Information System Model for Recyclable Waste Mapping to Help Increase Waste Pickers Income

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Abstract. Waste pickers search for and collect recyclable waste to be handed to other parties can reprocessed them into goods of new values. However, the information of the locations of those materials is not always present. The availability of this information can reduce the time of searching, increase the number of collected materials and therefore raise waste pickers income. The purpose of this work is to develop an information system model of recyclable waste availability. This model based on SWOT Analysis where data environment internal and external faced situation and condition. Build design of use case high-level to be as a grand design management, database, and user interface where a structured approach using prototype method. Input of this model is data where comes from the local society and is validated & verified by the local government and output of the model is information provided in texts and geographics map. This model is an effort to help waste pickers to obtain information about potential areas of waste sourced from the society together with the local government.

1. Introduction
Waste Pickers are one of the employment statuses of the informal sector which is still considered low by most people. Socially and economically on average, work as a waste pickers is far from enough. They work by choosing trash or used goods that only have commodity value or resale value to be given to recyclers. This is what waste pickers catch as an opportunity to get used goods that still have value. The process of selecting used goods is done by searching from a home or industrial waste bin, roadside area, and final waste disposal site based on limited information. According to some research, it was found that the range of waste pickers income varied greatly from 5.000-100.000 rupiah per day, depending on the amount of goods obtained. They work from morning to evening with an average of 9-13 hours each day. They work was apparently not only done by men or women but children also participated in doing so, generally by reason of economic pressure. Even though they have worked, the poverty line is still attached to the identity of the waste pickers, which can have an impact on the vulnerability of them in various aspects[1-4].

According to Laudon and Sawyer, the presence of information technology should be able to help various people[5,6], specifically in this case waste pickers in carrying out their activities to support the development of them from various aspects, especially from economic aspects. A good economy will certainly encourage the level of welfare of them and impact on various things. This is the effort of researchers to support their economy through the construction of an information system that can map and inform the existence of areas that have the potential for waste or used goods to them. This is expected
to increase the quantity of waste or used goods collected by them, which has a domino effect on the increase in their income. Of course this is supported by various stakeholders such as the society and the local government as parties who distribute information about potential areas of waste or used goods. A lot of research suggests about the social and economic aspects of waste pickers. However, there is still minimal research that seeks to improve this aspect related to the use of information technology or information system. For this reason, researchers want to do this part through research by building a information system that focuses on "Information System Model for Recyclable Waste Mapping to Help Increase Waste Pickers Income" [7 -10].

2. Research Methods

This research method is divided into four stages, there are: 1. Data Collection, 2. Data Analysis, 3. System Design, and 4. Implementation and Impact System Analysis. The following is the research methodology chart (See Figure 1).

![Figure 1. Research Method](image)

Data is collected from various sources, such as: 2 persons as Waste Pickers, 21 persons as Society, 1 person as Chairperson of RT/RW, 1 person as Parties of Bandung City Government, and 1 organization as Bank Sampah. Each stakeholder can support the system through access they can do. Steps taken through interviews, observation, and questionnaires. The collected data was analyzed based on the SWOT Analysis to see the objects of research in the internal and external environment. The results of the analysis are used in the design of the system that will be proposed to get the standard in the overall system development.

3. Results and Discussion

3.1. Data Analysis

The SWOT model used to build foundation and strategies based on internal environment analysis (strength & weakness) that are faced with external situations and conditions (opportunity & threat)[7-9]. Table 1 represents the inputs obtained from various literature sources and stakeholder interviews, then explained as an output based on the connectedness of the SWOT model (see Table 1).

| Opportunities                                                                 | Strengths                                                                 | Weakness                                                                 |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 1. The amount of waste that has not been managed properly.                     | 1. The large number of Indonesian people who choose jobs as waste pickers because of the lack of jobs with low education qualifications. | 1. Many waste pickers have low levels of education.                      |
| 2. The quantity of waste management that is not proportional to the amount of waste that is in the middle of the society. | 2. The presence of communities and forums for waste pickers, such as Ikatan Pemulung Indonesia (IPI) dan Asosiasi Pemulung dan Pelapak Indonesia (APPI), | 2. Low waste pickers economy, below the poverty line.                     |
| 3. Progress in information technology and use of mobile devices that have been used by some waste pickers. |                                                                             | 3. Waste pickers occupy slums, which are vulnerable to disease.           |
|                                                                                |                                                                           | 4. Limited waste pickers in managing waste that have economic value.     |
3. The involvement of the government in protecting waste pickers is proven by involving them in environmental campaigns.
1. The involvement of waste collectors in managing waste. \((S1,S2,S3 – O1,O2)\)
2. Building an integrated information system to manage waste and help waste pickers activities. \((S1,S2,S3 – O3)\)

### Threats
1. Society stigma about waste pickers that are close to the crime area.
2. Involving children as waste pickers, even though at their age they need school.
3. There is social discrimination against waste pickers in society life.

