© Universiti Tun Hussein Onn Malaysia Publisher's Office

IJIE

Journal homepage: http://penerbit.uthm.edu.my/ojs/index.php/ijie
ISSN : 2229-838X e-ISSN : 2600-7916

The International Journal of Integrated Engineering

Evaluation of Sanitation Risk Index to Achieve Sustainable Development Goals 2020 in Sanitation Sector

I. Gede Arimbawa[1], Florianus Rooslan Edy Santosa[2], Sengguruh Nilowardono[1], Sri Wiwoho Mudjanarko[2*]

[1]Faculty of Economic and Business,
Narotama University, Surabaya, 60117 Jawa Barat, INDONESIA

[2]Faculty of Engineering,
Narotama University, Surabaya, 60117 Jawa Barat, INDONESIA

*Corresponding Author

DOI: https://doi.org/10.30880/ijie.2020.12.01.029
Received 5 April 2019; Accepted 12 November 2019; Available online 17 February 2020

Abstract: Challenges concerning fresh and clean water for drink coupled with sanitation in Indonesia becomes larger than before. It is not only happened in the East area but also all over Indonesia. Continuing the successful of Millennium Development Goals program in 2000 – 2015, government of the developing countries are planning to establish Millennium Sustainable Development Goals program for the period of 2015 - 2030. Evaluation and Assessment of Environmental Health Risk is a research which dedicate to achieve the aims of Sustainable Development Goals (SDGs) in 2020. The present study shows sanitation access of villages in Surabaya concerning drinking water, domestic wastewater, solid waste and drainage as follow: achieves 96,75 % target of drinking water, achieves 94,14% target of domestic wastewater, achieves 96,75% target of solid wastewater, and achieves 92,86% target of drainage. Average Surabaya city achievements in the sanitation sector were 95.125%, it shows villages in Surabaya already achieve the aims of the Sustainable Development Goals program mainly in sanitation sector.

Keywords: Millenium Development Goals (MDGs), Sustainable Development Goals (SDGs), Sanitation Sector

1. Introduction

Issue concerning drink water and sanitation becomes huge challenge that is faced by Indonesia nowadays [1]. It becomes national issue that is not faced by east and suburb area of Indonesia but also faced by numerous cities in Indonesia. This issue is strengthen by final report of Millennium Development Goals (MDGs) which mentioned that access for drink water coupled with basic sanitation are the major issue in Indonesia [2]. Sanitation approach based on the Society (STBM) can be used as an alternative to solve this issue. Department of Public Works and Spatial East Java Region stated that in order to increase the service of waste water from 72.15% in 2013 into 73.40% in 2015, it needs around 2.3 billion rupiah [3]. Numerous studies show that good sanitation will able to increase social, health and economical aspects mainly in developing country [4]. Issues about sanitation in Indonesia commonly focused on access of clean water and disposal of waste water [5].

In order to gain effectivity and efficiency in all villages to achieve the target of Sustainable Development Goals (SDGs) coupled with Universal Access 2020 in sanitation sector, Environmental Health Risk Assessment (EHRA) approach need to be conducted. Mapping area by using EHRA method in order to deter-mine environmental risk area need to be conducted. This method produces classification area which are high, medium, low and safe risk area. Moreover, this result will be used as reference in conducting intervention.

*Corresponding author: sri.wiwoho@narotama.ac.id

2. Research Background

Study conducted by *Indonesia Sanitation Sector Development Program* (ISSDP) shows that 47% of Indonesian citizen are performing defecation in open area such as river, pool, field and other open area [6]. *Basic Human Services* (BHS) [7] reported that Indonesian people behaviour concerning washing hand are as follow: (i) after defecation 12%, (ii) after cleaning defecation of baby or children 9%, (iii) before meal 14%, (iv) before feeding baby 7%, and (v) before preparing meal 6 % [7]. Around 11.5 billion or 18.88% house hold in Indonesia do not possess latrine or conducting defecation open free [8].

