

Waste Engineering and Management

Proceeding

SIBE-2009

The 1st International Conference on Sustainable Infrastructure and Built Environment in Developing Countries

SABUGA ITB, Bandung - Indonesia
2nd - 3rd November 2009

Published by
Faculty of Civil and Environmental Engineering
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SIBE 2009 published eight (8) volumes of proceeding as following :

Volume A : Structure and Material
Volume B : Transportation System and Engineering
Volume C : Water Engineering and Management
Volume D : Waste Engineering and Management
Volume E : Ocean Engineering
Volume F : Construction Management
Volume G : Geotechnical Engineering
Volume H : Environmental Proiection and Management

PREFACE

The 1st International Conference on Sustainable Infrastructure and Built Environment in Developing Countries (SIBE) 2009 is aimed to provide a forum to discuss and disseminate recent advance in scientific research, technology, and management approach to obtain better environment quality.

Infrastructure that provides the basic need of a society and sustainable infrastructure system are essential for the survival, health and well-being of a society. In developing countries, civil and environmental engineers are at the epicenter in seeking means to enhance the quality of human life through modernization of infrastructure as evidenced by provision of shelters, water, and transport, amongst others. The current rate of urbanization and industrialization raises a number of environmental issues, often resulting in environmental mismanagement, especially in developing countries. The problems are further aggravated by environmental degradation such as soil erosion, depletion of water resources, etc. In order to meet these multifaceted challenges, proper planning followed by implementation and verification must be exercised, via an integrated, multi disciplinary and holistic approach.

The conference will provide an opportunity for professionals and researchers to learn, share and exchange about the latest development and research in civil and environmental engineering. The scope of the conference covers all aspect of civil and environmental engineering practices.

Participants of the conference include researchers, academic staffs, students, industries, public and local governments. The keynote presentations during the conference are as follows:

Keynote speakers:

- **Indonesian Government Representative**
  Minister of Public Works, Indonesia
- **Dr. Puti Farida Marzuki**
  Dean of the Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia
- **Dr. Tony Liu**
  National Taiwan University, Taiwan
- **Prof. Shunji Kanie**
  Hokkaido University, Japan
- **Prof. Syunsuke Ikeda**
  Tokyo Institute of Technology (AUN/SEED-Net), Japan.

Invited speakers:

- **Dr. Setiawan Wangsaatmaja**
  Environmental Protection Agency of West Java Province, Indonesia
- **Dr. Edwan Kardena**
  Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia
- **Prof. Harianto Rahardjo, Ph.D.**
  School of Civil and Environmental Engineering, Nanyang Technological University, Singapore
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  Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia
- **Prof. Nakasaki Kiyohiko**
  Tokyo Institute of Technology, Japan.

The objectives of this conference are:

1. To provide a platform for exchange of ideas, information and experiences among academics, researchers, consultants, engineers, manufacturers and post graduate scholars in civil and environmental engineering.
2. To discuss and evaluate the latest approaches, innovative technologies, policies and new directions in infrastructure development, pollution prevention and eco-friendly technologies adapted to developing countries.
3. To promote cooperation and networking amongst practitioners and researchers involved in addressing infrastructure and built environment issues.

The oral and poster presentations are subdivided into 8 major sections, as following:

A. Structure and material
B. Transportation system and engineering
C. Water engineering and management
D. Waste engineering and management
E. Ocean engineering
F. Construction management
G. Geotechnical engineering
H. Environmental protection and management.

There are 174 contributors in oral presentation and 36 contributors for poster presentation.

Finaly, the Organizing Committee wishes that this conference is able to provide beneficial scientific information to the participants and other concerned readers.

Bandung, November 2009
Organizing Committee

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CONTENT

International Conference on Sustainable Infrastructure and Built Environment in Developing Countries
November, 2-3, 2009, Bandung, West Java, Indonesia
ISBN 978-979-98278-2-1

Study of the Criteria Assessment in the Implementation of Packaging Waste Management System Related to Integrated Product Policy and Extended Producer Responsibility

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Abstract
The European Union introduced the Packaging and Packaging Waste Management Directive in 1994 which emerged due to the generation of packaging waste as part of the product. The Member States implemented this directive in different systems of compliances. Concurrent with the development of this system, the concept of Extended Producer Responsibility (EPR) emerges. The development of PWMS and EPR in conjunction with the changes of approach from stages-based (focusing on one part of product lifecycle) to product-based (focusing on every part of product lifecycle) stimulates the establishment of the Integrated Product Policy (IPP) directive. The IPP directive is also considered as a new initiative from the European Union based on the concept of EPR. This research focuses on the position of the existing Packaging Waste Management System in a conceptual framework and how it can be improved to fit into the implementation of Integrated Product Policy. The three conceptions were described and analyzed by using explanation building analysis and were integrated into one single framework to set up the position of PWMS in IPP within a conceptual framework and also developed the assessment criteria to be used for evaluating the implementation of The PWMS in Member States. The data were derived from documentation and archival records which were carried out from the text books, reports, studies / articles and original websites. The result of the literature research shows the result that basically, IPP gives a framework for integration of instruments to improve resource efficiency and reduce environmental impact of goods and services throughout product life cycle. In the conceptual framework, PWMS could be considered as one part of measures in IPP implementation. Another result of this analysis was the assessment criteria for case studies; they are legal basis, system of compliances, distribution of responsibility and monitoring aspects.

