The integrating of zero waste principles from national to local regulations: Case study of Banda Aceh, Indonesia

To cite this article: M Nizar et al 2018 IOP Conf. Ser.: Earth Environ. Sci. 216 012043

View the article online for updates and enhancements.
The integrating of zero waste principles from national to local regulations: Case study of Banda Aceh, Indonesia

M Nizar¹,², E Munir³, Irvan⁴*, V Waller⁵
¹Department of Natural Resource Management and Environment, Universitas Sumatera Utara, Medan
²Environmental Engineering Department, Universitas Serambi Mekkah, Banda Aceh
³Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Medan
⁴Chemical Engineering Department, Universitas Sumatera Utara, Medan
⁵Centre for Urban Transitions, Faculty of Health, Arts and Design, Swinburne University of Technology
*Email: irvan@usu.ac.id

Abstract. Garbage disposal to landfill is a waste of limited natural resources. The concept of upstream waste management to minimize waste dumped into a landfill is called Zero Waste. A number of cities in the world have successfully applied this concept and have demonstrated that it can save the limited natural resources. The application of the concept of Zero Waste needs a proper policy. Both Indonesia and the city of Banda Aceh have waste management policies which contain Zero Waste principles. In this paper, we argue that the city regulation is more detailed compared to the national regulation which could result in better waste management in terms of waste reduction. These include waste separation and avoidance, extended producer responsibility, pay as you throw scheme, community recycling centers and the provision of incentives and disincentives. The purpose of this paper is to examine how Zero Waste principles have been integrated into the policies at the national and Banda Aceh levels. The researchers conducted in-depth interviews with waste experts including academics, government officers, and waste activists, as well as regulations reviews. This paper recommended that Banda Aceh develop more regulations incorporating Zero Waste principles.

1. Introduction
The finite nature of non-renewable resources forces people to think hard about how to save the remaining natural resources. Zero Waste management system (ZW) becomes one of the holistic solutions used to sustainably manage waste and resources in a city [1]. ZW management ensures that waste items can be recycled, recovered or naturally degrade without polluting the environment. As a safeguard in the ZW concept, optimal utilization of natural resources is conducted with minimal environmental degradation [2].

The recycling rate in a country cannot be determined by the income of its population. Figure 1 shows the recycling rates in a number of countries where there is no clear relationship between the recycling rate and the incomes of the population. There are developed countries with high recycling rates but there are also developed countries with low recycling rates. Developing countries also have a good recycling rate of garbage between 20%-40% [3]. Cities are, however, increasing their waste generation so it is important that we see them as a living ecosystem with a "closed-loop" management cycle as shown in Figure 2.
Figure 1. Average recycling rates for 39 cities by income level [3]

Figure 2. Material flow rate in a Zero Waste city [4]

The ZW concept refuses incinerators and landfills and tries to bring an end to the throwaway society, instead creating sustainable communities. This sounds like a very utopian concept, but Indonesia can make it happen within a certain period of time. In Indonesia, we do not expect to reach ZW next year, but we can plan to be much closer to Zero Waste by 2020 [5]. Waste management is always one of the most challenging aspects in managing a city. The quality of waste services is one of the indicators of good governance of the city. Avoidance of waste is, in particular, a top priority. In Indonesia, however, the waste management sector is getting less attention than other urban issues [6].

A number of major cities in the world such as Adelaide, San Francisco and Stockholm have claimed to be Zero Waste cities and they are trying to reach the targets set and become the first cities to implement ZW [7]. Canberra has become the first metropolis in the world that successfully achieved the ZW target [8] [9]. Palmer [10] was the first to use the term Zero Waste in 1973 to describe the recovery of resources from chemical waste. The ZW concept continues to grow, not stopping just at recycling. It also restructures the product design to prevent the emergence of waste in
the early stages [11]. Figure 3 shows the ZW city's principles that, if implemented properly, can turn a city into a ZW city.

![Diagram of the principles for turning the city into Zero Waste](image)

**Figure 3.** The principles for turning the city into Zero Waste [7]

This change requires a holistic set of strategies based on the principles of development. Education and research place the top spot of the ZW hierarchy. The next place is the transformation of industrial design through practices such as cradle-to-cradle design, eco-design or net production combined with the principle of Extended Producer Responsibility (EPR). Products designed in these ways can be easily recycled, so achieving maximum recycling and recovery of resources is possible in the long run. It is also important to have specific Zero Depletion legislation and incentive policies as part of environmental policy.

