

MULTIDIMENSIONAL CLUSTER ANALYSIS OF THE 2023 CHILD PROTECTION INDEX (CPI) BASED ON PROVINCES IN INDONESIA

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ABSTRACT

This study aims to (1) classify Indonesia's 34 provinces into homogeneous clusters based on the multidimensional profile of the 2023 IPA, (2) map the structural relationships between IPA dimensions through network analysis, and (3) analyze the unique characteristics of each cluster to formulate focused and differentiated policy recommendations. This study uses a quantitative approach with the K-Means non-hierarchical cluster analysis method and is enriched with correlation network analysis. The data analyzed are the scores of the five dimensions that comprise the 2023 IPA released by the Ministry of Women's Empowerment and Child Protection (KemenPPPA) and the BPS-Statistics Indonesia. Determining the optimal number of clusters using *the Elbow Method* and *Bayesian Information Criterion* (BIC) shows three clusters are the most appropriate structure. The analysis results identified three clusters of provinces with significantly different characteristics: Cluster 1 ("Multidimensional Structural Challenges"), Cluster 2 ("Moderate and Even Performance"), and Cluster 3 ("Excellent Implementers"). Network analysis revealed powerful and positive relationships between the Family Environment dimension (D2) and Special Protection (D5) and Basic Health (D3), as well as between Civil Rights (D1) and Basic Health (D3). This result indicates that the family environment and access to health care are central foundations supporting various other aspects of child protection. Combining these two analyses provides a more nuanced understanding than a single national ranking.

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Introduction

Children are a fundamental asset that determines the future of a nation. With a child population of around 30.2 million, or one-third of Indonesia's total population, investing in their quality of life, growth, development, and protection is an absolute prerequisite for realizing the vision of "Golden Indonesia 2045". The state has a constitutional responsibility to guarantee and protect the rights of every child to live, grow, develop, and participate optimally in accordance with human dignity, as well as to receive protection from violence and discrimination (Mawarni et al.,

2023). However, the reality on the ground shows that children in Indonesia still face various complex challenges. The National Survey on the Life Experiences of Children and Adolescents shows that one in two children aged 13-17 has experienced at least one type of violence in their lifetime (Kementerian Kesehatan, 2024). Reports from the Indonesian Child Protection Commission (KPAI) and the National Commission for Child Protection (Komnas PA) consistently record thousands of cases of child rights violations each year, ranging from physical and psychological violence, sexual crimes, bullying, to economic exploitation. Ironically, violence often occurs in the child's immediate environment, such as the family and school, which should be the safest places.

To respond to these challenges and monitor progress objectively, Indonesia has established a strong legal framework through Law No. 35 of 2014 on Child Protection (Ayunda & Yustitiantingtyas, 2025) and developed quantitative measurement tools. Since 2019, the Ministry of Women's Empowerment and Child Protection (KemenPPPA) has been working with the BPS-Statistics Indonesia to develop the Child Protection Index (CPI) as a composite index to describe the achievement of children's rights and special protection (Misbah, 2021). The CPI is built on five main dimensions: (1) Civil Rights and Freedoms; (2) Family Environment and Alternative Care; (3) Basic Health and Welfare; (4) Education, Leisure Time Utilization, and Cultural Activities; and (5) Special Protection (Ministry of Women's Empowerment and Child Protection & Central Statistics Agency, 2024). Although generally showing improvement, analysis of national IPA trends reveals persistent challenges, particularly in the special protection component, which often fails to meet the set targets (Misbah, 2021). This failure signals systemic weaknesses in protecting the most vulnerable children, exacerbated by the impact of the COVID-19 pandemic.