Washing hand using soap able to decrease diarrhea issue around 45%, meanwhile improvement of sanitation access able to decrease diarrhea around 32% [9]. Moreover, behavior in managing clean water able to decrease 39% of diarrhea issue. When those three intervention habits applied regularly it will decrease around 94% of diarrhea issue. Data of mapping area of environmental health risk in Surabaya as follow: high risk area (18%), medium (22%), low (45%) and safe area (14%) [10]. Conducted further research which show data of mapping area of environmental health risk in Surabaya as follow: There are 9 villages or 5,84% that regarded as less risk area (Index 1), there are 67 villages or 43,51% regarded as medium risk area (index 2), there are 61 villages or 39,61% regarded as high risk area (index 3), and 17 villages or 11,04% regarded as very high risk area (index 4) [11]. High risk area is a slum settlement in coast area, downstream river area, and surround water territorials that have high population density. Meanwhile, safe area is a settlement which arranged coupled with supported with good sanitation facility and it has low density population.

Further study show that domestic waste water management is determined by the household based on regulation that is implemented by the government [12]. Disposal facilities that mentioned in the regulation are *off-site* system that used in *condominial* [13-15] or *on-site* system such as VIP toilet, closet, and ecological sanitation (eco-san) toilet [16-17]. Although ending process of those systems will be processed in final dumping site [18].

SDGs are abbreviations or stands for sustainable development goals, namely a document that will become a reference in the framework of development and negotiation in the countries of the world. The SDGs concept continues the development concept of the Millennium Development Goals (MDGs) where the concept has ended in 2015. So, the development framework related to changing the world situation which originally used the concept of MGDs is now replaced by SDGs.

Following up on the success achieved by the Millennium Development Goals (MDGs), which are guided by global development efforts over the period 2000-2015, governments of countries in the world are negotiating a set of Sustainable Development Goals (SDGs) for the period 2015 - 2030. The MDGs will continue efforts to alleviate poverty, and add challenges to ensure equitable development and environmental sustainability, especially the main targets to minimize the dangers of human-caused climate change. But will a new set of goals be useful to drive the shift from the dangerous business-as-usual path towards real sustain-able development in the world, Can the UN goals make a difference.

There are a number of important reasons for setting goals. First, an important goal for social mobilization. This world needs to be directed towards one direction to eradicate poverty or help achieve sustainable development, but it will be very difficult to do in complex, different, separate, crowded, crowded, easily transferable situations, and often overwhelmed in order to support consistent efforts to achieve goals together. Adopting global goals will help individuals, institutions, and governments around the world to agree on these directions and essentially focus on things that truly benefit our future. The second function with the aim is to create peer pressure. By adopting the MDGs, every step taken by political leaders to alleviate poverty will always be questioned, both in public and in private. A third reason that shows the importance of having a goal is to spur epistemic communities - networks of expertise, knowledge and practice - towards actions to overcome the difficulties of sustainable development. When solid goals have been established, a group of knowledge and practice will rise together to recommend a practical path to achieving results. Finally, the goal can be to mobilize a network of stakeholders. Community leaders, politicians, ministries, the scientific community, prominent non-governmental organizations, religious groups, international institutions, donor agencies and foundations will all be compelled to join the common goal. This multi-stakeholder process is very important to address complex challenges in sustainable development and efforts to fight poverty, hunger and disease.

Along with the remarkable progress achieved by the world with the MDGs, we can find ways to realize the SDGs. Despite the cynicism, confusion, and obstructive politics that emerge amid efforts to eradicate poverty, inequality and environmental degradation, new breakthroughs are still possible, large powers in the world may appear unresponsive, but they can change. Ideas have influence. The idea of being able to influence public policy is far greater and faster than what detractors expect. One effort that will be carried out to support the achievement of the Sustainable Development Goals target is the Evaluation of Environmental Health Risk Assessment as an effort to achieve the 2020 Sustainable Development Goals (SDGs).