Keywords: assessment criteria, explanation building analysis, extended producer responsibility, integrated product policy, Packaging Waste Management.

1. Introduction

The developed countries have been aware of packaging waste problems. They had realized that they were generating tonnes of packaging waste every year. According to the Environment and Heritage service (intern.EHSNI, 2007), United Kingdom generated 10 million tonnes of packaging waste which ended up in landfills; one third of 66 millions of solid waste (2007) in Canada is packaging waste (intern. CIWMB, 2007). To cope with this kind of trend in the waste stream, they developed different measures to manage the packaging waste. They see it as a challenge within the development of a prevention system and start to involve stakeholders in it. The European Union (EU) has already introduced a Packaging and

Packaging Waste Directive to cope with this problem. The member states have transposed this directive into their own regulation with different measures. The introduction and implementation of this system had attracted many researches aiming to improve its effectiveness and efficiency. There were only a few researches that concentrate on using the qualitative criteria to evaluate and improve the system.

Apart from the packaging waste, there is one concept of instrument called the Extended Producer Responsibility (EPR). This concept is really related to product, waste and responsibility in the supply chain. There are many kinds of terminologies in the implementation of this concept, but the main idea is to encourage stakeholders in the supply chain to be responsible for the collection and handling the product throughout its lifecycle, particularly, at the end of its life. In some countries the concept of EPR are being integrated with the packaging waste management system. EPR helps to define the responsibility of each stakeholder in the system. The main point of integrating the EPR in relation to the packaging waste management is concern on shared or non-shared responsibility among stakeholders in the packaging supply chain. In the EU, there are some member states that include this kind of concept. The integration of these concepts in EU is not explicitly defined in the system, but the Member States try to make a new initiative based on this concept. In EU the concept of EPR is being introduced as Integrated Product Policy (IPP). IPP is a preventive approach. It still formed as a draft of policy that will be introduced to "*... control the environmental pollution by looking at the impacts which individual products will have on the environment along their supply chain throughout their lifetime*" (Malcolm, 2005). It assessed the environmental impact of the product in each stage to achieve a "greening" of products. This policy stated about waste, which as follow: "*Waste volumes are predicted to continue rising unless remedial action is taken. Waste prevention will be a key element of an integrated policy approach*" (Malcolm, 2005)". This policy is also a means to control and manage product waste, including the packaging itself. The EU is still preparing this concept and is trying to introduce it to its member states.

2. Materials and Methods

This research started with the literature review about the packaging waste management system, the extended producer responsibility and the integrated product policy using academic sources including text books, articles and reports from governments and agencies. The similarities and differences between three concepts in the conceptual framework were analyzed to gain some criteria. This assessment was based on the description of process and best practices of implementation of the existing concepts. The compatible analysis in assessing this part used the explanation building. According to Yin, 2003, p.120, this analysis is mainly relevant to explanatory case study since this part describes and explains three concepts and develops ideas to be used in assessing the case study.

3. Results and Discussion

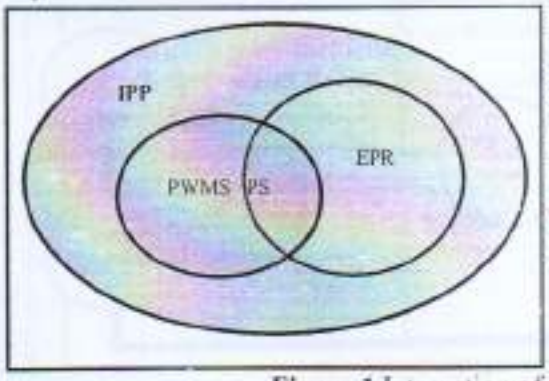
Based on Table 1, the scope in principle, objective, object, measures and responsibility of Integrated Product Policy seems to be wider than others. Integrated Product Policy introduces the precautionary and prevention principle. Meanwhile the other three uses the polluter pays principle. The scope of IPP have a wider scope of priority in prevention and tries to prevent the generation of waste, while the others seems to inject the principle of end of pipe, not preventing the waste but managing it. Based on the object to manage, the IPP try to reduce the environmental impact from the product in every phase of its entire life-cycle while the other three still focus on the packaging, as being a part of product. EPR concept in ideal way concerns about the product, but in practices it still focuses only on the waste.

