Towards Smart Society: A Study on Multi-Channel and Public Participation-Based System Architecture for Civil Registration and Population Data in Indonesia

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***Abstract*— Current procedure for updating the civil registration and population data in Indonesia has weaknesses that need improvements. One of them is the only written reporting procedure, submitted personally by the person in need to the civil registry officer. With this procedure, the accuracy of the data contained in the database SIAK (Sistem Informasi dan Administrasi Kependudukan—Population Administration and Information System) is very dependent on public awareness. This paper discusses a literature study of current government regulations and prior researches in the field of civil registration and population data updating procedure. It also proposes a new SIAK data updating procedure involving active public participation that can be done through a multi-channel telecommunications architecture. The architecture is designed as a complement to the official data updating procedure. This paper also reveals a number of important technical aspects that arise and should be considered in the new procedure.**

Keywords—information system, multi-channel architecture, public participation, civil registration system

I. INTRODUCTION

In Indonesia since 2011, there has been a population administration and information system, namely SIAK (Sistem Informasi dan Administrasi Kependudukan), based on Ministerial Regulation No.25 of 2011 [1]. The registration and its updating of the population data are done by the Department of Population and Civil Registration at the sub-district, village, and other designated places. New data entry and old data changes are incorporated into the SIAK (*Sistem Informasi dan Administrasi Kependudukan*—Population Administration and Information System) distributed server system at the district/city level. In current conditions, the updating data procedure is based on personal awareness. For example, the procedure for issuing e-ID cards, which is the most important citizenship document, is based on the private filing of a physical letter. The role of community leaders is only as the party to validate the printed letters with their signature and stamp [2]. This conventional procedure is certainly the main cause of the low data validity, due to the potential data forgery.

The following sections will discuss the current official regulation on civil registration, a glimpse of the condition of Indonesian society and the availability of telecommunication infrastructure in Indonesia.

A. Current official regulations

1) Birth

The regulations concerning the registration of births, resulting in updating of data within the system and producing birth certificates are governed by Presidential Act No. 24 of 2013 [3] of article 27 and article 49. This regulation only governs the deadline for birth registration reporting by the infant's parents. According to Presidential Act No. 025 of 2005 Article 105 [4] late reporting is subject to administrative fines, but practically, the regulation of late reporting penalties is specifically contained in the regulations of each region. For example, in DKI Jakarta area, fines due to delay in reporting are regulated in the Provincial Regulation of DKI Jakarta Number 3 of 2012 on Regional Retributions [5], but the provisions have been removed, based on Jakarta Provincial Regulation No. 1 of 2015 [6] so there is no obligation to pay a fine if it is too late to make a birth certificate.

2) Death

The regulations concerning the reporting of deaths occurring in the community also depend on the family of the deceased's intentions. If they think there is no need to have a death certificate, the family is generally reluctant to report this. Whereas Presidential Act No. 24 of 2013 [3] article 44 requires the community leader or other members of the surrounding community to report within 30 days of the incident. This is rarely done because reporting procedures are not easy. A family member of the deceased must make a written report, validate it with the community leaders and physically carry it to the Population and Civil Registration Office.

3) Displacement

In the event of displacement, the obligation to update data is regulated by Presidential Act No. 22 of 2006 article 15 [7] and Act No. 24 of 2013 article 63 [3]. These regulations also emphasize the personal obligation to report the event of his/her displacement. With this rule, if a person does not want to report, then the population data in the territory he left behind and which he entered becomes invalid.

If summarized, the problems arising from the emphasis on updating data tasks on individual liabilities directly related to population events (births, deaths, and displacements) have come from low data validity. There are regulations requiring the implementation of the population census as a way of validating data [8], [9], but the duration of the census is too long, every 10 years.

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The main disadvantage of the population data low validity is the difficulty for the government to make policies. For example, it is hard to make policies in public health that relate with the infant mortality data, due to the low awareness to report the event, which occurs before the deadline for reporting the event of a birth to make a birth certificate. Another example, in the legal area, is the crime of fraud pension claims that still must be paid by the state or private companies due to no reported death of a pensioner by his/her family.

Although some regulations have governed the community participation, the inadequacy of existing procedures leads to low public participation in updating the population data. This led to a number of crimes, such as the issuance of false population documents [10] that could be used for other crimes, such as fake election participants [11].