SDGs (Sustainable Development Goals) are new developments program that drive change towards sustainable development through mutual agreement in the general assembly of the United Nations (UN) based on human rights and equality to encourage social, economic and environ-mental development. On September 25-27 2015 a large meeting was held at the UN forum in New York which was attended by 193 countries and was issued at the beginning of October 21, 2015 until 2030, with the agenda of "Transforming Our World: The 2030 Agenda for Sustainable Development". With the publication of the SDGs, it is expected to be able to provide innovations in addressing development challenges, as well as the achievements of the previous Millennium Development Goals (MDGs) program. The SDGs carry 5 fundamental principles that balance the economic, social and environmental dimensions, namely 1) People, 2) Planet, 3) Prosperity, 4) Peace, and 5) Partnership.

SDGs are an ongoing program, in which it has 17 objectives with 169 measured targets up to a predetermined time limit. Sustainable waste management is one of the program tar-gets among these 169 targets, where a sustainable waste

management target refers to the 6th goal. The 6th goal of the SDGs program is to ensure the availability and management of sustainable water and sanitation. One of the fundamental changes triggered by the SDGs is the principle of "no one is left behind". Which means that the SDGs strongly apply equality without any gaps to achieve social and economic balance. The striking differences between the development of the MDGs and the development of the SDGs are as follows:

Table 1 - The Striking Differences Between of the MDGs and the SDGs

MDGs in 2000–2015	SDGs in 2015–2030
50 percent The target and objective are half: halving poverty. Targets that are too minimal. Many countries have already reached it	**100 percent** The targets and targets are all, fully and completely. Ending poverty, 100 percent of the population has birth certificates, focus needed, to embrace those who are located furthest and outermost.
From developed countries, to developing countries The MDGs assume that poor and developing countries have homework. Meanwhile developed countries support with provision.	**Universally Applied** SDGs view all countries as having homework. Every country must overcome it. Each country must work together to find funding sources and policy changes that are needed.
From Top-Bottom The MDG documents are formulated by the elite of the United Nations and the OECD, in New York, without going through a process of consultation or meetings and citizen surveys.	**From Bottom-Top and participative** SDGs documents are formulated by joint teams, with meetings and face-to-face interviews in more than 100 countries, and citizen surveys.
Partial or patchy solution The 8 goals of the MDGs are mostly dealing only with the symptoms of poverty. Ecological and environmental problems are not recognized. Inequality does not get attention. Likewise with the matter of tax and development financing	**A comprehensive solution** Contains 17 goals that attempt to overhaul structures and systems • Gender equality • Governance • Changes in consumption and production models • Changes in the taxation system • Admittedly the problem of inequality • Recognized urban problems

In its program, the Sustainable Development Goals (SDGs) themselves have universal shared goals that are able to maintain the balance of the three dimensions of sustainable development, which are environmental, social and economic.

3. Research Methodology

3.1 Research Area

Research area that is used in the present study is Surabaya city, East Java Province which is located 7º 9’ – 7º 21’ south latitude, and 112º 36’ – 112º 57’ east longitude, with wide of the mainland around 33.048 Ha (330,048 km2) and approximately 19.039 Ha for the ocean wide.

3.2 Topographic Condition

Most of the City of Surabaya topographically has a height of land between 0-10 meters (80.72%) which spreads to the east, north, south and downtown. In coastal areas the height ranges from 1-3 meters above sea level. In other areas it has a height of 10-20 meters and 20 meters above sea level which is generally found in the western part of the city, namely in the Villages of Pakal, Lakarsantri, Sambikerep and Tandes.

3.3 Population and Sampling

The present study uses field study in which the primary data will be analyzed toward Study of Environmental Health Risk Assessment (EHRA). Result of EHRA provides factual and scientific data about sanitation service in society (households in scale of district or city). Moreover, secondary data will be taken from numerous institution related to sanitation or health service.

Population of EHRA uses in the present study is 1.554 neighbourhoods which consist of approximately 755.914 households [19], therefore sample of the present study is head of the family. Furthermore, primary sampling of the present study is neighbourhoods in which mother and married daughter around 18 to 60 years old as the respondent. Determination of sample is highly related to determination of study area amount within the present study, therefore study

areas for the present research are conducted in 154 villages in which the number of respondents will representing the district. Moreover, EHRA requires 40 respondents as the minimum number. Meanwhile, total number of neighbourhoods each district are 8 as the minimum number and 5 households will be selected as the respondent for each neighbourhood. Therefore total respondents in each district are 40 households.