Research on child protection in Indonesia has been conducted extensively, mainly focusing on legal-normative analysis of regulations (Mawarni et al., 2023) (Ayunda & Yustitiantingtyas, 2025). or partial qualitative studies (Save the Children Indonesia, 2024). On the other hand, the analysis of IPA data published by the government tends to be descriptive, with a primary focus on presenting provincial rankings (Kementerian PPPA, 2024). This approach risks obscuring the heterogeneity of complex problems, where two provinces with the same total score may have very different profiles of challenges. In terms of methodology, the application of cluster analysis to group regions based on socioeconomic indicators such as the Human Development Index (HDI) and poverty rates has proven effective in Indonesia in revealing hidden patterns (Maryani et al., 2024) (Rahmati & Wijayanto, 2021) (Dini & Fauzan, 2020). Based on this review, a significant research gap has been identified: no studies apply cluster analysis to group provinces in Indonesia based on multidimensional IPA profiles.

Based on this research gap, this study aims to (1) identify groups (clusters) of provinces that have similar characteristics in terms of child protection performance in the five dimensions of the 2023 IPA; (2) analyze the unique profiles of each cluster to understand their specific strengths and weaknesses; and (3) formulate more targeted and differentiated policy implications. Methodologically, this study offers a new approach to analyzing IPA data in greater depth. This study produces a typology of provinces that policymakers can use for more effective planning. Conceptually, this study aims to shift the narrative from mere "rankings" to "understanding problem profiles," so that child protection efforts can be carried out more strategically in each region's specific context and needs.

Method

This study uses a quantitative design with a *cross-sectional* secondary data analysis approach, with provinces as the unit of analysis. The data used are scores from the five dimensions that make up the 2023 Child Protection Index (CPI)—Civil Rights and Freedoms (D1), Family Environment

and Alternative Care (D2), Basic Health and Welfare (D3), Education, Leisure Time Utilization and Cultural Activities (D4), and Special Protection (D5)—sourced from official publications of the Ministry of Women's Empowerment and Child Protection (KemenPPPA) and BPS-Statistics Indonesia. The analysis procedure began with data standardization for the five dimensions using Z-score transformation to equalize the variable scales (Hair et al., 2019). Next, the non-hierarchical K-Means clustering method was applied to group the 34 provinces into homogeneous clusters. The determination of the optimal number of clusters (k) was carried out through statistical evaluation using the *Elbow Method* (Figure 1) and *Bayesian Information Criterion* (BIC), where in Table 1 the lowest BIC value of 137.8 indicates that three clusters ($k=3$) are the most suitable structure for this data. The explained variance in the formation was 0.486, with a Silhouette value 0.20.

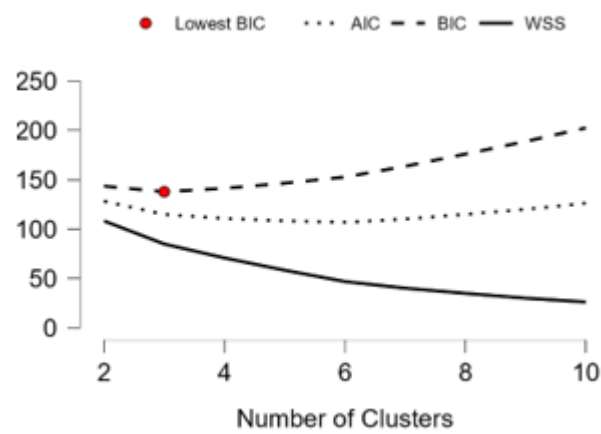


Figure 1. Elbow Method Plot

Results

Before conducting cluster analysis, it is important to understand the overview and distribution of the 2023 Child Protection Index (IPA) data across 34 provinces. Table 1 presents descriptive statistics for the total IPA score and five dimensions (Ministry of Women's Empowerment and Child Protection & Central Statistics Agency, 2024).

Table 1. Model Summary: K-Means Clustering

Clusters	N	R	AIC	BIC	Silhouette
3	34	0.486	114.9	137.8	0.2

Note. The model is optimized with respect to the BIC value.

After the K-Means iteration process converges and cluster membership is formed, the analysis is enriched with network analysis to map the structural relationships between the five dimensions of science using Pearson's correlation coefficient. The final stage is the interpretation of the results, where the unique characteristics of each cluster are analyzed based on the cluster centroid values to formulate profiles and relevant policy.