However, there is no single strategy that can solve the current garbage problem. A holistic approach to managing municipal solid waste and long-term sustainability concept is needed to seriously design the city of Zero Waste. Understanding of both the local context and the global market situation will enable maximum adaptation of ZW. If waste generation levels rise as predicted through ‘business as usual’, a lot of materials will need to be drawn from the garbage stream to meet higher targets [12]. Also important is early intervention through well-designed education in order to change the behaviors that perpetuate the throwaway society [13].

### 1.1. Waste management in Indonesia

In early May 2008, Government of Indonesia passed Law No. 18 of 2008 regarding Waste Management, making it part of the national legal framework. The government of each district and city as well as private sector organisations appointed to manage waste at the regional and provincial levels are required to improve their services so that landfills are entirely environmentally friendly. In addition, local governments are required to close all open dumping sites within a maximum period of 5 years (until 2013). Within the same time frame, a new landfill must be built to replace the old open dumping site. Construction of the new landfill must use the Sanitary Landfill system in accordance with applicable standards and regulations [14].

This situation is a challenge but it also offers the potential to better manage municipal solid waste. The potential and challenges in MWM in Indonesia are shown in Table 1.
Table 1. Potential and challenges in waste management in Indonesia

| Potential | Challenges |
|-----------|------------|
| 1. Waste Act No. 18/2008 accommodates a greater role for local government | 1. Enactment of Law No. 18/2008, forces local governments to propose plans and implementations to close open dumping no later than 1 year and 5 years from the enactment of the Waste Law (May 2008) |
| 2. Community participation has been indirect. This can be improved through direct involvement, for example in waste separation | 2. Developers of landfill are required to build waste separation facilities |
| 3. Incentive and disincentive scheme which is included in the Waste Act could encourage the enforcement of law | 3. The target to achieve the MDGs in the community waste sector is 70% in year 2015 |
| 4. Recycling policies in 3R can increase the potential for waste reduction, waste recovery and profit | 4. Low community awareness in separating waste |
| 5. Waste with high organic content is a main source for composting | 5. Low priority in local authorities’ allocation annual finances |
| 6. The projected increase in plastic consumption has the potential to achieve waste added value as it may become the raw material for recycling plants and incinerators in the future | 6. Low participation from the non-public sector |

7. Lack of waste infrastructure
8. Despite the enactment of the Waste Act, there is no policy on solid waste management and most of the municipal waste is solid waste

Source: Mediana & Gamse [15]

1.2. Banda Aceh waste management

Banda Aceh is the capital of Aceh province with 250,303 inhabitants and a population growth rate of 0.32% in 2015. The city produces 180 tons of waste daily or 720 m3/day with each person producing an average of 0.58 kg/day [16].

The shares of organic, paper and plastic waste produced throughout Banda Aceh were 89.1%, 2.5%, and 0.74% respectively. The weight of garbage produced throughout Banda Aceh is 8,605.764 tons/month which produces carbon emission of 837,266 tons/month. Municipal waste management is still carried out in a conventional manner, namely collecting garbage, transporting it and disposing of it in an open dumping site. Trash is transported by truck to the open dumping site in Gampong Jawa, which is about 10 kilometers from downtown.

Most of the garbage arriving at the landfill is just dumped although some of it is sorted and taken by cleaning officers and scavengers for sale and recycling. Since 2014, Gampong Jawa open dump has had an Intermediate Treatment Facility (ITF) which is a waste treatment facility aimed at reducing the amount of waste before entering the open dump. ITF will process organic waste into electricity and compost [17].

Gampong Jawa landfill has exceeded its capacity, so Blang Bintang Regional Landfill has been built in the Aceh Besar District. In the future, Gampong Jawa landfill will be used as a waste sorting station [18]. Banda Aceh city government has implemented a waste avoidance program by imposing charges for plastic bags and establishing community recycling centers [19].

