal 22 April 2022.

readiness in the area concerned, as well as other necessary requirements.

## 2. The Formulation of the Application of Blockchain-based E-Voting in the Local Elections System

According to data from the AEC Project, as of January 2010, the total number of countries that have had contact with e-voting 43 countries with details, countries that practice e-voting with voting machines (12 countries), countries that practice internet voting (7 countries), countries that have just arrived at the planning and trial stage of e-voting (24 countries), and countries that have stopped the implementation of e-voting (4 countries).<sup>40</sup> Here are the details of those countries:

**Table 2.** Details of Countries Using e-Voting<sup>41</sup>

No.	Types of e-Voting	Country
1.	e-voting with voting machine	Australia, Brasil, Kanada, Prancis, India, Jepang, Kazakhstan, Peru, Rusia, Amerika Serikat, Uni Emirat Arab, Venezuela
2.	e-voting with internet voting	Australia, Austria, Kanada, Estonia, Prancis, Jepang, Swiss
3.	e-voting planning and trial	Argentina, Azerbaijan, Belarus, Bulgaria, Chili, Republik Ceko, Finlandia, Yunani, Italia, Latvia, Lituania, Meksiko, Nepal, Nigeria, Norwegia, Polandia, Portugal, Rumania, Slovakia, Slovenia, Afrika Selatan, Spanyol, Korea Selatan, Swedia
4.	The implementation of e-voting is stopped	Germany, Irlandia, Belanda, Inggris

*Source: Muhammad Habibi and Achmad Nurmandi, 2018*

From this categorization, it can be grouped again into 2 (two) categories, namely countries that have successfully implemented e-voting and countries that have failed to implement e-voting. Countries that are successful in implementing e-voting continue to use e-voting. In contrast, countries that are not successful in implementing e-voting still have obstacles and even stop the implementation.

As for the things that made these countries continue to try and even finally stop the implementation of e-voting, namely due to security

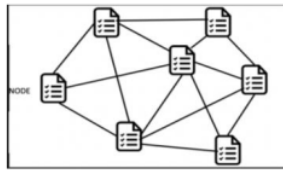
<sup>40</sup> Ace Project, *E-Voting*, 2010, [https://aceproject.org/ace-en/focus/e-voting/countries\\_aceproject.org](https://aceproject.org/ace-en/focus/e-voting/countries_aceproject.org),

<sup>41</sup> Muhammad Habibi dan Achmad Nurmandi, *Dinamika Implementasi E-Voting di Berbagai Negara*, 2018, <https://zenodo.org/record/1295466#.YmV1n9pBzIV>

problems, results in transparency problems, privacy issues, limited human resources, high costs, diverse infrastructure.

Based on the description related to these weaknesses, then in the application of e-voting, blockchain-based. Director of the Blockchain Innovation Hub at RMIT University in Melbourne, Professor Jason Potts, said using blockchain to collect votes in elections makes sense and makes sense.<sup>42</sup> Recording data using blockchain technology will provide confidence in the electoral process, as well as low-cost technology to prove that the voting process is running. Blockchain is an information storage system on a distributed network network, each of which is called a node and each node has the same data.<sup>43</sup> The blockchain system and storage system (nodes) are as follows:<sup>44</sup>

**Figure 1.** Blockchain System



Source : Ery Punta Hendraswara, *Blockchain From a society's perspective, Indonesia Blockchain Society, 2019*: p. 7.

From the schematic above, it can be seen that the blockchain system runs independently and does not have a centralized control center, so it will not provide a centralized system setting to be able to change data, and the data system on the blockchain is sealed with the Timestamp Cryptography function and locked, so that transaction data is immutable, not can be changed, deleted and restored. Blockchain technology would have several features that ensure security and consistency in transactions and data storage.<sup>45</sup> Blockchain as the technology used in bitcoin for its transaction database<sup>46</sup> can be used to reduce problems in local elections as described. It's easier, to understand blockchain is as in the picture below:<sup>47</sup>

42 Tempo.com, Teknologi Blockchain Bisa Digunakan Membantu, 2018, <https://www.tempo.co/abc/2090/teknologi-blockchain-bisa-digunakan-membantu-pemilu-di-indonesia>, accessed on 25 April 2022.

