# Tarumanagara International Conference on the Applications of Technology and Engineering

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# 1st Tarumanagara International Conference on the Applications of Technology and Engineering 2018

## Preface

On behalf of the organising committee of 1st Tarumanagara International Conference on the Applications of Technology and Engineering (TICATE) 2018, I would like to welcome all delegates to the Campus of Universitas Tarumanagara (UNTAR) in Jakarta, Indonesia with great pleasure. Being held from November 22 to 23, 2018 the international conference is organized by UNTAR and technically sponsored by IOP Conference Series: Materials Science and Engineering (MSE).

Universities play an important role in facing the rapid development of technology and engineering in recent digital era. The rapid developments of technology and engineering impact various aspects of people's life in welcoming the era of Industry 4.0. The biggest challenge faced by universities due to these rapid developments is how the results of research and technological innovation can contribute to the people's prosperity. As a form of contribution from universities in responding this challenge, Universitas Tarumanagara hold the 1st TICATE 2018 with the theme of: "The Implementation of Research Results and Innovation for People's Prosperity".

This international conference activity is expected to be a forum of discussion, networking and exchanging ideas among researchers, academicians, and practitioners to work together to pursue research and technological innovation that can be used to contribute to people's prosperity.

Over 160 papers have been submitted to 1st TICATE 2018 from 6 different countries, those are Germany, France, Australia, Taiwan, Malaysia, and Indonesia. We categorized the papers under seven groups, namely Mechanical Engineering and Technology; Electrical Engineering; Industrial Engineering; Civil and Environmental Engineering; Food and Agriculture Technology; Informatic Engineering & Technologies; and Medical & Health Technology. All papers, regardless of their standing or initial classification, were available for general discussion at the committee's meeting.

Our special thank goes to our Rector, Prof. Dr. Agustinus Purna Irawan, who has initiated this conference, Dr. Svann Langguth as Head of Science and Technology Division from the Embassy of the Federal Republic of Germany in Jakarta, Prof. Dr. Mohd. Zulkifly bin Abdullah as Professor from Universiti Sains Malaysia, and Dr. Ir. Yono Reksoprodjo, DIC as Vice President Corporate Affairs of Sintesa Group, as our pleanary speakers and Bank DKI, Bank Mandiri, Tarzan Photo, Hyperzone Computer, as our patrons. I would like to give special thanks to all of you for the interesting keynote speech at this international conference.

We also thank all individuals and organisations such as the members of international editorial board, the conference organisers, the reviewers, and the authors, for their contribution in making TICATE 2018 as a successful international conference and a memorable gathering event. I am also grateful for the support of publication service of IOP Conference Series: Materials Science and Engineering (MSE).

We hope that the conference could present you wonderful memories to bring home in addition to new insights and friendship congregated during the event. We truly value your participation and support for the conference. We hope that you will enjoy TICATE 2018 and Betawi culture and tradition in Jakarta.

Dr. Hugeng, S.T., M.T. (SMIEEE)

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# Participatory GIS for collaborative decision making development of village resource potential

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# Participatory GIS for collaborative decision making development of village resource potential

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**Abstract.** This study aims to develop participatory GIS applications for village resource mapping decisions. This study consists of two stages, the first stage is mapping village resources using Quantum GIS and Tableu server software, and the second stage is collaborative decision making modeling using the borda voting method. The results showed that there were 67 potential resource points that could be mapped in the Sumbersari village area. Decision making to determine the priority ranking of the village resource potential that will be developed, can involve community representatives and collaborate with the village government.

## 1. Introduction

When facing local goverment issues, maps are a very effective tool. They can help in collecting facts about an area, bring issues to the table, allow for comparison between areas, act as a tool of communication with local decision makers, and identify key issues for action [1]. While the maps on their own do not alter the power relationships within which communities live their lives, many studies and examples have shown the purposeful role of mapping as part of community mobilisation and action [2], [3]. The use of maps and geographical information to address community concerns is integrating different areas, including participatory mapping [2], participatory geographic information systems (PGIS) or Public Participation GIS (PPGIS) [3] and the emerging area of citizen science [4].