2. Materials and Methods

This paper uses a qualitative method to analyze waste policy in Banda Aceh. The policy will be analyzed from the Zero Waste perspective by comparing between the Law of the Republic of
Indonesia Number 18 of 2008 on Waste Management (Waste Act), Qanun Kota Banda Aceh Number 5 of 2003 on Cleanliness and Beauty (local old regulation) and Qanun Kota Banda Aceh Number 1 of 2017 on Waste Management (local regulation).

Policies analyzed are those concerning waste separation, waste avoidance, producer responsibility (extended producer responsibility/EPR), waste payment according to the amount of waste disposed (pay as you throw), waste management by the community as well as the incentives and disincentives.

3. Results and Discussion

3.1. National and Banda Aceh waste policy

Banda Aceh has had a waste policy before there was any at the national level. The following Table 3 shows a comparison of the structure between the Law of the Republic of Indonesia Number 18 of 2008 on Waste Management (UU No. 18), Qanun Kota Banda Aceh Number 5 of 2003 on Cleanliness and Beauty (Qanun No.5) and Qanun Kota Banda Aceh Number 1 of 2017 on Waste Management (Qanun No. 1).

| No. | Description | Qanun No. 5 | UU No.18 | Qanun No. 1 |
|-----|-------------|-------------|----------|-------------|
| 1.  | Chapter     | 9           | 18       | 19          |
| 2.  | Article     | 20          | 49       | 42          |
| 3.  | Clause      | 30          | 99       | 117         |
| 4.  | Applied     | February 14, 2003 | May 7, 2008 | July 3, 2018 |

Although it had a simple structure, the Qanun governing waste was ratified in Banda Aceh before the Waste Law was passed at the national level. The establishment of the Waste Law at the national level was triggered by a landslide at the landfill site located in Bantar Gebang that killed people in 2000 [20].

3.2. Sorting waste

Sorting waste is necessary to prevent unnecessary waste generation. Table 3 shows the policies related to waste sorting enclosed in both the law and qanun.

| No. | Regulation               | Sorting Waste                                      |
|-----|--------------------------|----------------------------------------------------|
| 1.  | Qanun Banda Aceh No.5/2003 | NA                                                 |
| 2.  | Waste Law No.18/2008     | Article 13, Article 16, Article 19, Article 22, Article 45 |
| 3.  | Qanun Banda Aceh No.1/2017 | Article 6, Article 9, Article 10, Article 11, Article 12, Article 13 |

From Table 3, it can be seen that Qanun No.5 does not contain a single article concerning sorting of waste. Meanwhile, the Waste Law and Qanun No.1 has included articles on waste sorting. The Waste Law contains 5 articles related to temporary sorting and Qanun No.1 contains 8 articles. This means that Qanun No.1 Banda Aceh is more comprehensive in regulating waste sorting.

Separation of waste has become a major concern in the waste policies, but in practice the sorting has not been carried out properly. Observation around the city of Banda Aceh reveals that different types of waste are mixed in the sorting containers and a lot of it dumped not in the designated containers.

3.3. Waste avoidance

Qanun No. 1 is more advanced because it has explicitly mentioned the handling of plastic waste sources. Table 4 shows articles related to waste avoidance both in national and city regulation.
Table 4. Waste avoidance in national and Banda Aceh policies

| No. | Regulation                  | Waste Avoidance          |
|-----|-----------------------------|--------------------------|
| 1   | Qanun Banda Aceh No.5/2003  | NA                       |
| 2   | Waste Law No.18/2008        | Article 20               |
| 3   | Qanun Banda Aceh No.1/2017  | Article 7, Article 8     |

Qanun No. 1 cites restrictions on the use of plastic bags in shopping places such as supermarkets, malls, stores and other waste sources, as well as restrictions on paper waste generation in public and private offices. Supermarkets, malls, shops, and other business places that provide plastic bags to consumers must use environmentally friendly plastic bags.

Qanun No. 1 was authorized in early 2017. It previously had been published in the Decree of the Ministry of Environment and Forestry Directorate General of Waste Management, Waste and Hazardous and Toxic Substances Number: S.1230/PSLB3-PS/2016 on Pricing and Mechanism of the Paid Plastic Bags Implementation. This memorandum contains the restrictions on the use of plastic bags by consumers where they have to pay a minimum of Rp.200 for each plastic bag [21].