Table 2. Descriptive Statistics of the 2023 Child Protection Index (CPI) and Its Dimensions

Indicator	mean	SD	Min	Max
Child Protection Index (CPI)	62.00	5.228	45.10 (Papua)	71.48 (Yogyakarta)
Civil Rights and Freedoms	47.09	4,735	30.42 (Papua)	56.70 (NTB)
Family Environment	78.22	6,712	64.61 (West Nusa Tenggara)	92.46 (Yogyakarta)
Alternative Care	76.05	6,382	57.30 (Papua)	89.53 (Bali)

Indicator	mean	SD	Min	Max
Education, Leisure, and Culture	32.49	6,369	20.70 (West Sulawesi)	49.31 (Jakarta)
Special Protection	71.98	9,604	46.79 (Papua)	85.83 (North Maluku)

The data in Table 2 reveal several important findings. First, provinces have a sharp disparity or gap in child protection performance. The total HDI score ranges from 45.10 in Papua to 71.48 in DI Yogyakarta, a difference of more than 26 points, indicating massive disparities in policy implementation. This gap reflects a deeper "Human Development Gap," in which the CPI is not merely a social index, but also a proxy for the effectiveness of governance, budget allocation, and development priorities at the regional level. Second, on a national average, the dimensions with the highest achievements are D2 (Family Environment) with a score of 78.22 and D3 (Basic Health) with a score of 76.05. Conversely, the dimensions with the lowest achievements are D4 (Education, Leisure & Culture) with an average score of only 32.49. The consistently low scores in D4 in almost all provinces indicate a systemic national challenge in providing access to quality education, safe recreational facilities, and cultural activities that support child development. Third, Dimension 5 (Special Protection) shows the highest standard deviation (9.604), indicating the most significant variation in performance between provinces in protecting children in vulnerable situations. This result aligns with findings that national targets for special protection are often unmet, and confirms that some provinces face a much more severe crisis in this area than others (Kementerian PPPA, 2024) (Misbah, 2021).

Based on the *Elbow Method* analysis and the lowest BIC value, the optimal number of clusters for the 2023 CPI data is $k=3$. This three-cluster configuration provides the best balance between low variance within clusters and efficient model complexity. The results of grouping 34 provinces into three clusters are presented in Table 3.

Table 3. Province Membership in Each 2023 IPA Cluster

Cluster	Cluster Name	Number of Members	Province Members
Cluster 1	Multidimensional Structural Challenges	5	East Nusa Tenggara, Southeast Sulawesi, West Sulawesi, West Papua, Papua
Cluster 2	Moderate and Even Performance	20	Aceh, North Sumatra, West Sumatra, Riau, Jambi, South Sumatra, Bengkulu, Lampung, Bangka Belitung Islands, West Java, Central Java, West Nusa Tenggara, West Kalimantan, Central Kalimantan, South Kalimantan, North Sulawesi, Central Sulawesi, South Sulawesi, Gorontalo, North Maluku
Cluster 3	Excellent Performance	9	Riau Islands, DKI Jakarta, DI Yogyakarta, East Java, Banten, Bali, East Kalimantan, North Kalimantan, Maluku

The membership of this cluster shows a clear geographical pattern. Cluster 1, which performs the worst, consists exclusively of provinces in Eastern Indonesia. This pattern is not a coincidence, but rather a reflection of the historical development disparities between Western and Eastern Indonesia, a phenomenon that has been widely documented in studies on poverty and

human development (Gabur et al., 2024) (Al Muflih & Wijaya, 2024). This gap, which is often seen in economic and HDI indicators, is also clearly reflected in the capacity of regions to provide child protection. Meanwhile, the high-performing Cluster 3 is dominated by provinces in Java, Bali, and several provinces rich in natural resources, confirming the correlation between regional economic progress and child protection capacity.

To understand the unique characteristics of each cluster, the cluster centroid values for the five dimensions were analyzed. Table 3 presents the centroid values in the form of Z-scores, where positive values indicate performance above the national average, negative values indicate performance below the national average, and values close to zero indicate performance equivalent to the national average.