4. Results and Discussion

The evaluation of the Environmental Health Risk Assessment as an effort to Achieve the 2020 Sustainable Development Goals (SDGs) for the Sanitation Sector was carried out using the results of the EHRA Study analysis (access to clean water, waste water access, solid waste access, drain-age and Clean and Healthy Behavior), secondary data analysis access to clean water, the number of poor families, latrine access and overcrowding), which results in the form of an Environmental Health Risk Assessment map as an effort to Achieve the 2020 Sanitation Sustainable Development Goals (SDGs) and starting in 2014 until 2017.

The achievement of SDGs are classified into 4 categories as follow: Score 1 (low), Score 2 (moderate), Score 3 (high) and Score 4 (very high). Calculation of SDGs achievement is resulted by counting all respondents answer related to variable and research indicators. The calculation result will be scored in order to gain minimum and maximum value. Score range will be counted based on minimum and maximum value to determine interval as the limitation value. Complete result of the research can be seen on the Table 2. Table 2 especially for the achievement of the sanitation sector if implemented in the map of the city of Surabaya can be seen in Fig. 1.

Table 2 - Villages achievement based on SDGs in drinking water and sanitation sector

Indicator	Achievements			
	Very High (Score 4)	High (Score 3)	Moderate (Score 2)	Low (Score 1)
Drinking Water	132	17	3	2
Domestic Wastewater	101	44	4	5
Solid Waste	126	23	3	2
Drainage	114	29	8	3

Fig. 1 - Surabaya City Achievement in the Field of Sanitation

4.1 Less Risk

The sanitation risk index (IRS) with a less risk category is 6%, meaning that as many as 6% of the 31 villages and 154 urban villages in Surabaya are less at risk; Water sources (unprotected water sources, use of unprotected water sources, and scarcity of water, domestic wastewater (septic tanks are suspected of being unsafe, pollution due to disposal of septic tank contents, and pollution due to SPAL), Waste (waste management, frequency of garbage transportation, timeliness of garbage transportation, and processing of local waste), the presence of puddles, and healthy living behavior (CTPS at five important times, are the floors and walls of the latrine free of feces, are the toilets free of cockroaches and flies? there is soap in or near the latrine, pollution in water storage and handling container, and BABS behavior), secondary data (direct cash assistance, population density, PDAMs and latrines), and SKPD perceptions.

4.2 Moderate Risk

The sanitation risk index (IRS) with a medium risk category is 47%, meaning that as many as 47% of the 31 villages and 154 urban villages in Surabaya are less at risk; Water sources (unprotected water sources, use of unprotected water sources, and scarcity of water, domestic wastewater (septic tanks are suspected of being unsafe, pollution due to disposal of septic tank contents, and pollution due to SPAL), Waste (waste management, frequency of garbage transportation, timeliness of garbage transportation, and processing of local waste), the presence of puddles, and healthy living behavior (CTPS at five important times, are the floors and walls of the latrine free of feces, are the toilets free of cockroaches and flies, there is soap in or near the latrine, pollution in water storage and handling container, and BABS behavior), secondary data (direct cash assistance, population density, PDAMs and latrines), and SKPD perceptions.

4.3 High Risk

The sanitation risk index (IRS) with a medium risk category is 34%, meaning that as many as 34% of 31 villages and 154 urban villages in Surabaya are less at risk; Water sources (unprotected water sources, use of unprotected water sources, and scarcity of water, domestic wastewater (septic tanks are suspected of being unsafe, pollution due to disposal of septic tank contents, and pollution due to SPAL), Waste (waste management, frequency of garbage transportation, timeliness of garbage transportation, and processing of local waste), the presence of puddles, and - healthy living behavior.