B. Characteristic of Indonesian society

Among neighbors, Indonesian people generally know each other. Many people in one area still have close kinship ties, thus creating mutual help culture (*gotong royong*), especially in the events of birth, death or displacement [12], [13]. This community characteristic can actually be used to speed up the updating process and validating the demographic data if the available means can be used easily and cheaply.

C. The Infrastructure of telecommunication in Indonesia

In 2017, the 2G networks cover 88.28% of villages in Indonesia and the 3G networks cover 75.06% [14]. As for the internet penetration in 2017 is about 54.68% [15]. Based on this condition, the reporting, updating, and validation scheme of population data must be designed in accordance with the conditions of telecommunication infrastructure in each different areas:

a. Areas without telecommunication infrastructure.

b. Areas with limited access to telecommunication infrastructure. Data can be sent/received via short message service.

c. Areas with good access to telecommunication infrastructure. Data can be sent/received via short message service and Internet protocol.

This research proposes an information system architecture that can be used to report, to update and to validate the population data, based on public participation. The proposed architecture and procedures are designed to work in line with the existing system (SIAK) and in accordance with the condition of telecommunication infrastructure in Indonesia.

II. THE MULTI-CHANNEL PUBLIC PARTICIPATION-BASED ARCHITECTURE

The use of multi-channel architecture has been used in other fields, such as management [16] and even government [17]–[20]. Such prior research cannot necessarily be applied in Indonesia, due to the different conditions of the telecommunication infrastructure and the characteristics of Indonesian society as described above. Principally, multi-channel architecture tries to utilize a variety of telecommunication channels that can be used in places with different infrastructures availability or constraint.

Fig. 1 depicts the proposed multi-channel architecture for population data updating system based on public participation and the availability of telecommunication access and infrastructure throughout Indonesia.

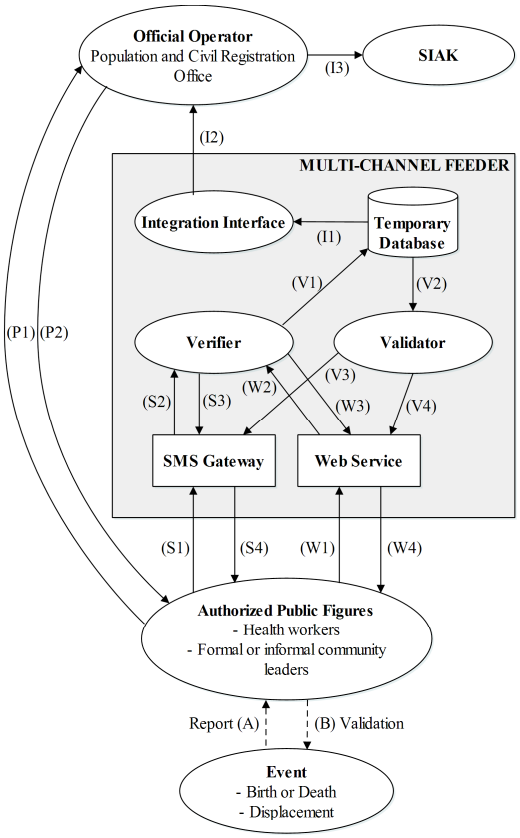

Fig. 1. The proposed multi-channel public partition-based architecture for updating civil registration and population data

The **Event** is the occurrence of a population-related event observed by **Authorized Public Figures** and then becomes a reporting object.

The **Authorized Public Figures** are the community members that have the right to report, verify, or validate a population-related event. Included in this group are health workers such as midwives, medical doctors, and nurses who have reporting authorization related to the event of death and birth. While other formal and informal community leaders have reporting authorization related to the event of displacement. In special circumstances, such as no public figure with proper authorization present, other figures who have similar authorizations can report, verify or validate an event.