1. Campaigning that waste collectors have a contribution in waste management. \((S1,S2,S3 – T1,T2,T3)\)
2. Cooperate with various parties to distribute information on the location and condition of waste that can have economic value for Waste Pickers. \((S2,S3 – T3)\)

1. Providing active education to waste pickers in improving their standard of living. \((W1,W2 – O1, O2,O3)\)
2. Building a system that connects waste collectors, communities and the government. \((W4 – O1,O2,O3)\)
3. Providing media to provide knowledge to waste pickers. \((W1,W2 – T1,T2,T3)\)
4. Involving the private sector and government in helping waste pickers to become independent families through entrepreneurship programs. \((W2,W4 – T2,T3)\)
5. Punishing those who discriminate. \((W1,W2 – T2,T3)\)

#### 3.2. System Design

After analyzing internal and external environment using SWOT model, we were translate into a holistic design. The design of a information system model for a recyclable waste mapping is divided into several stages using the development of a prototype system; begins with the stage of identifying user needs through interaction with the user, and continued with the construction, testing, and repair of prototypes\(^{[10]}\). This has become a plot in the construction of a mapping information system model for waste pickers.

In designing an information system consists of hardware, software, brainware, network, data and information components, and procedures. Later system users are the Society, Waste Pickers, and the Government. They have limited access through their respective accounts. The society becomes the party that provides data in realtime about waste and will be validated and verified by the government as information to be published to waste pickers. Thus, waste pickers becomes the party that receives the information and can adjust its activities through the information obtained. All parties access the system through various devices that can be connected via the internet network with the condition that each device has a browser (See figure 2).
This is due to the construction of a web-based system with the intention of being able to operate in various types of computer devices with various operating system platforms. Not only by internet network but with short message service gateway. As a whole data relation, translated into design of Involvement in Figure 3.

Focus in the construction of information system model for a recyclable waste mapping for waste pickers is the distribution of data and information. The domains in the monitoring are described in the construction of high-level to be use cases. Using Case of system design describes the relation of various cases in its management. There are consist of four main cases that declare their activities as illustrated in Figure 4:

1. Case of Data Distribution Trash Area.
   This section describes the data provided to the system from the society regarding potential waste areas.
2. Case of Validation & Verification.
Data provided by the society is not immediately published for waste pickers, but must go through validation and verification to confirm that the data provided is suitable for them.

3. Case of Trash Information.
This section describes information provided by the local government regarding the potential waste area in the local government area.

4. Case of Request for Involvement.
In this section, the society or the local government can actively request the involvement of waste pickers to be involved in maintaining cleanliness in certain areas, certain times, and certain moments determined by the society or the local government (See Figure 4).

![Information System Model for Recyclable Waste Mapping](image)

**Figure 4.** Defining Use Case High-Level To Be Information System Model for Recyclable Waste Mapping

3.3. Implementation and Impact System Analysis
The application of information system when fit and done will be implemented by using a pilot conversion approach which segmenting organizations in one area where waste pickers are on the move. This approach is applied in order to obtain the evaluation value of the recyclable waste mapping information system for them. The evaluation value becomes a parameter for improving the information system to get overall system best practices. Basically, every stakeholder will get education or socialization before the information system is implemented. This is needed to provide basic information and knowledge on the use of information system[11].

By implementing the information system for recyclable waste mapping to waste collectors, it is hoped that it will be able to help with the quantity of waste collection that has an impact on increasing their income. Of course, through continuous data and information, waste pickers will help in improving the economy which has an effect on many parts of their lives.

4. Conclusion
The information system model for a recyclable waste mapping to waste pickers is an effort to help them to obtain information about potential areas of waste sourced from the society together with the local government. This is expected to be able to support the quantity of waste collection that can affect the increase in their income.
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References
[1] Akbar A. 2016. Strategi Bertahan Hidup Pemulung di Kelurahan Sidomulyo Kecamatan Samarinda Ilir E-Journal Pembangunan Sosial. 4 (3), pp 141–154
[2] Adam A and Mukramin S. 2014. Eksistensi Pemulung Sebagai Profesi (Di TPA Sampah Tamanggapa Kota Makassar). 2 (2) 21-32
[3] Gunawan.2012. Startegi Bertahan Hidup Pemulung. Naskah Publikasi: Universitas Maritim Raja Ali Haji.
[4] Permanasari E 2017 Analisis Permukiman Pemulung Sebagai Sebuah Assemblage Studi Kasus: Permukiman Pemulung Di Wilayah Jurangmangu Tangerang Selatan. NALARs. 16 (1), pp. 27
[5] Laudon K C and Jane P Laudon. 2006.Management Information Systems: Managing the Digital Firm 12th ed (USA: Prentice Hall)
[6] Williams Sawyer.2007. Using Information Technology: Pengenalan Praktis Dunia Komputer dan Komunikasi (Yogyakarta: Penerbit Andi)
[7] Rangkuti Freddy. 1997.Analisis SWOT Teknik Membedah Kasus Bisnis (PT. Gramedia Pustaka Utama)
[8] D Leigh.2010.Chapter Five SWOT Analysis
[9] Hosseini-Nasab H.2011. Coping with Imprecision in Strategic Planning: A Case Study Using Fuzzy SWOT Analysis. IBusiness, 03 (01) pp 23–29
[10] Yang, Maria C and Epstein Daniel J.2005. A Study of Prototypes, Design Activity, and Design Outcome, 26 pp 649–669
[11] Efrem G Mallach.2009.Information System Conversion Strategies: A Unified View. Pp.2009–2012