4.4 Very High Risk

The sanitation risk index (IRS) with a medium risk category is 13%, meaning that as many as 13% of the 31 villages and 154 urban villages in Surabaya are less at risk; Water sources (unprotected water sources, use of unprotected water sources, and scarcity of water, domestic wastewater (septic tanks are suspected of being unsafe, pollution due to disposal of septic tank contents, and pollution due to SPAL), Waste (waste management, frequency of garbage transportation, timeliness of garbage transportation, and processing of local waste), the presence of puddles, and healthy living behavior. Villages of Tembok Dukuh, Si-dodadi, Tambakrejo, Perak Timur, Pegirikan, Sidotopo, Kemayoran, Perak Barat, Tanah Kalikedinding, Sidotopo Wetan, Bulak Ban teng, Kedung Cowek, Bulak, Petemon, Ngagel, Ngagel Rejo, Sawunggaling, Tambaksari, Pacar Kembang, and Manukan Kulon.

4.5 Access of Drinking Water

Table 2 show that achievement of SDGs in sanitation sector in Surabaya reach 96.75% in which it can be regarded as a great result since there are only 2 villages that included as low achievement. Reduction of environment quality degree (clean water access) stimulate the occurrence of disease. This reduction commonly triggered by numerous factors related to development and success of clean water access such as financial, institutional, technical aspect and political issue [18].

Improvement of drinking water coupled with sanitation access such as clean, reasonable, and adequate reflect firm quality of society in handling issues concerning health problems. This statement is supported by WHO which stated that access of clean water and sanitation are essential in supporting health degree, life viability, development and improvement. Access of drinking water and sanitation play important role toward productivity, health, economic condition and quality of society in order to decrease numerous issues about poverty and health [20]. Further achievements for drinking water in Surabaya City as in Fig. 2.

4.6 Access of Domestic Wastewater

One major issue related to clean and healthy behavior of the society is concerning high number of defecations open free habit. This habit stimulates endemic diseases in which this habit is mainly caused by poverty and hygiene condition. Further study stated that this habit is also supported by less priority of development in waste water sector which make this issue become serious problem that is faced by Surabaya. The study mentioned above shows that there are 5 villages in Surabaya that regarded as very high risk in regard to access of waste water. Further study shows that 14 % Surabaya people performing defecation open free. This data is in line with national survey that there 12.5% people in Surabaya performing defecation open free. Further achievements for domestic waste water in Surabaya City as in Fig. 3.

4.7 Access of Solid Waste

Disposal of garbage is an essential indicator in the present study. Study shows that Surabaya concerns about solid waste since it is only 2 villages in Surabaya that regarded as low achievement concerning solid waste. Overall, Surabaya achieves 96.75% target of sustainable disposal management. Furthermore, research show that Surabaya (84% of villages in Surabaya) able to decrease solid waste issue mainly about solid waste. Further achievements for solid waste in Surabaya City as in Fig. 4.