The **Multi-Channel Feeder** is a series of modules that utilize the condition of telecommunication infrastructure to receive reports and determine the stages of a verification and validation of reports received. This system consists of interrelated modules that are:

a. The **SMS gateway** receives and sends messages related to the report via Short Message Service (SMS).

b. The **Web Service** receives and sends messages related to the report through Internet Protocol.

c. The **Verifier** verifies a report both formatting correctness and proper authentication and authorization.

d. The **Validator** specifies validation stages appropriate to the telecommunication infrastructure in a given area to determine who the correct public person is to validate the report.

e. The **Temporary Database** stores the entire report so it can be checked in the verification and validation stage, as well as stores the correct data to be accessed by the **Integration Interface** module.

f. The **Integration Interface** module prepares the format of the data that has passed the verification and validation process to the SIAK system through the designated operator in a particular population and civil registration office.

g. The **Official Operator** is the designated operator in a particular population and civil registration office. They will send the validated data to the **SIAK**.

A. The reporting procedure in the area with no telecommunication infrastructure

(A) At the time of an event of birth, death or displacement (incoming or out) is known by an authorized public figure, the public figure will **(P1)** send a paper-based report to the SIAK system through the designated operator in a particular population and civil registration office.

(P2) The operator will perform the verification and validation process related to the report by sending a letter to other authorized public figures to be followed up by **(B)** the validation process to the report object and then the validator's will send back a written report related to the validation of the event. The designated operator in a particular population and civil registration office will enter the validated data into the SIAK.

B. The reporting procedure in the area with SMS infrastructure

(A) At the time of an event of birth, death or displacement (incoming or out) is known by an authorized public figure, the public figure will **(S1)** send an SMS report with a proper format to the designated SMS Gateway.

(S2) The report is then sent to the Verifier module. This module will verify the reporter, whether he/she has a proper authorization to make such a report. In case of false verification, this module will make **(S3)** a verification message to the SMS Gateway to another Authorized Public Figure within that particular area, concerning the report.

In the case of a verified report, the Verifier module will **(V1)** send the verified report to the Temporary Database module, and then **(V2)** ask the Validator module to make **(V3)** a validation request to the SMS Gateway.

The SMS Gateway then sends a validation message **(S4)** to another Authorized Public Figure in that particular area, to **(B)** validate the report.

After validating the event, the Authorized Public Figure will send a validated event report **(S1)** with a proper format to the SMS Gateway, to be **(S2)** checked and verified by the Verifier and then **(V1)** notified the particular report in the Temporary Database as valid and ready to **(I1)** be send to the Integration Interface.

The operators in a particular population and civil registration office then can **(I2)** fetch the valid data and then **(I3)** send it to the SIAK.

In case of invalid data, the Authorized Public Figure will send an invalidated event report **(S1)** with a proper format to the SMS Gateway, to be **(S2)** checked and verified by the Verifier and then **(V1)** notified the particular report in the Temporary Database as invalid. The temporary invalid datum can be logged for further analysis.

If needed, paper-based reporting in this area can also be carried out as in areas with no telecommunication infrastructure.

C. The reporting procedure in the area with SMS and Internet Protocol infrastructure

In areas with good telecommunication infrastructure, means of reporting can be a mix of paper, SMS, and Internet protocol-based reporting.

(A) At the time of an event of birth, death or displacement (incoming or out) is known by an authorized public figure, the public figure will **(S1)** send an SMS report with a proper format to the designated SMS Gateway, or **(W1)** send an email report with a proper format to the designated email gateway. Reports can also be submitted in the form of a web-based report or native application report to a designated server.

If the report is sent via the Internet Protocol, then the Web Service will **(W2)** send the report to the Verifier module. This module will verify the reporter, whether he/she has a proper authorization to make such a report. In case of false verification, this module will make **(S3)** a verification message to the SMS Gateway, or **(W3)** make a verification email to another Authorized Public Figure in that particular area, concerning the report. The selection of communication means to verify the report is based on the telecommunication accessibility of that particular person.

In the case of a verified report, the Verifier module will **(V1)** send the verified report to the Temporary Database module, and then **(V2)** ask the Validator module to make **(V3)** a validation request to the SMS Gateway, or to the Web Service**.**

The SMS Gateway then sends a validation message **(S4)** or **(W4)** to another Authorized Public Figure in that particular area, to **(B)** validate the report.

After validating the event, the Authorized Public Figure will send a validated event report **(S1)** or **(W1)** with a proper format, to be **(S2)** or **(W2)** checked and verified by the Verifier and then **(V1)** notified the particular report in the Temporary Database as valid and ready to **(I1)** be send to the Integration Interface.

The operators in a particular population and civil registration office then can **(I2)** fetch the valid data and then **(I3)** send it to the SIAK.