Public Participatory Geographical Information Systems (PP GIS) is a field of research that focuses on the use of GIS by the general public and aims at involving the citizen in a decision-making processes. PP GIS is an abbreviation which indicates that public needs to be supported when addressing community based problems, since a variety of perspectives are common in different planning processes. Such recognition does not necessarily enhance the capabilities of a conventional GIS. PP GIS seeks to expand the use of GIS to the general public and non-governmental organizations that are not usually represented in traditional topdown GIS projects [5], [6].

Traditional planning methods only single to make various planning map, to manually create and modify tables, for planning map update is even more difficult to achieve. GIS can not only low cost but high to quickly generate a variety of programming with graph and table data, but also can realize the dynamic data updating [7]. Thus, G1S reduces the consumption of time, manpower and material resources planning, greatly improves the accuracy of planning operation efficiency and information, and the

implementation of the planning of science, rationality and operability. Therefore, GIS is the foundation of an indispensable tool in new rural planning [8]

The problem of developing village resource potential is a major problem in rural development. The village development program will succeed if the development problem is a proposal that involves community participation, and is supported in accordance with the available resource potential. A tool is needed that can map the potential and problems of village development, as a storage tool and collaboration for decision making. The information technology-based tool is a combination of GIS capabilities and group decision support system (GDSS) capabilities. This study aims to develop GIS applications that have the ability to facilitate community participation and collaboration in village development program decision making.

## 2.   Methodology

This research consists of two stages, namely: the GIS mapping stage and the collaborative decision making modeling stage of the user (Figure 1).

2.1. The GIS mapping phase, the steps taken are as follows:
- Collecting data by conducting interviews and location surveys to obtain data on village resource potential.
- Perform GeoTagging to determine the coordinates of the location of village resources
- Digitize maps using QGis software with predetermined location coordinates for village resource potential
- Upload the digitized map results to the server table

2.2. The colaborative decision making modeling phase, the steps taken are as follows:
- Identification of problems
- Identification of the decision maker
- Determine the model
- modeling
- Model validation
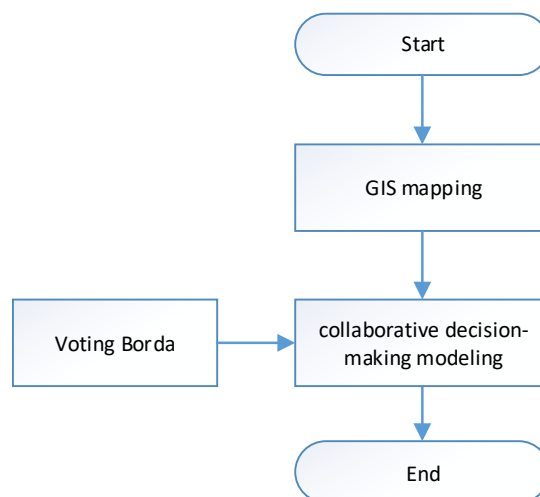


Figure 1. Stages of Research

## 3.   Results and discussion

The system developed involves two types of users, namely the community and the decision maker. Communities are villagers who have potential resources that can be developed. The community participates in terms of proposing and managing resource data. Decision maker (DM) is a user who has the authority to decide on the priority of potential resources to be developed. DM is a community group

consisting of community leaders and representatives from the village government. Each DM prioritizes the proposed resource potential, then priority proposals are decided based on voting. The description of the user's relationship with the system can be seen through the usecase diagram as shown in figure 2.
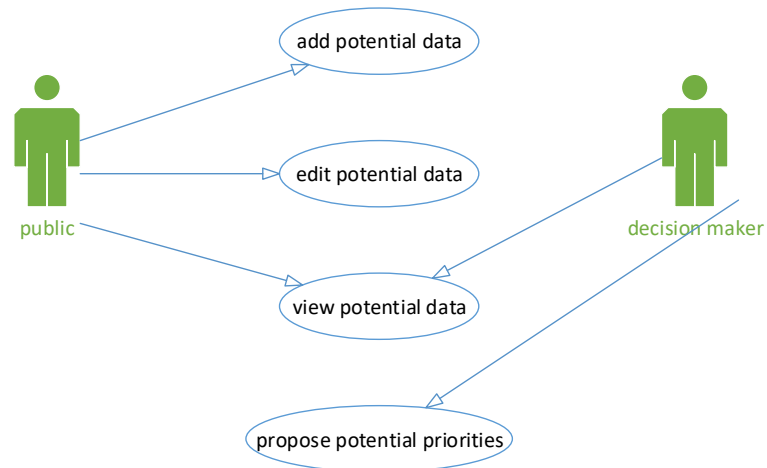