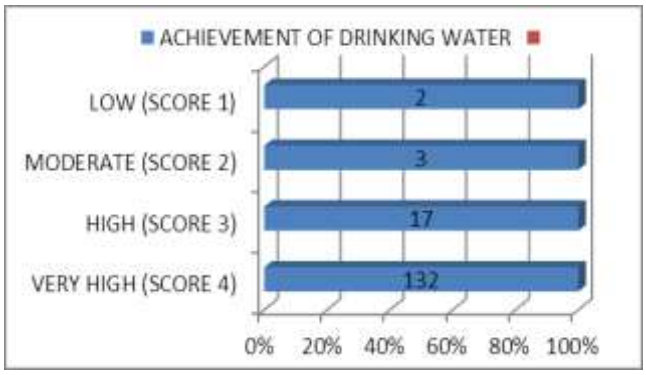

Fig. 2 - Achievement of Drinking Water

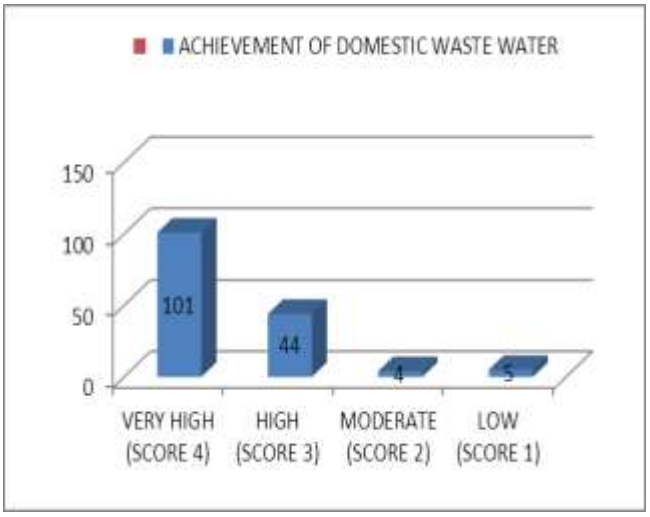

Fig. 3 - Achievement of Domestic Waste Water

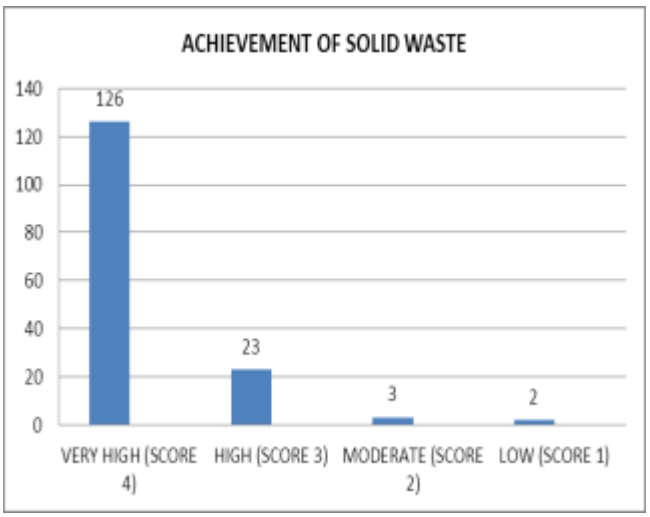

Fig. 4 - Achievement of Solid Waste

4.8 Access of Drainage

Concerning drainage, Surabaya still have 3 villages that regarded as very high risk area. Overall, Surabaya able to achieve 92.86% target of sustainable drainage management. Further achievements for drainage in Surabaya City as in Fig. 5. Clear description about SDGs achievement in Surabaya can be seen below Fig. 6.