In case of invalid data, the Authorized Public Figure will send an invalidated event report **(S1)** or **(W1** with a proper format, to be **(S2)** or **(W2)** checked and verified by the Verifier and then **(V1)** notified the particular report in the Temporary Database as invalid. The temporary invalid datum

can be logged for further analysis. If needed, paper-based reporting in this area can also be carried out as in areas with no telecommunication infrastructure.

III. Discussion

The proposed multi-channel public participation-based architecture and the new procedures described earlier require in-depth research on a number of aspects. We consider the following aspects that will determine the success of the actual design and implementation of the architecture.

A. Aspects of authorization and authentication

The authorization phase ensures the components within the administrative reporting procedure are executed and properly followed up by the right person to produce the output correctly. This phase is the process of a verifying that someone has access to particular data, usually based on a username and password. In security systems, authentication is distinct from authorization, which is the process of giving individuals access to system objects based on their identity.

In the proposed multi-channel architecture, since the system collaborates between different infrastructure services and the involvement of public participation, the determination of appropriate authorization dan authentication techniques is essential for the system to run safely, effectively, efficiently, and certainly to support the collaborative process. Here are the things that need to be noticed in the aspect of authorization and authentication:

a. Multi-Factor Authentication [21], a security system that requires more than one method of authentication to verify the user's identity [22].

b. Claim-Based Authentication [23, 24] is a way to acquire the information they need about the user's identity.

c. 3 Way Handshaking [25-27] or SYN-SYN-ACK is the method originally used by TCP set up a TCP/IP connection over an Internet Protocol-based network. The idea of this protocol will be used in the authentication procedure, involving different communication channel to send a challenge code and to receive a confirmation code.

d. Convenient management of determining and altering authorization of public figures within the system. The goal is to ensure the sustainability of the system can be guaranteed because the authorization regulation can be arranged easily and precisely.

B. Aspects of a verification dan validation

In the proposed multi-channel architecture, verification and validation aspects play a key role. Here are the things that need to be noticed in the aspects of a verification and validation:

a. The speed of access and respond in the process of a verification and validation of reports follow-up.

b. Flexible, planned and measurable validation procedures relating to the diverse background of each member of the community.

C. Aspects of data integration

Because the results of this proposed multi-channel architecture must be well utilized by SIAK, the system must support the open-data concept that is kept confidential. Here are the things that need to be considered in the aspects of integration or data utilization:

a. The data format should work in multiplatform [28], [29]. The integration process efficiency can be improved with the right format [30].

b. The Integration interfaces that can provide multiplatform data [31].

D. Aspects of data security

Because the system must be accessible collaboratively, the security aspect becomes crucial in ensuring the level of confidence in the reporting outcomes and ensuring community participation is in a safe and sustainable environment. Aspects that need to be considered in data security are:

a. The selection of appropriate security methods, both in terms of data communication and information storage.

b. Good regulation in every stage of the authorization process related to the right and entitled person, in relation to the aspect of authorization and authentication.

c. Information security techniques of data access in the integration processes [33], [34].

d. Encryption techniques of the information flow [35], [36].

E. Aspects of system performance measurement

In the proposed multi-channel architecture, performance measurement of IT systems and people is required. It is used to determine the success rate at each stage and as a basis for evaluating the performance of each process. Some of the performance measurement techniques that have been applied are IT Balanced Scorecard method [37], or performance measurement on government work units with a value for money perspective [38] and performance measurements using key performance indicators [39].

F. Aspects of hardware implementation

The implementation of hardware on the proposed multi-channel architecture has an impact on the effectiveness and efficiency of the system as a whole, according to different field conditions. The decisive factors are the condition of infrastructure in the particular area as well as the number of transactions that will be serviced each day. Here are the aspects to consider regarding the hardware implementation of the multi-channel architecture:

a. Determination of the right SMS Gateway hardware [40], [41].

b. Determination of appropriate web service hardware [42], [43].

IV. Conclusion

This paper has presented a proposed updating procedure for population and civil registration data. The procedure involves active public participation through multi-channel telecommunications architecture, without altering the current official population data updating procedure.

A number of technical aspects to be considered in order for this proposal to be properly designed and implemented have also been expressed, along with related references from many previous types of researches that can be used as implementation considerations.

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