ANALYTIC NETWORK PROCESS IN DETERMINING RECIPIENTS OF EDUCATION GRANTS NORTH SUMATRA PROVINCE

Adelia Fariza Putri[1*], M. Fakhriza[1]
[1]Computer Science, Universitas Islam Negeri Sumatera Utara
email: *adeliafairizaptr@gmail.com

Abstract: This research is motivated by the high volume of education grant applicants in North Sumatra Province which reached 3,041 proposals in 2024, while the budget allocation is only available for 1,585 recipients. The limitations of objective evaluation standards and the potential for subjectivity in decision-making are major challenges that can result in unfair distribution of funds. The method used is the Analytic Network Process (ANP), a decision support system approach that is able to accommodate the linkages between assessment criteria. Data was collected through interviews, documentation, and observation at the North Sumatra Provincial Education Office. The four main criteria tested included institutional feasibility, performance, social impact, and accountability and transparency. The results showed that the accountability and transparency criteria had the highest priority weight of 0.44. Of the three alternatives analyzed, community-based education foundations (A2) obtained the highest score of 0.30, making them the top priority for grant recipients. The implementation of this system resulted in a consistency ratio (CR) value of < 0.1, which means that the ranking results are valid and reliable. It can be concluded that the use of the ANP method is effective in increasing objectivity and governance in the distribution of grant funds. The web-based system built makes it easier for the government to select recipients faster, fairer, and more transparently, while minimizing bias in the public policy process.

Keywords: analytic network process (anp); decision support system; grants.

Abstract: Penelitian ini dimotivasi oleh tingginya volume pemohon hibah pendidikan di Provinsi Sumatera Utara yang mencapai 3.041 proposal pada tahun 2024, sementara alokasi anggaran hanya tersedia untuk 1.585 penerima. Keterbatasan standar evaluasi objektif dan potensi subjektivitas dalam pengambilan keputusan merupakan tantangan utama yang dapat mengakibatkan distribusi dana yang tidak adil. Metode yang digunakan adalah Analytic Network Process (ANP), sebuah pendekatan sistem pendukung keputusan yang mampu mengakomodasi keterkaitan antar kriteria penilaian. Data dikumpulkan melalui wawancara, dokumentasi, dan observasi di Dinas Pendidikan Provinsi Sumatera Utara. Empat kriteria utama yang diuji meliputi kelayakan institusional, kinerja, dampak sosial, serta akuntabilitas dan transparansi. Hasil penelitian menunjukkan bahwa kriteria akuntabilitas dan transparansi memiliki bobot prioritas tertinggi sebesar 0,44. Dari tiga alternatif yang dianalisis, yayasan pendidikan berbasis masyarakat (A2) memperoleh skor tertinggi sebesar 0,30, menjadikannya prioritas utama bagi penerima hibah. Implementasi sistem ini menghasilkan nilai rasio konsistensi (CR) < 0,1, yang berarti hasil pemeringkatan valid dan dapat diandalkan. Dapat disimpulkan bahwa penggunaan metode ANP efektif dalam meningkatkan objektivitas dan tata kelola dalam distribusi dana hibah. Sistem berbasis web yang dibangun memudahkan pemerintah untuk memilih penerima hibah dengan lebih cepat, adil, dan transparan, sekaligus meminimalkan bias dalam proses kebijakan publik.

Keywords: proses jaringan analitik (ANP); sistem pendukung keputusan; hibah.

INTRODUCTION

Budgeting is an important resource allocation process, given the nature of governments that seek to allocate limited resources to meet unlimited demands. The budget is also a detailed list or statement of state expenditure and revenue expected within a certain period of time. The expenditure receipt and expenditure plan is designed by the government and then submitted to the legislative institution which then considers it and then decides and stipulates it in the Law. Every year local governments, both provincial and regency/city governments throughout Indonesia, allocate budgets for grants and social assistance [1] [2] [3].

Based on the Governor of North Sumatra Regulation No. 19 of 2022 concerning procedures for managing grant and social assistance expenditures sourced from the regional revenue and expenditure budget, namely: Article 6 point 1 the central government, other local governments, regional-owned business entities, agencies, institutions, community organizations and political parties may submit grant proposals/proposals in writing to the governor through the regional apparatus or related work units. The People's Welfare Bureau is one of the grant implementation work units that has responsibility for managing grant funds. For agencies, institutions/foundations, education, and community organizations, they can submit grant proposals to the people's welfare bureau of the provincial secretariat. In 2024, the number of applicants who apply for education grants at the people's welfare bureau of the provincial secretariat will reach 3,041 applicants, while the number of

recipients of education grants is only 1,585 recipients [7].