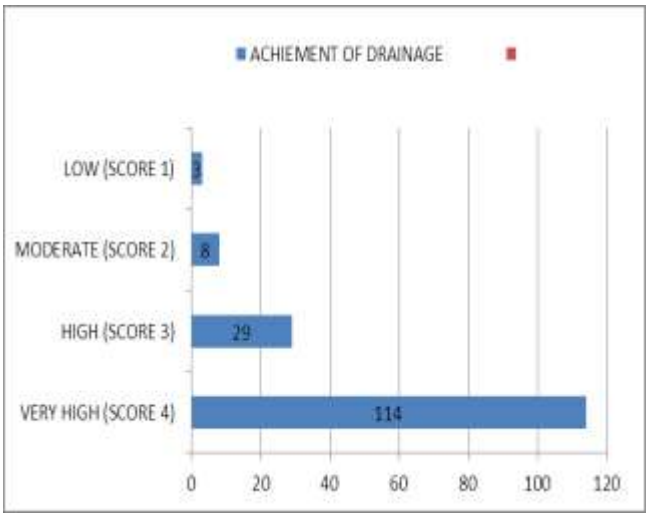

Fig. 5 - Achievement of Drainage

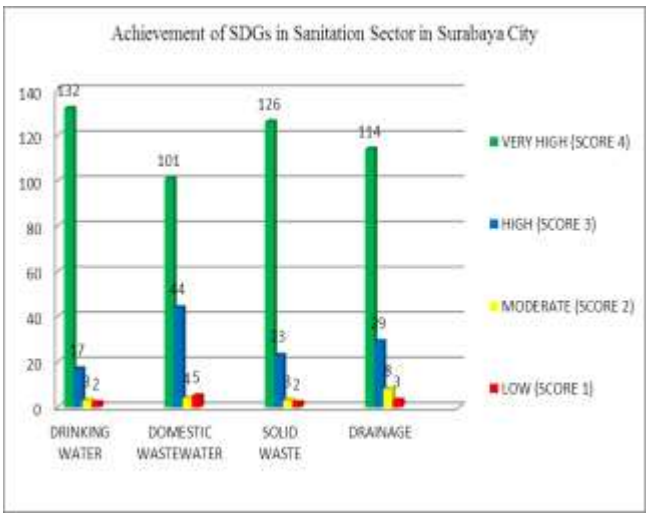

Fig. 6 - Achievement of SDGs in Sanitation Sector in Surabaya City

5. Summary

Based on the description describe above, it can be concluded that: Surabaya achieves 96.75 % target of Clean Water Access, Surabaya achieves 94.14% target of Waste Water Access, Surabaya achieves 96.75% target of Garbage Disposal, and Surabaya achieves 92.86% target of Drainage Access. Surabaya achieves 95.125% target of SDGs on 2020.

Acknowledgement

Thanks to the Ministry of Research, Technology, and Higher Education and Coordination of Private University Region VII which has funded this research and provided full support in conducting the present study.

References

[1] Proyek Penyediaan Air Bersih dan Sanitasi Pedesaan di Nusa Tenggara Timur (ProAir) (2011). Kerjasama Bilateral Bilateral Pemerintah Republik Indonesia dengan Pemerintah Republik Federal Jerman.
[2] Sanitasi Total Berbasis Masyarakat (2008). Departemen Kesehatan Republik Indonesia, Jakarta.
[3] Dinas Pekerjaan Umum Cipta Karya dan Tata Ruang – Provinsi Jawa Timur (2015). Rencana Kerja – PU Cipta Karya dan Tata Ruang.
[4] Mara, D., Lane, J., Scott, B., & Trouba, D. (2010). Sanitation and Health. Plos.
[5] Carter, R. C. (1999). Impact and sustainability of community water supply and sanitation programmes in developing country. Journal of the Chartered Institution of Water and Environmental Management, 13, 292-296.
[6] Indonesia Sanitation Sector Development Program (2006). Lessons in Urban Sanitation, Water and Sanitation Program. World Bank.
[7] Basic Human Services (2006). Survey Rumah Tangga Tentang Perilaku Kesehatan Ibu dan Anak serta Pola Pencairan-Pengobatan di Tingkat Masyarakat. Departemen Kesehatan Republik Indonesia dan Pusat Penelitian Kesehatan, Universitas Indonesia.

[8] Biro Pusat Statistik (2011). Sensus Penduduk Tahun 2010. Jakarta.
[9] World Health Organization (2003). The World Health Survey Programme, Geneva.
[10] Santosa, F. R. E, & Hermana, J. (2012). Mapping of environmental health risk area for Surabaya City as An Evaluation of Millenium Development Goals 2015. International Journal of Academic Research, 4, 168-170.
[11] Santosa, F. R. E. (2016). Profil Sanitasi Wilayah untuk Penentuan Sistem Air Limbah Domestik (Studi Kasus: Kota Surabaya). Dissertation.
[12] Mara, D., & Alabaster, G. (2008). A New Paradigm for Low-cost Urban Water.
[13] Neder, K. D., & Nazareth, P. (1998). Condominial Sewer Systems for the Federal.
[14] Mara, D., Sleigh, A., &Tayler, K. (2001). PC-based simplified sewer design. Plas Medicine, 7, 1-7.
[15] Sarmento, V. (2001). Low Cost Sanitation Improvements in Poor Communities. University of Leeds, United Kingdom.
[16] Mara, D. (1996). Low-Cost Urban Sanitation. John Wiley and Sons, Chichester.
[17] Winblad, U., & Simpson-Hebert, M. (2004). Ecological Sanitation. Stockholm Environment Institute, Sweden.
[18] Lenton, R., & Wright. A. (2004). Achieving the Mil-lennium Development Goals for Water and Sanita-tion: What Will It Take? Interim Full Report, Task Force on Water and Sanitation Millennium Project.
[19] Statistic Bureau of Surabaya City (2010). Surabaya City in Figures. Surabaya, Indonesia.
[20] Manda, M. A. Z. (2009).Water and Sanitation in urban Malawi: Can the Millenium Development Goals be met? Study of informal settlements in three cities. Human Settlements Working Paper Series, Int. Institute for Environemnet and Development, London.