Figure 2. Usecase of Participatory GIS

### 3.1. Result of Participatory GIS

The first stage of the research is the development of GIS applications. There are 67 locations of potential village resources (PSD) that have been successfully mapped. Furthermore, the location of the PSD is depicted on the map of Sumbersari village based on the coordinates of its location (Figure 3).



**Figure 3.** GIS Potency Map

Examples of summary data on village resource potential, with latitude x, longitude y, village name, hamlet name, sub-district name, potential name, and type of allocation can be seen in Table 1.

**Table 1.** Resource potential GIS data

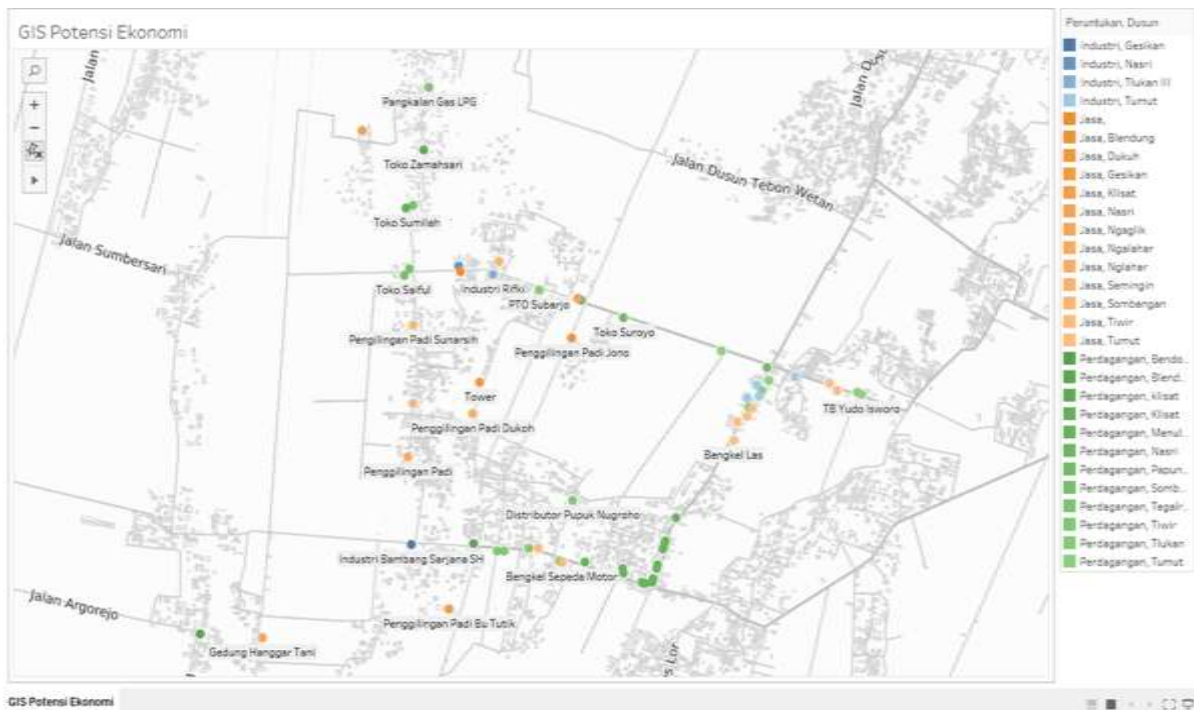| ID. Potency | Latitude X | LongitudeY | Village | Hamlet | sub-district | Name | type of allocation |
|---|---|---|---|---|---|---|---|
| PSD1 | 419360.55 | 9140144.1 | Sumbersari | Nasri | Moyudan | Industri H Zuhair | Industry |
| PSD2 | 419513.36 | 9140108.9 | Sumbersari | Tlukan III | Moyudan | Industri Rifki | Industry |
| PSD3 | 419716.27 | 9140046.4 | Sumbersari | Tlukan | Moyudan | PTO Subarjo | Trading |
| PSD4 | 419886.88 | 9140010.3 | Sumbersari | Nasri | Moyudan | Bengkel Sugiyanto | Service |
| PSD5 | 419901.44 | 9140003.4 | Sumbersari | Nasri | Moyudan | PTO Krempyeng | Trading |
| PSD6 | 420089.79 | 9139930.3 | Sumbersari | Papungan | Moyudan | Toko Suroyo | Trading |
| PSD7 | 419123.3 | 9140105.1 | Sumbersari | Sombangan | Moyudan | Toko Saiful | Trading |
| PSD8 | 419163.5 | 9139573.7 | Sumbersari | Sombangan | Moyudan | Bengkel Asfandi | Service |
| PSD9 | 419160.13 | 9138980.9 | Sumbersari | Gesikan | Moyudan | Industri Bambang | Industry |
| PSD10 | 419147.3 | 9140131.6 | Sumbersari | Sombangan | Moyudan | Toko Mujiono | Trading |
| PSD11 | 419429.51 | 9138993.9 | Sumbersari | Blendung | Moyudan | Toko Besi | Trading |
| PSD12 | 419672.45 | 9138974 | Sumbersari | Tiwir | Moyudan | Toko Driyo Pawiro | Trading |
| PSD13 | 419536.88 | 9138962.5 | Sumbersari | Tiwir | Moyudan | Toko Sunaryo | Trading |
| PSD14 | 419567.12 | 9138960.2 | Sumbersari | Tiwir | Moyudan | Toko Sajiyo | Trading |
| PSD15 | 419717.14 | 9138973.6 | Sumbersari | Tiwir | Moyudan | Bengkel Tiga Karya | Service |