The *Analytic Network Process* (ANP) method is present as one of the approaches that can be used in helping complex decision-making. ANP is a development of the *Analytic Hierarchy Process* (ANP) method, with the advantage of being able to take into account the relationships and dependencies between criteria. This is important because in determining the recipients of education grants, the criteria used such as economic conditions, academic achievement, institutional feasibility, accountability, and equitable distribution of territory, are interconnected and cannot stand alone. Thus, ANP allows the assessment process to be more comprehensive and realistic [10] [11].

Previous research was carried out by testing grant application proposal data using the ANP method by comparing the results of calculations manually and systemically. The data on grant application proposals uses data owned by the Social Empowerment and Poor Affairs. In this study, the test was carried out using 30 grant application proposal data, the system will provide recommendation results in the form of a ranking of 30 grant proposals. From the results of the test, between the calculation of the results of the system and the calculation manually, the results of the same ranking recommendation from 30 grant application proposals and only differ in terms of decimal rounding, out of 30 grant application proposals, there are 4 grant proposals that have a difference in the value after the comma. The results of the recommendation for determining grant application proposals using the ANP method based on 30 proposal data used for testing were obtained ranking results with the highest score of 0.094, namely the Surau Al

Mundzir proposal and the lowest value of 0.010, namely the Musolla Silaturahim proposal [12].

Previous research has not explained in detail the evaluation criteria for grant proposals used in the ANP process. Without an explanation of the weight or structure of the criteria, it is difficult for the reader to evaluate the validity and objectivity of the decision-making process. This study explicitly focuses on North Sumatra Province, so as to provide more contextual and appropriate solutions to local problems in the distribution of education grants. This is different from previous research which was more general and did not focus on a specific region or sector.

METHODS

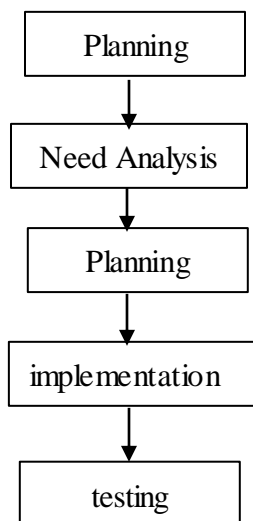Here's the plan *Flowchart* Method *Analytic Network Process (ANP):*

```
        ┌──────────────┐
        │   Planning   │
        └──────┬───────┘
               │
        ┌──────▼───────┐
        │ Need Analysis│
        └──────┬───────┘
               │
        ┌──────▼───────┐
        │   Planning   │
        └──────┬───────┘
               │
        ┌──────▼───────┐
        │implementation│
        └──────┬───────┘
               │
        ┌──────▼───────┐
        │   testing    │
        └──────────────┘
```

Figure 1. *Research Framework*

RESULTS AND DISCUSSION

Application of the Analytic Network Process (ANP) Method

Based on the results of interviews and literature studies, it was obtained that the assessment of education grant recipients considered four main criteria, namely:

Figure 2. Criteria Data

Meanwhile, there are three alternative recipients analyzed:

1. A1 = Secondary Level Private Education Institution (SMA/SMK).
2. A2 = Community-based education foundation (Nonformal).
3. A3 = Outstanding individual scholarship recipient (Student/student).

Figure 3. Alternative Data

1. Network Model

The ANP network model is formed by paying attention to the relationships between elements. In this study, each criterion is not independent, but affects each other. For example, [14] the performance of an institution can increase accountability, while high accountability also increases public trust which has an impact on the social impact of education.

163

2. Paired Comparison Assessment

Paired comparison assessment was carried out using *the Saaty* scale (1–9) to assess the level of relative importance between elements. Assessments were obtained from 5 expert respondents consisting of: [15] Head of planning Division of the Education Office, Two technical staff of educational grants, One academic in the field of public policy and One education management expert.

Table 1. Comparison of Pairs of Criteria

Criteria	K1	K2	K3	K4	Initial Weight
K1	1	1/2	1/3	1/4	0.08
K2	2	1	1/2	1/3	0.17
K3	3	2	1	1/2	0.31
K4	4	3	2	1	0.44
Quantity					1.00

From the results above, K4 (Accountability and Transparency) received the highest weight (0.44), followed by Social Impact and Education (0.31). This means that in the context of education grants, transparency in the use of funds is a top priority.