Table 4. Cluster Centers (Centroids) Based on Science Dimensions (in Z-Scores)

Cluster	D1: Civil Rights	D2: Family	D3: Health	D4: Education	D5: Special Protection
Cluster 1: Structural Challenges	-1,407	-1,232	-1,178	-0.979	-1,888
Cluster 2: Moderate Performance	0.399	-0.114	-0.121	-0.153	0.108
Cluster 3: High Achievers	-0.105	0.939	0.922	0.885	0.810

Discussion

Cluster 1: Multidimensional Structural Challenges

This cluster profile affirms Bronfenbrenner's Ecological Systems Theory, which states that child development cannot be separated from the broader environmental context (Bronfenbrenner, 2013). In the case of this cluster, weaknesses in *the macrosystem* (regional development inequality, structural poverty) and *exosystem* (limited access to health and education services) directly affect *the microsystem* (family and school), resulting in deficits in all dimensions of child protection (Gabur et al., 2024). Very low performance in all dimensions, especially D5 (Special Protection), indicates multidimensional poverty that makes children in this region highly vulnerable to various forms of exploitation and violence (Al Muflih & Wijaya, 2024).

Cluster 2: Moderate and Even Performance

This largest cluster represents the national "average" condition, where child protection programs are in place but have not reached an optimal level yet. Its balanced profile at a moderate level shows that although basic standards have been met, there is still ample room for improvement in all sectors. Performance slightly above average in D1 (Civil Rights) and D5 (Special Protection) may reflect the success of specific national programs. However, slightly below average performance in D2, D3, and D4 indicates challenges in the equitable implementation of quality basic services.

Cluster 3: Excellent Implementers

The success of this cluster in many dimensions is likely driven by strong local government commitment, adequate resource allocation, and policy innovation, in line with the success factors of the Child Friendly City (CFC) program found in cities such as Surabaya (Athaya Salsabilla Pamarito, 2024) (Arindi & Hidayat, 2024). These provinces have created a more supportive *ecosystem* for child development. However, relative weaknesses in D1 (Civil Rights & Freedoms) indicate that the development focus may still be more heavily weighted towards physical well-being and protection from harm. At the same time, more abstract participatory rights are not yet a top priority,

a "blind spot" that needs attention even for the best-performing regions.

Furthermore, network analysis provides a complementary perspective by mapping the structural relationships between the dimensions of science itself. Table 5 presents the Pearson correlation matrix between the five dimensions.

Table 5. Pearson Correlation Matrix Between IPA Dimensions 2023

Dimension	Dimension Pair	Correlation Coefficient (r)
D1: Civil Rights	D2: Family Environment	0.291
	D3: Basic Health	0.601
	D4: Education & Culture	0.125
	D5: Special Protection	0.316
D2: Family Environment	D3: Basic Health	0.620
	D4: Education & Culture	0.379
	D5: Special Protection	0.695
D3: Basic Health	D4: Education & Culture	0.367
	D5: Special Protection	0.471
D4: Education & Culture	D5: Special Protection	0.522

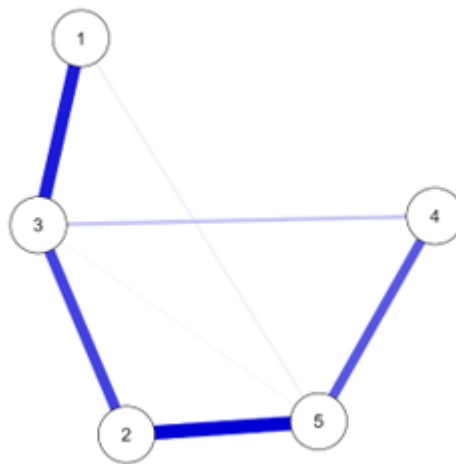


Figure 2. Visualization of Network Dimensions

Network visualization and correlation matrices reveal several fundamental structural patterns. The strongest relationship ($r=0.695$) is between D2 (Family Environment) and D5 (Special Protection). This crucial finding empirically confirms the theoretical basis of child protection, in which the family is seen as *the primary microsystem* and the front line in parenting and protection (Mardiyati, 2015). Various studies emphasize that strengthening family functions—through social support, parenting education, and economic stability—is the most effective preventive strategy for reducing the risk of child abuse and neglect (Kumpfer & Alvarado, 2003). This robust correlation indicates that investment in family strengthening programs (D2) will yield direct returns in reducing child vulnerability (D5).