| PSD16 | 419921.98 | 9138917.5 | Sumbersari | Menulis | Moyudan | Toko Riyanto | Trading |
| PSD17 | 419938.95 | 9138900.4 | Sumbersari | Menulis | Moyudan | Toko Erna | Trading |
| PSD18 | 420090.38 | 9138872.8 | Sumbersari | Menulis | Moyudan | Toko Toko Sriyatun | Trading |
| PSD19 | 420185.54 | 9138829.4 | Sumbersari | Menulis | Moyudan | Toko Ririn | Trading |
| PSD20 | 420630.55 | 9139524 | Sumbersari | Tumut | Moyudan | Salon Walristo | Service |
| PSD21 | 420656.31 | 9139558.4 | Sumbersari | Tumut | Moyudan | Modiste Windi | Service |
| PSD22 | 420685.86 | 9139607.7 | Sumbersari | Tumut | Moyudan | Genteng H Sigit | Industry |
| PSD23 | 420697.33 | 9139630.1 | Sumbersari | Tumut | Moyudan | Toko Juwandono | Trading |
| PSD24 | 420725.33 | 9139671.2 | Sumbersari | Tumut | Moyudan | Toko Tejo Suparjo | Trading |
| PSD25 | 420717.8 | 9139724.7 | Sumbersari | Papungan | Moyudan | Toko H Suharto | Trading |
| PSD26 | 420673.49 | 9139654.1 | Sumbersari | Tumut | Moyudan | Industri Saiful | Industry |
| PSD27 | 420632.28 | 9139598.3 | Sumbersari | Tumut | Moyudan | Genteng H Kafni | Industry |
| PSD28 | 420842.9 | 9139688.7 | Sumbersari | Tumut | Moyudan | Industri Kuntari | Industry |
| PSD29 | 420991.72 | 9139661.1 | Sumbersari | Tumut | Moyudan | Bengkel Widodo | Service |
| PSD30 | 421117.64 | 9139621.4 | Sumbersari | Tumut | Moyudan | TB Suwarno | Trading |
| PSD31 | 421135.65 | 9139613.7 | Sumbersari | Tumut | Moyudan | TB Yudo Isworo | Trading |
| PSD32 | 421028.25 | 9139628.9 | Sumbersari | Tumut | Moyudan | Bengkel Bambang | Service |
| PSD33 | 419809.64 | 9138918.8 | Sumbersari | Tiwir | Moyudan | Toko Kelontong & Laundry | Trading |
| PSD34 | 419819.24 | 9138916.6 | Sumbersari | Tiwir | Moyudan | Bengkel Sepeda Motor | Service |
| PSD35 | 420218.72 | 9138847.6 | Sumbersari | Menulis | Moyudan | Toko Purwojo, Salon & Pakan Ternak | Trading |
| PSD36 | 420230.56 | 9138880.6 | Sumbersari | Menulis | Moyudan | Toko Erna | Trading |
| PSD37 | 420234.96 | 9138891 | Sumbersari | Menulis | Moyudan | Toko Sapari | Trading |
| PSD38 | 420238.8 | 9138906.4 | Sumbersari | Menulis | Moyudan | Toko Mujiyo, Bakso, & Pakan Burung | Trading |