3. Supermatrix and Limit Supermatrix

The next stage is to compile *an unweighted supermatrix* based on the relationship between criteria and subcriteria. After normalization a *weighted supermatrix* is obtained which is then raised until it converges into *a supermatrix limit*.

Table 2. Alternative End Weights

Alternatives	Qualifications (K1)	Performance (K2)	Impact (K3)	Accountability (K4)	Total Weight
A1	0.22	0.18	0.20	0.16	0.19
A2	0.31	0.25	0.34	0.28	**0.30**
A3	0.17	0.22	0.18	0.20	0.19

The results of the calculation show that A2 (Community-based Educa-

tion Foundation) has the highest total score of **0.30**, which means that it is the most worthy of being the recipient of education grants.
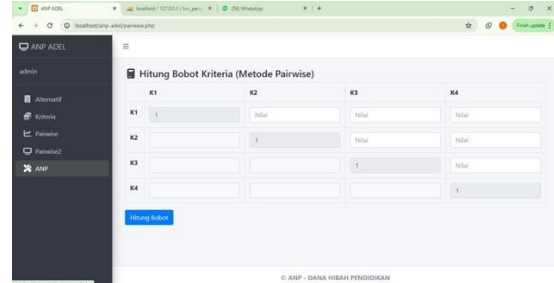

Figure 4. Calculate the Weight of the Criteria

Table 3. Criteria Paired Comparison Matrix

Criteria	K1	K2	K3	K4
K1	1	1/2	1/3	1/4
K2	2	1	1/2	1/3
K3	3	2	1	1/2
K4	4	3	2	1

Table 4. Weighting Criteria (GM Normalization)

Criteria	GM	Weight
K1	0.451754	0.0953
K2	0.759836	0.1602
K3	1.316074	0.2775
K4	2.213363	0.4669

Consistency Test (CI & CR)
The calculation of A·w yields $\lambda 1 = 4.035$ $\lambda 2 = 4.028$ $\lambda 3 = 4.025$ $\lambda 4 = 4.035$
$\lambda max = 4.031$ CI = (4.031 - 4)/3 = 0.0103 CR = 0.0103 / 0.90 = 0.0114 < 0.1 (Consistent)

Table 5. Alternative Weights Per Criteria

Alternatives	K1	K2	K3	K4
A1	0.22	0.18	0.20	0.16
A2	0.31	0.25	0.34	0.28
A3	0.17	0.22	0.18	0.20

Table 6. Alternative Final Ranking

Alternatives	Score	Ranking
A2	0.2947	1

A3	0.1948	2
A1	0.1800	3

4. Analysis and Discussion

From the results of the calculation using the ANP method, it can be seen that accountability and transparency are the most dominant factors in determining grant recipients.

The results of the study show that the application of *the Analytic Network Process* (ANP) method in determining the recipients of education grants in North Sumatra Province can produce a more systematic, objective, and transparent assessment process compared to the previous manual mechanism. This analysis was carried out by comparing the results of weighting between criteria, relationships between elements, and determining the final priority of each alternative education grant recipient based on the results of the supermatrix limit.

Analysis Based on Assessment Criteria

In the ANP model used, there are four main criteria, namely Institutional Feasibility (K1), Performance and Achievement (K2), Social and Educational Impact (K3), and Accountability and Transparency (K4). From the results of paired comparison and weighting using the Saaty scale, the Accountability and Transparency (K4) criteria obtained the highest weight, which was 0.44. This means that the aspect of openness and the ability of the institution or individual grantee to account for the use of grant funds is the dominant factor in decision-making.

This is in line with the mandate of the Governor of North Sumatra Regulation Number 19 of 2022, which emphasizes that grants must be given on the principle of selectivity, transparency, accountability, and fairness. Thus, insti-

tutions that have a clear financial reporting system, a good track record, and are able to demonstrate the responsible use of funds have a greater chance of being prioritized. The second criterion with the largest weight is Social and Educational Impact (K3) of 0.31. This shows that institutions or recipients that can provide broad benefits to the community, such as improving access to education, improving learning facilities, or empowering the poor through education are also the government's main concern. This means that the granting of grants is not only seen from the internal needs of the institution, but also from the extent to which the grant has a multiplier effect for the surrounding community.