Furthermore, two other strong relationships form the "foundation of well-being." The strong correlation between D2 (Family Environment) and D3 (Basic Health) ($r=0.620$) confirms that the family is the central pillar in ensuring children's access to health (Fatimaningsih, 2021). Meanwhile, the strong correlation between D1 (Civil Rights) and D3 (Basic Health) ($r=0.601$) implies an important institutional mechanism: possession of legal identity documents such as birth certificates (a key component of D1) is often an administrative prerequisite for accessing formal public services, including health insurance (component D3). Thus, the fulfillment of civil rights is not only a matter of legal recognition, but also functions as a 'gateway' to fulfilling other welfare rights.

Implications for Cluster- and Network-Based Policies

The combination of cluster and network analysis enables the formulation of more focused and evidence-based policy recommendations:

- For Cluster 1 (Structural Challenges): Interventions must be integrated with an ecological approach, simultaneously targeting both the macro and micro systems. Given that the strongest relationship is between D2 (Family) and D5 (Special Protection), family capacity-building programs (parenting, family economics) must be at the forefront, in line with the principle of *family strengthening* as the primary preventive strategy. This must be combined with affirmative policies at the *macrosystem* level to address poverty and regional inequality, which are the root causes of the problem.
- For Cluster 2 (Moderate Performance): Policies should optimize synergies between dimensions to improve service quality. These provinces can improve their performance by strengthening identified key relationships. For example, joint programs between social services (related to D2 and D5) and health services (D3) should be created to ensure that families accessing health services receive childcare and protection support.

For Cluster 3 (High-Performing Implementers): Policies should focus on innovation, dissemination of good practices, and addressing specific weaknesses. These provinces can serve as laboratories for advanced family-based intervention models, in line with best practices in KLA programs. The focus of improvement should be on D1 (Civil Rights). Given the strong relationship between D1 and D3, they can leverage their superior health systems to promote the fulfillment of civil rights, for example, by integrating birth registration services in all health

Conclusion

Overall, this study successfully mapped the heterogeneity of child protection challenges in Indonesia by identifying three fundamentally different clusters of provinces: "Multidimensional Structural Challenges," "Moderate and Even Performance," and "Excellent Implementers." This typology, which goes beyond conventional ranking analysis, is enriched by network analysis, confirming the family dimension's central role as a pillar supporting basic health and special protection. Combining these two methods proves that a "one size fits all" policy approach is no longer relevant. Although these findings are limited by the *cross-sectional* and aggregate nature of the data at the provincial level, the implications are clear: governments need to adopt cluster-based strategies, formulate integrated affirmative policies for the most disadvantaged provincial groups, and leverage high-performing provinces as centers of excellence for the dissemination of good practices. For researchers, there are opportunities to conduct longitudinal studies to track the dynamics between clusters over time and to carry out qualitative case studies and analyses at the district/city level to generate a more granular understanding and support more precise interventions.

References

- Al Muflih, M. R., & Wijaya, Y. T. (2024). Pekerja Anak di Kawasan Timur Indonesia Tahun 2022: Kondisi dan Faktor yang Memengaruhi. *Jurnal Ekonomi Kependudukan Dan Keluarga*, 1(2), 173–191. <https://doi.org/10.7454/jekk.v1i2.06>
- Arindi, A. P., & Hidayat, E. (2024). Implementasi Kebijakan Kota Layak Anak (KLA) Melalui Pengoptimalan Program PUSPAGA Kota Surabaya. *Innovative: Journal Of Social Science Research*, 4(3), 10267–10278. <https://j->