| ID. Potency | Latitude X | LongitudeY | Village | Hamlet | sub-district | Name | type of allocation |
|---|---|---|---|---|---|---|---|
| PSD39 | 420262.94 | 9138969.7 | Sumbersari | Menulis | Moyudan | Toko Roti Aneka & Counter Hp | Trading |
| PSD40 | 420266.24 | 9138977.9 | Sumbersari | Menulis | Moyudan | Toko Kelontong Harsilah | Trading |
| PSD41 | 420272.27 | 9138992.1 | Sumbersari | Menulis | Moyudan | Warung Belut Aurel | Trading |
| PSD42 | 420275.29 | 9139005.8 | Sumbersari | Menulis | Moyudan | Toko Bangunan H. Harno | Trading |
| PSD43 | 420318.75 | 9139101.9 | Sumbersari | Menulis | Moyudan | Toko Roti Aneka 2 | Trading |
| PSD44 | 420170.06 | 9138832.7 | Sumbersari | Menulis | Moyudan | Toko Darsono | Trading |
| PSD45 | 420177.77 | 9138830.1 | Sumbersari | Menulis | Moyudan | Toko Sarjiyo | Trading |
| PSD46 | 420614.1 | 9139541.6 | Sumbersari | Tumut | Moyudan | Toko Kayu | Trading |
| PSD47 | 420666.02 | 9139579 | Sumbersari | Tumut | Moyudan | Toko Kayu | Trading |
| PSD48 | 419233.51 | 9140887.2 | Sumbersari | Tegalrejo | Moyudan | Pangkalan Gas LPG | Trading |
| PSD49 | 419370.36 | 9140122.3 | Sumbersari |  | Moyudan | P. Padi Arjuno | Service |
| PSD50 | 419538.62 | 9140163 | Sumbersari | Semingin | Moyudan | P. Padi Jono | Service |
| PSD51 | 418939.13 | 9140707 | Sumbersari | Klisat | Moyudan | Penggilingan Padi Nanang | Service |
| PSD52 | 420590.69 | 9139498 | Sumbersari | Tumut | Moyudan | Bengkel Motor Widayat | Service |
| PSD53 | 419865.79 | 9139171.4 | Sumbersari | Tiwir | Moyudan | Distributor Pupuk Nugroho | Trading |
| PSD54 | 419862.8 | 9139846.7 | Sumbersari | Blendung | Moyudan | Penggilingan Padi Jono | Service |
| PSD55 | 418230.83 | 9138613.7 | Sumbersari | Bendosari | Moyudan | Distributor Pupuk Pak Impun | Trading |
| PSD56 | 419324.45 | 9138719 | Sumbersari | Gesikan | Moyudan | P. Padi Bu Tutik | Service |
| PSD57 | 420519.42 | 9139793.4 | Sumbersari | Tumut | Moyudan | Pengepul Rosok Pak Kasman | Trading |
| PSD58 | 419153.17 | 9139903.9 | Sumbersari | Sombangan | Moyudan | P. Padi Sunarsih | Service |
| PSD59 | 419143.47 | 9139350.9 | Sumbersari | Ngalahar | Moyudan | P.Padi | Service |
| PSD60 | 419427.42 | 9139532.2 | Sumbersari | Nglahar | Moyudan | P. Padi Dukoh | Service |
| PSD61 | 419134.22 | 9140384.7 | Sumbersari | Klisat | Moyudan | Toko Sumilah | Trading |
| PSD62 | 419163.15 | 9140394.6 | Sumbersari | Tegalrejo | Moyudan | Toko Ana | Trading |
| PSD63 | 419208.71 | 9140626.7 | Sumbersari | klisat | Moyudan | Toko Zamahsari | Trading |
| PSD64 | 420501.08 | 9138832.8 | Sumbersari | Menulis | Moyudan | Indomart | Trading |
| PSD65 | 418504.48 | 9138599.5 | Sumbersari | Ngaglik | Moyudan | G. Hanggar Tani | Service |
| PSD66 | 420571.98 | 9139423.8 | Sumbersari | Tumut | Moyudan | Bengkel Las | Service |
| PSD67 | 419458.84 | 9139663.3 | Sumbersari | Dukuh | Moyudan | Tower | Service |