Meanwhile, the Waste Law only normatively mentions the limitation of waste generation without mentioning any specific regulations.

3.4. Extended producer responsibility

The responsibility of producers, known by the term Extended Producer Responsibility (EPR), requires the producers to manage the waste they produce in a continuous program. This is so important that it needs to be included in the policies at both national and provincial levels. Table 5 compares the EPR enclosed in the three policies. In Table 5, it can be seen that Qanun No. 5 does not contain anything about EPR while the Waste Law and Qanun No.1 have EPR as a similar priority but with a significant difference. The Waste Act lists producer obligation to provide a label or a sign related to waste reduction and handling on packaging and/or product. Qanun No. 1 rules that the producers (factories and/or sole distributors) based in Banda Aceh must contribute by paying a fee. Major industries responsible for the distribution of their products have branches of distributors in Banda Aceh so it is proper that this issue is raised in the Qanun No. 1 which can also be said to be derived from the Waste Law.

Table 5. Responsibility of producers in national and Banda Aceh policies

| No. | Regulation                  | Extended producer responsibility/EPR |
|-----|-----------------------------|--------------------------------------|
| 1   | Qanun Banda Aceh No.5/2003  | NA                                   |
| 2   | Waste Law No.18/2008        | Article 13, Article 14, Article 15   |
| 3   | Qanun Banda Aceh No.1/2017  | Article 24, Article 25               |

3.5. Pay as You Throw

Retribution (user charging) is a very important strategy for financing the waste management programs of a city. In addition to funding the programs, user charging can also help to control the amount of waste produced. Ideally the more waste is disposed of, the more charges are paid by the public. This scheme, when combined with good infrastructure to separate the different wastes and recognize good citizens, can improve the performance of recycling [23]. Unfortunately, the policies at both national and Banda Aceh levels (Qanun No. 5 and Qanun No. 1) do not include this formula either explicitly or implicitly.

The municipal government of Banda Aceh requires that people receiving waste services pay a fee based on the size or type of the building in accordance with Qanun Kota Banda Aceh Number 5 of 2017 on Retribution Service of Waste/Cleanliness [22]. Table 6 shows the fees for recipients of
Banda Aceh garbage service.

Table 6. Tariff for recipients of Banda Aceh waste service

| No | Retribution Type | Object Building/Unit Size | Main Road & Downtown | Sub-main Road & Village Area |
|----|------------------|---------------------------|----------------------|-----------------------------|
| 1. | House            | >150 m²                   | 20,000,-             | 20,000,-                    |
|    |                  | 36–150 m²                 | 15,000,-             | 15,000,-                    |
|    |                  | <36                       | 10,000,-             | 10,000,-                    |
| 2. | Shop             | >64m²                     | 25,000,-             | 20,000,-                    |
|    |                  | 48-64m²                   | 20,000,-             | 15,000,-                    |
|    |                  | <48m²                     | 15,000,-             | 10,000,-                    |
| 3. | Restaurant/Café shop | >200m²                 | 80,000,-             | 80,000,-                    |
|    |                  | 100 - 200m²               | 60,000,-             | 60,000,-                    |
|    |                  | 65 – 100 m²               | 45,000,-             | 45,000,-                    |
|    |                  | 48 – 64 m²                | 35,000,-             | 35,000,-                    |
|    |                  | < 48 m²                   | 30,000,-             | 30,000,-                    |
| 4. | Hotel /motel / Boarding | 5 stars               | 800,000,-            | 800,000,-                   |
|    |                  | 4 stars                   | 650,000,-            | 650,000,-                   |
|    |                  | 3 stars                   | 450,000,-            | 450,000,-                   |
|    |                  | 2 stars                   | 350,000,-            | 350,000,-                   |
|    |                  | 1 stars                   | 300,000,-            | 300,000,-                   |
|    |                  | Melati Motel Boarding     | 250,000,-            | 250,000,-                   |
|    |                  |                           | 150,000,-            | 150,000,-                   |
| 5. | School / Madrasah | > 1000 students           | 250,000,-            | 250,000,-                   |
|    |                  | 500 - 1000 students       | 200,000,-            | 200,000,-                   |
|    |                  | 200 - 500 students        | 150,000,-            | 150,000,-                   |
|    |                  | 100 - 200 students        | 75,000,-             | 75,000,-                    |
|    |                  | < 100 students            | 40,000,-             | 40,000,-                    |

Source: DPRK Banda Aceh [22]

The retribution payments as regulated by the Qanun above do not take into consideration the different amounts of waste disposed of by recipients. It could be that a service recipient who produces a large amount of waste pays less than the other recipient who produces a small amount of waste, thus creating an unfair situation.