43 Ery Punta Hendraswara, *Blockchain From a society's perspective*, Indonesia Blockchain Society, 2019, page.7.

44 *Ibid.*

45 Nopendri, Rio Aurachman, Muhammad Rafid Amrullah, Rancangan Simulasi Penerapan Blockchain dalam Pemilihan Presiden Indonesia, *Jurnal Rekayasa Sistem dan Industri*, Vol. 7, No. 1, 2020, page.12.

46 Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System, <<https://bitcoin.org/bitcoin.pdf>>, accessed on 22 April 2022.

47 Nopendri, Rio Aurachman, dan Muhammad Rafid Amrullah, *Op.Cit.*, page. 12.

**Figure 2.** Illustration of data transaction process using blockchain.<sup>48</sup>



Each data that appears and will be recorded is referred to as a block. Each of these blocks forms a series so that it is called a blockchain or blockchain, and the block will prevent data misappropriation. Because every change of the data already stored in the blockchain will affect the blocks that follow and, of course, will be immediately realized by the system so that it will not be easily changed. The advantages of blockchain are:<sup>49</sup>

- a. Process flow can be simpler because there is no need for a third party/middleman/intermediary;
- b. Transparency or openness. Blockchain applies a transparent system so that the processes in it can be seen and shared with everyone.<sup>50</sup>
- c. The processing time will be shorter.
- d. Distributed network makes the system more secure and cannot be hacked;
- e. Data is safer because it is stored in hash form so it cannot be changed, deleted or returned as before.
- f. Privacy is more guaranteed because of the concept of cryptography.
- g. Data is easy to trace (auditable).

From this description, it can be seen that with this blockchain system, the main problems related to e-voting, namely data security and privacy, can be resolved. Learning from the e-voting failures mentioned above, what can be done so that the implementation of the electronic local election, which incidentally uses the blockchain system in Indonesia, is successful:

- a. A review is carried out on the readiness of the Regency/City regarding the readiness of infrastructure, human resources, funds, and so on before implementing the post-conflict local election with a blockchain system that is completely ready
- b. Make studies and rules by inviting stakeholders
- c. Human Resources Training
- d. There needs to be training on Human Resources before implementing blockchain in this post-conflict local election, both to the authority of the Regional General Elections Commission (KPUD), the District Election Committee (PPK), the Voting Committee (PPS), and the Voting Organizer Group (KPPS), The General Election Provincial

<sup>48</sup> *Ibid.*

<sup>49</sup> Ery Punta Hendraswara, *Op.Cit.*, page. 9.

<sup>50</sup> Fakultas Keguruan dan Ilmu Pendidikan, Kelebihan dan Kekurangan Pemakaian Blockchain, 2021, <https://fkip.umsu.ac.id/2021/12/02/kelebihan-dan-kekurangan-pemakaian-blockchain/>, accessed on 25 April 2022.

- Supervisory Agency (BAWASLU), Regency/City Election Supervisory Committee, and so on
- e. Socialization to the Community at least 1 (one) year before the post-conflict local election with the blockchain system, in order to understand the mechanism.
  - f. Applications are carried out in stages
  - g. In the use of blockchain in local elections, it can be done in stages which incidentally does not need to be done simultaneously. This is parallel to the Constitutional Court Decision No.147/PUU-VII/2009.
  - h. Implementing a Trial (Pilot Project).

If local elections are implemented using this blockchain system, then based on the period of application, it is classified into 2 (two), namely short-term and long-term. In the short term, the Authority of the Regional General Election Commission can cooperate with third parties that have blockchain technology until the Authority of the Regional General Election Commission is ready, especially until it has its system. In the long term, the authority of the Regional General Election Commission will be able to have its system related to the post-conflict local election through blockchain.

#### D. CONCLUSION

The urgency of using e-voting in the post-conflict local election system is because there are still various problems in the post-conflict local election, namely: 1) Multiple Voter Data, which results in voters being able to vote more than 1 (one) time, 2) There are still ballots that have been cast, due to the role of irresponsible individuals, 3) The distribution of ballot boxes and ballots that often experience problems both before and after voting, and 4) Many post-conflict local election officers die and become sick during the simultaneous post-conflict local election, due to fatigue while on duty. In the formulation of the application of blockchain-based e-voting in the local elections system, the following things must be considered: 1) Review of Regency/City Readiness, 2) Making Rules By Inviting Stakeholders, 3) Human Resource Training, 4) Socialization To the Community, 5) Implementation is carried out in stages, and 6) Implementing a pilot project before it is implemented.

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