### 3.2. DSS collaborative

The collaborative DSS referred to in this research is decision making involving groups, namely farmer groups, cooperatives, or cadets. While the other groups are groups that represent the government, namely the village government. Each group member votes (voting) for determining the priority of potential to be developed. The voting method used in this study is the Borda method.

Unlike other popular voting systems, in the Borda count it is possible for a candidate who is the first preference of an absolute majority of voters to not be elected; this is because the Borda count affords greater importance to a voter's lower preferences than most other systems, including other preferential methods such as instant-runoff voting and Condorcet methods.

The Borda count tends to favor candidates supported by a broad consensus among voters, rather than the candidate who is necessarily the favorite of a majority [9] for this reason, its supporters see the Borda count as a method that promotes unity and avoids the 'tyranny of the majority', and the resulting divisiveness and even violence that it can lead to.

Simulation of calculations in this study, using 5 proposals for village resource potential (PSD) chosen by the government to be developed, as illustrated in Table 2.

| No. Rank | ID. Potency | Latitude X | LongitudeY | Village | Hamlet | sub-district | Name | type of allocation |
|---|---|---|---|---|---|---|---|---|
| 1 | PSD1 | 419360.5495 | 9140144.053 | Sumbersari | Nasri | Moyudan | Industri H Zuhair | Industry |
| 2 | PSD2 | 419513.3619 | 9140108.944 | Sumbersari | Tlukan III | Moyudan | Industri Rifki | Industry |
| 3 | PSD3 | 419716.2705 | 9140046.401 | Sumbersari | Tlukan | Moyudan | PTO Subarjo | Trading |
| 4 | PSD4 | 419886.8759 | 9140010.273 | Sumbersari | Nasri | Moyudan | Bengkel Sugiyanto | Service |
| 5 | PSD5 | 419901.4431 | 9140003.357 | Sumbersari | Nasri | Moyudan | PTO Krempyeng | Trading |

Table 2. Proposed development of PSD from the government

Furthermore, the DM consisting of community representatives and village government representatives, totaling 12 people ($DM_1$, ... $DM_{12}$) voted on the five candidates for the PSD proposal, as illustrated in Table 3. Recapitulation of the number of votes can be seen in Table 4.

| No. Rank | $DM_1$ | $DM_2$ | $DM_3$ | $DM_4$ | $DM_5$ | $DM_6$ | $DM_7$ | $DM_8$ | $DM_9$ | $DM_{10}$ | $DM_{11}$ | $DM_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | PSD1 | PSD1 | PSD2 | PSD3 | PSD1 | PSD1 | PSD1 | PSD1 | PSD2 | PSD2 | PSD1 | PSD1 |
| 2 | PSD2 | PSD2 | PSD1 | PSD2 | PSD2 | PSD4 | PSD4 | PSD2 | PSD1 | PSD1 | PSD2 | PSD2 |
| 3 | PSD3 | PSD4 | PSD3 | PSD1 | PSD4 | PSD3 | PSD3 | PSD3 | PSD3 | PSD3 | PSD3 | PSD3 |
| 4 | PSD4 | PSD3 | PSD4 | PSD4 | PSD3 | PSD2 | PSD2 | PSD4 | PSD4 | PSD4 | PSD4 | PSD4 |
| 5 | PSD5 | PSD5 | PSD5 | PSD5 | PSD5 | PSD5 | PSD5 | PSD5 | PSD5 | PSD5 | PSD5 | PSD5 |