innovative.org/index.php/Innovative/article/view/8134

- Athaya Salsabilla Pamarito. (2024). Implementasi Kebijakan Kota Layak Anak (KLA) Klaster Perlindungan Khusus Di Kota Padang. In *IPDN*. IPDN.
- Ayunda, A. U., & Yustitiningtyas, L. (2025). Pemenuhan Hak Pendidikan Anak Menurut UU No. 35 Tahun 2014 Tentang Perlindungan Anak. *DOKTRINA Journal of Law*, 8(1), 78–96.
- Bronfenbrenner, U. (2013). Ecology of the family as a context for human development: Research perspectives. *Adolescents and Their Families: Structure, Function, and Parent-Youth Relations*, 22(6), 1–20. <https://doi.org/10.1037//0012-1649.22.6.723>
- Dini, S. K., & Fauzan, A. (2020). Clustering Provinces in Indonesia based on Community Welfare Indicators. *EKSAKTA: Journal of Sciences and Data Analysis*, 1(1), 56–63. <https://doi.org/10.20885/eksakta.vol1.iss1.art9>
- Fatimaningsih, E. (2021). Memahami Fungsi Keluarga Dalam Perlindungan Anak. *Jurnal Sosiologi*, 17(2), 77–88.
- Gabur, M. S., Andriansyah, M., & Cengga, G. S. H. (2024). Determinan Kemiskinan Multidimensi Anak di Provinsi Nusa Tenggara Timur. *STAR*, 4(2), 29–54. https://www.researchgate.net/profile/Agung-Laksono-2/publication/353680162_Stunting_di_Provinsi_Nusa_Tenggara_Timur_Apakah_status_bekerja_ibu_berpengaruh/links/610a372b169a1a0103db03e8/Stunting-di-Provinsi-Nusa-Tenggara-Timur-Apakah-status-bekerja-ibu-ber
- Hair, F., Risher, J. J., Anderson, R. E., & Black, W. C. (2019). *Multivariate Data Analysis*. Cengage Learning.
- Kementerian Kesehatan. (2024). *Survei Nasional Pengalaman Hidup Anak dan Remaja (SNPHAR)*.
- Kementerian PPPA. (2024). *Laporan Kinerja KemenPPPA (periode 2020–2023)*.
- Kumpfer, K. L., & Alvarado, R. (2003). Family-Strengthening Approaches for the Prevention of Youth Problem Behaviors. *American Psychologist*, 58(6–7), 457–465. <https://doi.org/10.1037/0003-066X.58.6-7.457>
- Mardiyati, A. (2015). Peran Keluarga dan Masyarakat dalam Perlindungan Anak Mengurangi Tindak Kekerasan. *Jurnal PKS*, 14(4), 453–464.
- Maryani, H., Rizkianti, A., & Izza, N. (2024). Classification of healthy family indicators in indonesia based on a k-means cluster analysis. *Journal of Preventive Medicine and Public Health*, 57(3), 234–241. <https://doi.org/10.3961/jpmp.23.497>
- Mawarni, W., Hidayati, R., & Rokhim, A. (2023). Perlindungan Hukum terhadap Anak

- Korban Kekerasan Seksual menurut Hukum Positif di Indonesia (Analisis Putusan Nomor 320/Pid.Sus/2022/PN.Kpn). *Jurnal Mercatoria*, 16(1), 13–30. <https://doi.org/10.31289/mercatoria.v16i1.9107>
- Misbah. (2021). *Perkuat Perlindungan Kemen PPPA – BPS Kembangkan Tiga Indeks*. <https://www.gatra.com/>. <https://www.gatra.com/news-526332-hukum-perkuat-perlindungan-anak-kemen-pppabps-kembangkan-tiga-indeks.html>
- Rahmati, R., & Wijayanto, A. W. (2021). Analisis Cluster Dengan Algoritma K-Means, Fuzzy C-Means Dan Hierarchical Clustering. *JIKO (Jurnal Informatika Dan Komputer)*, 5(2), 73–80.
- Save the Children Indonesia. (2024). *Catatan Akhir Tahun, Situasi Anak dan Pemenuhan Hak Anak Sepanjang Tahun 2023*. <https://savethechildren.or.id/>. <https://savethechildren.or.id/artikel/catatan-akhir-tahun-situasi-anak-dan-pemenuhan-hak-anak-sepanjang-tahun-2023>