A DATA MINING APPROACH TO ENHANCING BIRTH AND DEATH REGISTRATION PROCESSES

ERFAN HASMIN

ASIA e UNIVERSITY

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ERFAN HASMIN

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ABSTRACT

Accurate and timely birth and death registration is crucial for effective policymaking and public service delivery. however, Indonesia's current population administration system faces challenges such as centralized registration processes and low public awareness, leading to delays and incomplete records. this study explores the use of data mining techniques to enhance registration efficiency by analyzing birth and death records from Makassar city's population and civil registration office. using k-means clustering, apriori association rules, and c5 decision trees, this research identifies key patterns influencing late registrations. the optimal number of clusters of clusters for birth and death data is determined as three using elbow and silhouette validation methods. the apriori algorithm refines registration data by identifying associations that reduce inconsistencies, while decision three analysis highlights critical factors contributing to registrations delays. a total 45 decision trees were generated, leading to policy recommendation aimed at improving data collection and public compliance. this study contributes to ICT governance and public administration by demonstrating how data-driven approaches can optimize civil registration service. the findings offer actionable insights for policymakers to enhance registration models, reduce delays, and improve public accessibility. future research may explorer the integration of deep learning models for further automate the registration process and enhance predictive accuracy.

Keywords: Civil registration, data mining model, k-means, apriori, c5.0

APPROVAL

This is to certify that this thesis conforms to acceptable standards of scholarly presentation and is fully adequate, in quality and scope, for the fulfilment of the requirements for the degree of Doctor of Philosophy.

The student has been supervised by: **Prof Ts Dr Aedah Abd Rahman**

The thesis has been examined and endorsed by:

Ts Dr Amna Saad,
Asia e University
Examiner 1

Prof Madya Ts Dr Zulkefli Mansor,
Universiti Kebangsaan Malaysia
Examiner 2

This thesis was submitted to Asia e University and is accepted as fulfilment of the requirements for the degree of Doctor of Philosophy.

Professor Dr Siow Heng Loke
Asia e University
Chairperson, Examination Committee
(21 March 2025)

DECLARATION

I hereby declare that the thesis submitted in fulfilment of the requirements for the Degree of Doctor of Philosophy is my own work and that all contributions from any other persons or sources are properly and duly cited. I further declare that the material has not been submitted either in whole or in part, for a degree at this or any other university. In making this declaration, I understand and acknowledge any breaches in this declaration constitute academic misconduct, which may result in my expulsion from the programme and/or exclusion from the award of the degree.

Name: Erfan Hasmin

Signature of Student: **Date**: 21 March 2025

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LIST OF ABBREVIATION

DBI	Davies Bouldin Index
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IKI	Institut Kewarganegaraan Indonesia
SIAK	Sistem Informasi Administrasi Kependudukan
SSE	Sum of Square Error
UNICEF	United Nations Childrens Fund
UPT	Unit Pelaksana Teknis/Technical Implementation Unit
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.0 Background of Study

The Population Administration System in Indonesia has lasted since 2011. The system is Population Administration Information System (SIAK: *Sistem Informasi Administrasi Kependudukan*); It involves the registration of both births and deaths. The addition of new data and updates is entered into the SIAK system, which is hosted on a decentralized server within the city. Periodically, this information will be synchronized with a central server located at the Ministry of Home Affairs (Departemen Dalam Negeri Indonesia, 2011). The provisions regarding birth registration in the system and making birth certificates are regulated in articles 27 and 49. Simultaneously, the data of death reports that require families, community leaders, or residents to report within 30 days of the incidents is regulated in article 44 of Law of the Republic of Indonesia Number 24, 2013. Meanwhile, the steps in government programs to improve the birth and death registration rates become the authority of each region's civil registration offices. Procedures for registering births and deaths by visiting the population service office by bringing birth and death events. This procedure has the constraint that the community will only process the document if needed at some point in the future, even though the document should be registered after the birth and death events occur. This is due to several factors, including access to registration centralized in the district capital, making it difficult for people to come to the office due to distances and long queues. There is low public awareness of reporting births to issue birth certificates; generally, people inform deliveries when the child is sick, requires health insurance, and is entering school age (Ritonga et al.,

2021). Likewise, in reporting death events, death events are generally reported to the civil registry office to issue death certificates to withdraw insurance funds or become heirs (Adi, 2022).

Various efforts to enhance birth and death registration are ongoing. The optimization of technology in civil registration aims to achieve more efficient outcomes. Simultaneously, technology assumes a critical function in bolstering population management services. It has the potential to facilitate inter-agency collaboration, expedite registration processes, and streamline procedures. Consequently, it's imperative to oversee innovations that harness technology for support effectively (Adomako & Nguyen, 2024). However, the involvement of other institutions, such as health institutions, in the birth registration process can improve birth registration but becomes a dilemma because medical institutions already have the primary function of providing health facilities (Siagian et al., 2019). Moreover, registering deaths can involve sub-district and village institutions. This will increase the number of births and deaths. The Civil Registration Office of Makassar has innovated by developing a birth registration system that involves health institutions and urban village offices named KUCATA'KI. This innovation makes it easier for the people of Makassar to get services from the government and collaborate with related parties in the reporting process of some health institutions and every district in the city of Makassar (Sulmiah et al., 2022). In addition to these technological innovations, efforts to improve birth and death registration are also carried out in the civil registration service policy with various activities such as direct services to sub-districts and increasing understanding and technical capabilities of civil registration in the form of seminars and training. The Three in One Service Program also completes the application for a Birth Certificate by including the Family Card and Child Identity

Card as program outputs. The program is running well and should be more optimal (Malik & Ammar Hadi, 2022). The full potential of discounts offered to holders of the Child Identity Card (KUMARA) has not yet been fully realized in terms of quantity. The promotion and oversight of this program have not been optimized, requiring practical observations and supervision by service providers when serving recipients (Wirata et al., 2022). In addition, to ensure the success of the Civil Registration System for registering births and deaths, it is crucial to enhance infrastructure through a reliable electricity supply, better building facilities, a well-trained workforce, and the implementation of an online system with the necessary software installation (Rane et al., 2020).