Table 3. Voting Proposed PSD development

| No. Rank | 4 | 2 | 3 | 1 | 2 |
|---|---|---|---|---|---|
| 1 | PSD1 | PSD1 | PSD2 | PSD3 | PSD1 |
| 2 | PSD2 | PSD2 | PSD1 | PSD2 | PSD4 |
| 3 | PSD3 | PSD4 | PSD3 | PSD1 | PSD3 |
| 4 | PSD4 | PSD3 | PSD4 | PSD4 | PSD2 |
| 5 | PSD5 | PSD5 | PSD5 | PSD5 | PSD5 |

Table 4. The summary of the number of votes cast

Calculation of the total number of votes collected from the voting process can be seen in Table 5.

| No. Rank | PSD1 | PSD2 | PSD3 | PSD4 | PSD5 |
|---|---|---|---|---|---|
| 1 | (4+2+2)x5=40 | 3 x 5 = 15 | 1 x 5 = 5 | 0 | 0 |
| 2 | 3 x 4 = 12 | (4+2+1)x4=28 | 0 | 2 x 4 = 8 | 0 |
| 3 | 1 x 3 = 3 | 0 | (4+3+2)x3=27 | 2 x 3 = 6 | 0 |
| 4 | 0 | 2 x 2 = 4 | 2 x 2 = 4 | (4+3+1)x1=8 | 0 |
| 5 | 0 | 0 | 0 | 0 | (4+2+3+1+2)x1=6 |
| Total | 55 | 47 | 36 | 22 | 6 |

Table 5. Illustration of Borda's Count

Based on the results of the final calculation, the ranking sequence is as follows:
- Rank 1: PSD1 with 55 votes
- Rank 2: PSD2 with 47 votes
- Rank 3: PSD3 with 36 votes
- Rank 4: PSD4 with 22 votes
- Rank 5: PSD5 with 6 votes

## 4. Conclusion

The conclusions of this study are as follows:
- The application developed can facilitate the community to participate in proposing and managing data on village resource potential
- This study succeeded in mapping 67 PSD points, with the attribute coordinates of location, potential name, hamlet, village, sub-district and type of allocation.
- The community and village government can collaborate in making decisions on the priority ranking of the PSD to be developed.

## 5. References

[1] Haklay, M.E. and Francis, L., 2017. Participatory GIS and community-based citizen science for environmental justice action. Routledge.

[2] Chambers, R., 2006. Participatory mapping and geographic information systems: whose map? Who is empowered and who disempowered? Who gains and who loses?. *The Electronic Journal of Information Systems in Developing Countries*, *25*(1), pp.1-11.

[3] Sieber, R., 2006. Public participation geographic information systems: A literature review and framework. *Annals of the association of American Geographers*, *96*(3), pp.491-507.

[4] Haklay, M., 2013. Citizen science and volunteered geographic information: Overview and typology of participation. In *Crowdsourcing geographic knowledge* (pp. 105-122). Springer, Dordrecht.

[5] Talen, E., 2000. Bottom-up GIS: A new tool for individual and group expression in participatory planning. *Journal of the American Planning Association*, *66*(3), pp.279-294.

[6] Ghose, R. and Elwood, S., 2003. Public participation GIS and local political context: propositions and research directions. *URISA journal*, *15*(2), pp.17-22.

[7] J. Li, "DIS in the reconstruction planning of city village in the application research of city planning," vol. 33, pp. 89-92, 2009.

[8] Ran, L.H. and Bo, Z., 2013. Application of GIS in Rural Planning. *International Journal of Modeling and Optimization*, *3*(2), p.202.

[9] Lippman, D., 2013. *Math in society*. David Lippman.