3.6. Community Waste Management

Waste management by the public or community plays an important role in waste management based on the Zero Waste concept. Community waste management can prevent materials ending up in landfills because the actual materials are not treated as waste but are processed into other useful objects. Waste management sites that are easy to access by communities provide an opportunity for people to change their "junk" into useful objects again. Table 7. shows the national and Banda Aceh policies which include community recycling.

Table 7. Community waste recycling center

| No. | Regulation        | Community Waste Management |
|-----|-------------------|----------------------------|
| 1.  | Qanun Banda Aceh No.5/2003 | NA                         |
| 2.  | Waste Law No.18/2008 Article 6 , Article 28 |
| 3.  | Qanun Banda Aceh No.1/2017 Article 33 , Article 15, Article 16 |

Both Waste Law and Qanun No.1 concern waste management by the community while
Qanun No. 5 does not address the issue all. Both policies that implicitly and explicitly implicate the community's waste management encourage people to manage their own waste. Qanun No. 1 explicitly states that the municipal government is obliged to conduct community facilitation in the 3R program namely reducing, reusing and recycling waste. In addition, the municipality is also obliged to foster and facilitate the Integrated Waste Management Site owned by the community or private sectors.

The city of Banda Aceh has 5 community waste recycling centers, namely Alue Deyah Tengoh, Deyah Geulumpang (this system is called Waste Collecting Point/WCP), Lambung, Gampong Jawa and Punge (these are called TPS3R), 4 village waste banks and 35 school waste banks [19].

The city government of Banda Aceh has a legal basis for establishing the WCP, namely the Mayor Regulation Number 7 of 2017 on Guidelines for the Implementation of Community-Based Waste Management With Waste Collecting Point System [24].

3.7. Provision of incentive and disincentive
Providing incentives or awarding sanctions in the form of disincentives is commonplace in the Zero Waste approach. This initiative is taken in order to encourage the parties concerned to do waste processing that can reduce the amount of waste disposed to landfill. In addition, this also demonstrates the government’s support for waste management. Table 8 shows the articles that contain both schemes in the three policies.

| No. | Regulation | Incentives and Disincentives |
|-----|------------|------------------------------|
| 1.  | Qanun Banda Aceh No.5/2003 | NA |
| 2.  | Waste Law No.18/2008 | Article 21 |
| 3.  | Qanun Banda Aceh No.1/2017 | Article 34 |

Qanun No.1 has more details about the provision of incentives and disincentives to support waste management. Rewards and sanctions are given not only in the form of money but also in terms of granting facilities, tax deductibility and so on. The incentive is first offered to the community then should there be any violation, the incentives are revoked or turned into a disincentive. However, from the results of interviews with a number of parties, this scheme has not been implemented by the city government of Banda Aceh [25].

4. Conclusion
Qanun No. 5 of 2003 did not contain the principles of Zero Waste. This Qanun only comprises directives about the cleanliness and beauty of the city of Banda Aceh. Waste Law and Qanun No. 1 have included a number of directives as the basis for the application of the Zero Waste concept. However, there is still a shortcoming in terms of the retribution payment imposed on waste disposal service recipients. There is a need for a fair retribution system which involves payment based on the amount of waste disposed. Qanun No. 1 is more advanced than the Waste Law because it has explicitly imposed restrictions on the use of plastic bags in shopping centers. 4. The municipal government of Banda Aceh should be prepared to implement the strategies enclosed in the Qanun of Waste Management in order to achieve the goals of Zero Waste.