Meanwhile, Performance and Achievement (K2) and Institutional Feasibility (K1) received smaller weights of 0.17 and 0.08, respectively, but still played an important role. The performance of the institution shows the reputation and professionalism of the grantee in carrying out educational activities, while the feasibility of the institution is related to administrative readiness such as operational permits, legality, and year of establishment. These findings show that in the context of public policy, governance factors take precedence over mere administrative feasibility.

Analysis Based on Recipient Alternatives

Table 7. Final Weight

Alternatives	Total Weight
A1 (Private)	0.19
A2 (Community Foundation)	**0.30**
A3 (Individual)	0.19

The highest score was obtained by A2 (Community-Based Education Foundation) with a weight of 0.30. This means that in the context of distributing educa-

tion grants, community-based foundations are considered the most feasible and strategic to receive provincial government grants.

On the other hand, private educational institutions (A1) occupy the second position because they already have internal sources of funds such as tuition fees or other operational assistance. Meanwhile, outstanding individuals (A3), although important as a form of appreciation for academic achievement, are considered to have a more limited social impact than the other two alternatives. Discussion of ANP Results in the Context of Public Policy

The application of the ANP method in this study has important implications for the governance of education grants in North Sumatra. The grant decision-making process, which is usually done manually and administratively, can now be converted into a data-driven model and rational weighting. This approach supports the implementation of transparent and efficient e-government according to the principles of Good Governance. Comparison with Previous Research

The results of this study are consistent with several previous studies. For example:

Sulvia et al. (2022) proved that the ANP method can produce recommendations for grantee ratings with system results that are identical to manual calculations, showing a high level of accuracy. Then Parhusip et al. (2022) used ANP in the selection of prospective recipients of non-cash food assistance (BPNT) in Palangka Raya, and found that this method increased the accuracy of social program targets, then Simanjorang et al. (2022) also showed the effectiveness of ANP in determining recipients of subsidized food with objective and effi-

cient results and this research strengthens these results with a new context, namely the distribution of education grant funds in North Sumatra, so as to make a real contribution to expanding the application of ANP in the realm of regional public policy. Benefits of ANP Implementation for Provincial Governments

Consistency Validation

To ensure the consistency of the results, the consistency ratio (CR) test was carried out from each paired comparison matrix. The results showed that CR < 0.1 across the matrix, so the assessment was considered consistent and valid.

Implications of Research Results
1. The results of this study show that the application of the ANP method can provide: A scientific and objective approach in the determination of grant recipients.
2. The basis for transparent decision-making is in accordance with the principle of public accountability.
3. Flexible decision model, as it is able to adapt to new policy changes and indicators in the future.

The North Sumatra Provincial Education Office can integrate this model in a digital-based grant information system, so that the recipient assessment process can be carried out more quickly, measurably, and *auditably*.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the *Analytic Network Process* (ANP) method has proven to be effective in facilitating complex decision-making to determine the eligibility of education grant recipients in North Sumatra Prov-

ince. This method is able to accommodate the linkages and dependencies between criteria which include the number of fund proposals, cost details, year of establishment, operational permits, as well as the condition and type of education unit so as to produce more objective, transparent, and accountable decisions, where the criteria for the number of proposed funds and operational permits are identified to have the most dominant influence.

The implementation of a web-based decision support system using PHP and MySQL showed good model validity with a consistency ratio (CR) value below 0.1, and was able to provide accurate and consistent priority ranking recommendations. The presence of this system can practically assist the People's Welfare Bureau of the North Sumatra Provincial Government in selecting grant recipients faster, on target, and more efficiently, which ultimately contributes significantly to increasing transparency and fairness in the governance of the distribution of education grant funds. This study concludes that the aspect of Accountability and Transparency (K4) is the most dominant factor in determining the eligibility of grant recipients with a weight of 0.44. The results of the final ranking show that the Community-Based Education Foundation (A2) obtained the highest score of 0.30, making it a top priority compared to private institutions and individuals. This is based on the foundation's ability to provide a broad social impact and a reporting system that is considered more transparent.

BIBLIOGRAPHY

[1] F. Medea and S. Y. Sabandar, "Analysis of the Effectiveness of the Implementation of the Budget at the Investment and One-Stop Integrated Services Office of North Toraja Regency," *Journal of Marketing Management and Innovative Business Review*, vol. 2, no. 1, pp. 45–51, Jun. 2024, doi: 10.63416/mrb.v2i1.226.