Improvements in birth and death registration can be achieved by thoroughly understanding the data that has been recorded to date. An analytical approach is essential for understanding birth and death data. This necessity is underscored by the data mining analysis conducted on civil registration data. use of data mining techniques on government data is proven to make better planning and decision-making (Musadad et al., 2023). As well as the birth data analysis using the Neural Network method emphasizes the need for data mining analysis on civil registration data to understand e-governance data better (Desai, 2019). Utilization of birth and death data for the development and determination of policies and activities needs to be done to increase the number of registered births and deaths. Data recorded for three years can be analyzed using data mining tools to find new information that can be used as a basis for determining policies for developing birth and death registration systems. The utilization of pre-established algorithms and association rules in decision-making holds importance for policymakers in public service (Ebenezer, 2019), and the use of data mining techniques on civil registry databases to find association rules using the a

priori method succeeded in presenting new regulations that can be used for decision-makers to do the right thing for certain groups of rules that are generated (Musa & Ahmad, 2019). This underscores the importance of collecting data for analysis to derive association rules that relate to the correlation between the area of residence and the timeliness of reporting birth and death events, thereby enabling the precise formulation of activities. Beyond identifying specific rules and correlations within collected data, it is also possible to categorize the data using relevant and suitable criteria. This categorization allows the government to formulate public policies that align with the actual situation (Viloria & Lezama, 2019). Data mapping is needed for policy adjustments related to increasing birth and death registration, and a policy will be adjusted to the characteristics of the existing data clusters. This way, the policies taken can be implemented with finances limited to each cluster (Jurun et al., 2017). This ensures that improvements to the birth and death registration process are implemented based on accurate cluster data.

Understanding the characteristics of birth and death data recording, along with the factors influencing community registration of these events, is essential. These factors may include social, economic, cultural, and geographical aspects that affect individual or family decisions to report births and deaths (Yokobori et al., 2021). Additionally, the community awareness of the importance of civil registration plays a crucial role. In this context, data mining analysis is vital. It can uncover patterns and trends that are not immediately apparent, such as specific times of the year when registrations are lower or demographic groups that are less likely to report these significant events. The insights gained from this analysis can inform government strategies, particularly for the population and civil registration office, enabling the design of more effective programs and activities. For example, if data indicates low

birth registration rates among individuals with lower education levels, the government can implement educational programs highlighting the importance of civil registration or establish direct service initiatives in hard-to-reach areas. By developing activities based on accurate data and thorough analysis, it is anticipated that improvements in birth and death registration will increase in the future. This will ensure that every individual is officially recognized by the state, a fundamental right of every citizen. Enhanced registration can also improve public services, such as health and education, as accurate data facilitates more targeted resource allocation.

1.1 Problem Statement

Efforts to improve birth and death registration through various activities conducted to date are not yet data-driven. Initiatives undertaken without a data foundation may hinder the community access to basic rights, such as education, health services, and inheritance rights (Yu et al., 2020). Efforts and initiatives aimed at improving birth and death registration across various scenarios, geographic areas, and social contexts should be formulated based on data, prioritizing the results of data analysis as a crucial factor in these endeavors. Current data mining techniques can analyze specific data, including civil registration data, more effectively than other data analysis methods (Tekieh & Raahemi, 2015). This serves as the foundation for this study to utilize data mining analysis methods on civil registration data to:

i. Birth and death registration are fundamental events that must be recorded by the civil registration office. However, many regions in Indonesia, especially the city of Makassar, still face challenges in achieving optimal registration rates. One of the causes is the lack of understanding of the characteristics and patterns of registration in various community groups, which results in efforts

to improve birth and death registration being suboptimal. By understanding registration patterns in different community groups, service innovations can be tailored to these conditions. Additionally, by comprehending the characteristics and complex registration patterns, such as changes in population structure, migration, or changes in family composition, efforts to improve registration based on data can be more effective (Oktaviany et al., 2024). Therefore, a data mining approach is employed to categorize birth and death registration data using several criteria. This multi-criteria clustering enables the government to develop public policies that align with the actual situation (Viloria & Lezama, 2019). Clustering data based on relevant criteria, including birth and death events, child biodata, parental information, and regional demographics, is essential. The resulting data clusters can serve as a foundation for formulating activities aimed at improving birth and death registration.

ii. Significant challenges remain in improving the registration of births and deaths. Data shows that more than half of births and deaths are reported more than thirty days after the event. This phenomenon reflects a gap in public understanding of the importance of official registration. Many individuals and families believe that obtaining a birth certificate and death certificate from the hospital is sufficient, without realizing that official registration at the population and civil registration office is a crucial step to ensure legal recognition and better access to public services. One approach to improving this registration is to understand the associations in the data that influence people's decisions to register births and deaths. By applying data mining techniques, especially association rule methods, we can identify patterns and relationships that exist in civil registration data. The association process is also