5. References
[1] Zaman A U, Lehmann S 2011 What is the ‘Zero Waste City’Concept? http://w3. unisa. edu. Au/artarchitecturedesign/ZeroWasteSAR esearchCentre/docs/ZWC% 20Concept
[2] Zaman A U 2014 Ecological Indicators 36 682–693
[3] Wilson D C 2015 Global Waste Management Outlook United Nations Environment Programme
[4] Girardet H 1992 The Gaia Atlas of Cities: New Directions for Sustainable Urban Living London, UK: Gaia Books
[5] Connett P 2007 Zero Waste: A Key Move Towards A Sustainable Society Canton New York, USA
[6] Africa P S 2010 Solid Waste Management in the World’s Cities p 30
[7] Zaman A U, Lehmann S 2013 Journal of Cleaner Production 50 123–132
[8] Connett P 2013 The Zero Waste Solution Vermont: Chelsea Green Publishing
[9] Snow, Warren, Dickinson, and Julie 2003 The Road to Zero Waste: Strategies for Sustainable Communities Auckland
[10] Palmer P 2004 Getting to Zero Waste California: Purple Sky Press
[11] United Nations Economic Commission for Europe 2011 Climate Neutral Cities: How to Make Cities Less Energy and Carbon Intensive and More Resilient to Climatic Challenges http://www.unece.org/fileadmin/DAM/hlm/documents/Publications/climate.neutral.cities_e.pdf.
[12] Zaman A U 2014 Journal of Cleaner Production 66 407–409
[13] Pietzsch N, Luis J, Ribeiro D, de Medeiros J F 2017 Waste Management 67 324-353
[14] Undang-Undang Republik Indonesia Nomor 18 Tahun 2008 tentang Pengelolaan Sampah
[15] Meidiana C and Gamse T 2010 Development of Waste Management Practices in Indonesia,” European Journal of Scientific Research 40(2) 199–210
[16] Faisal M 2014 Jurnal Teknik Kimia 3(4) 6–11
[17] DK3 Banda Aceh 2014 DK3 Banda Aceh Mengadakan Pelatihan Operasional ITF (Intermediate Treatment Facility) http://www.acehprov.go.id/news/read/2014/07/02/1175/dk3-banda-aceh-mengadakan-pelatihan-operasional-itf-intermediate-treatment-facility.html.
[18] Hartati H, Zaki M, Fatimah E 2015 Analisis Manajemen Tempat Pemrosesan Akhir (TPA) Gampong Jawa Kota Banda Aceh Sebagai Stasiun Pemilahan Syiah Kuala
[19] DLHK3 Banda Aceh 2017 Profil DLHK3 Kota Banda Aceh Banda Aceh, Indonesia
[20] Anonymous 2017 Sri Bebassari, Ratu Sampah Dibalik Lahirnya UU Pengelolaan Sampah di Indonesia http://www.transformasi.org/id/pusat-kajian/berita/252-tokoh-perubahan/2668-sri-bebassari-ratu-sampah-dibalik-lahirnya-uu-pengelolaan-sampah-di-indonesia.
[21] Kementerian Lingkungan Hidup dan Kehutanan 2016 Surat Edaran Kementerian Lingkungan Hidup dan Kehutanan Direktorat Jenderal Pengelolaan Sampah, Limbah dan Bahan Berbahaya dan Beracun Nomor: S.1230/PSLB3-PS/2016 tentang Harga dan Mekanisme Penerapan Kantong Plastik Berbayar Jakarta, Indonesia
[22] DPRK Banda Aceh 2017 Qanun Kota Banda Aceh Nomor 5 Tahun 2017 Tentang Retribusi Pelayanan Persampahan/Kebersihan Banda Aceh, Indonesia
[23] Morlok J, Schoenberger H, Styles D, Galvez-Martos J, Zeschmar-Lahl B 2017 Resources 6 8
[24] Pemko Banda Aceh 2017 Peraturan Walikota Banda Aceh Nomor 7 Tahun 2017 Tentang Pedoman Pelaksanaan Pengelolaan Sampah Berbasis Masyarakat Dengan Sistem Waste Collecting Point Banda Aceh, Indonesia
[25] Irwansyah I, Syahputra M, Nadir, and Bakri G 2017 Indepth interview on Waste Community Banda Aceh, Indonesia