[2] I. D. E. Veronica, R. A. Mauliza, and M. Yasin, "Analysis of Budget Preparation to Determine Revenue and Expenditure of Malang City," *Journal of Creative Student Research (JCSR)*, vol. 1, no. 3, pp. 105–114, 2023, doi: 10.55606/jcsrpolitama.v1i3.

[3] Ali Yusran Gea, "Accountability for the Use of Grant Funds by Religious Legal Entities," *Research Domain : Journal of Multidisciplinary Research and Development*, vol. 6, no. 5, pp. 1763–1771, Aug. 2024, doi: 10.38035/rrj.v6i5.1073.

[4] A. Y. Gea, "Accountability for the Use of Grant Funds by Religious Legal Entities," *Domain Research: Journal of Multidiscpinary Research and Development*, vol. 6, no. 5, pp. 1763–1771, 2024, doi: 10.38035/rrj.v6i5.1073.

[5] R. V Karamoy, D. Rumimpunu, and Tasya Shalsa Ilaha, "Review Of The Right To Obtain The Inheritance Of An Adopted Child Based On The Grant Of A Will 1," *Lex Privatum*, vol. IX, no. 12, pp. 78–88, 2021.

[6] Ali Yusran Gea, "Accountability for the Use of Grant Funds by Religious Legal Entities," *Research Domain : Journal of Multidisciplinary Research and Development*, vol. 6, no. 5, pp. 1763–1771, Aug. 2024, doi: 10.38035/rrj.v6i5.1073.

[7] L. C. Tarigan, H. Juliani, and F. S. Adiyanta, "Accountability Of

Government Officials For Unlawful Acts That Cause State Financial Losses (Case Study Of Medan District Court Decision Number: 75 /Pid. Sus/Tpk/2016/Pn. Mdn.)," *Diponegoro Law Journal*, vol. 11, no. 4, 2022.

[8] J. Parhusip *et al.*, "Development Of Counseling Guidance Applications At Smk Negeri 1 Muara Teweh Using The Rapid Application Development (Rad) Method," *Journal of Information Technology Journal of Knowledge and Application in the Field of Informatics Engineering*, vol. 16, no. 1, pp. 61–72, 2022.

[9] R. Jaya, E. Fitria, Yusriana, and R. Ardiansyah, "Implementation of Multi Criteria Decision Making (MCDM) in Agroindustry: A Literature Review," *Journal of Agricultural Industrial Technology*, doi:10.24961/j.tek.ind.pert.2020.30.2.234.

[10] M. Ayucedar and E. Rusdianto, "Talent Interest Selection Decision Support System for Career Recommendations with Analytical Network Processing Method," *Atma Jogja Informatics Journal*, vol. 1, no. 1, pp. 50–59, 2020.

[11] M. I. Baskoro, D. Andreswari, and A. Johar, "Decision Support System To Determine Outstanding Students Using The Web-Based Analytical Network Process (Anp) Method," *Recursive Journal*, vol. 9, no. 1, pp. 14–29, 2021.

[12] A. Sulvia, T. Rismawan, and S. Bahri, "Determination of the Feasibility of Grant Assistance Proposals in Social Services Using the Analytic Network Process (ANP)," *Coding Computer and Application Journals*, vol. 9, no. 03, p. 387, 2022.

[13] C. Iswanaji, M. Zidny, N. ' Hasbi, F. Salekhah, and M. Amin, "Implementation Of Analitycal Networking Process (Anp) Zakat Distribution For Sustainable Community Economic Development," *Tabarru' Journal : Islamic Banking and Finance*, vol. 4, no. 1, p. 2021, 2021.

[14] A. Yudhistira, "Marketing Staff Recruitment Decision Support System Using the Analytical Hierarchy Process Method," *Journal of Information Technology, Software Engineering and Computer Science (ITSECS)*, vol. 2, no. 2, 2024, doi: 10.58602/itsecs.v2i2.110.

[15] Tri Ulandari, Triase, and Aninda Muliani Harahap, "Road Mapping Using The Ahp-Smart Method In The Eastern Range Based On Webgis," *Scientific Journal Of Information And Communication Technology (Jtik)*, vol. 15, no. 2, pp. 371–379, 2024, doi: 10.51903/jtikp.v15i2.902.