Based on the distribution of responsibility, IPP introduces the responsibility that should be taken by each actor involved in the system in every phase of life cycle of the product. The others focus on putting the burden in industries as a priority even in the implementation some responsibility is being shared with other stakeholders.

Table 1 Packaging Waste Management System, Extended Producer Responsibility and Integrated Product Policy

No.	Criteria	Packaging Waste Management System	Extended Producer Responsibility	Packaging Stewardship	Integrated Product Policy
1	Principles	Polluter Pays Principle	Polluter Pays Principles	Polluter Pays Principle	Precautionary and Pollution Prevention
2	Objective	to harmonize national measures concerning the management of packaging and packaging waste in order to : - to prevent any impact thereof on the environment or to reduce such impact, - providing a high level of environmental protection, - to ensure the functioning of the internal market - to avoid obstacles to trade and distortion and restriction of competition within the Community	to reach an environmental objective of a decreased environmental impact of a product, by making the manufacturer of a product responsibility for the entire life cycle of the product and especially for the take back, recycling and final disposal of the product	to reduce the environmental impact in the ways that "the packaging they introduce to the market place has a minimal impact on the environment; that their packaging recognizes the hierarchy of source reduction, reuse and recycling, in support of general resource conservation; that their packaging recognizes and incorporates full-cost pricing	to improve the resource efficiency and reduce the environmental impact of the final consumption of goods and services
3	Object	Packaging	Product	Packaging	Product including its packaging
4	Target	Quantitative : recycling and recovery Qualitative : prevention program	Qualitative : administrative instrument	Similar with PWMS	Target has not established
4	Measures	Voluntary Agreement, Environmental Charges, Command and Control Regulation	Until now there is not any measure in implementing this concept as a whole.	Voluntary Agreement, Environmental Charges, Command and Control Regulation	1. Measures aimed at reducing and managing waste generated by the 2. Measures targeted at the innovation of more environmentally-sound product. 3. Measures to create markets for more 4. Measures for transmitting information 5. Measures which allocate responsibility for managing the environmental burden of product systems
5	Responsibility of Industries	They have to be responsible for the impact of their packaging from its production, sorting, collecting, reprocessing until its disposal to the environment.	The producer have to be responsible for the impact of their products to the environment throughout its lifecycle	The producer have to be responsible for the impact of the packaging of their products to the environment throughout its lifecycle	All actors that involved in the chain have to be responsible in every phase of products lifecycle. Industry is one part of the system that needs to be responsible.

The measures and instruments which need to take into consideration in the IPP consist of some building blocks. Every building block refers to a different objective which involves many kinds of instruments to be used. This shows the complexity of the IPP. Based on those analysis the connection between those three concepts can be illustrated in Figure 1.



IPP:
Integrated Product Policy
PWMS:
Packaging Waste Management System
PS:
Packaging Stewardship
EPR:
Extended Producer Responsibility

Figure 1 Integration of PWMS, EPR and IPP

Integrated product policy will act as an umbrella for other concepts since it has a scope of products within its entire lifecycle, and puts the responsibility to all stakeholders in the supply chain. The packaging waste management system will take part as one of the measures in implementing the IPP concept. The incision of two concepts between the packaging waste management and the extended producer responsibility is the packaging stewardship; which is the measure that mostly reflects the implementation of the EPR. The extended producer responsibility will be below the concept of integrated product policy, since it only focuses in putting the responsibility on the producer's hands and based on the polluter pays principle. The extended producer responsibility will take part as one of the measures involved in the integrated product policy.

In a conceptual frame the integrated product policy is aimed to reduce the environmental impact of a product throughout its entire lifecycle. The simple lifecycle of packaging as a product in relation with IPP building blocks can be seen in Figure 2. Based on this figure, position of existing packaging waste management system and extended producer responsibility can be explained. According to Ernst and Young, 1998, the building blocks for the implementation of integrated product policy consist of five aimed measures. Measure I, waste management includes 'packaging as a product' life cycle from consumption to the end of its lifecycle, as packaging waste. It is aimed to reduce and manage waste which generated from the consumption. Measure II, green product innovation is includes 'packaging as a product' lifecycle focusing in greening packaging product concept and design. Measure III, include life cycle in packaging design and its consumption since it is aimed in creating market for environmentally sound product and packaging. Measure IV focuses on the consumption part of packaging lifecycle, since it tries to alter customer's behaviour across the product system. Measure V includes all part of the life cycle since it is aimed to allocating responsibility to every stakeholder in supply chain from the design of packaging to the end of its life as a waste.

The position of packaging waste management system is within the Measure I: Waste Management. The exception of this position of the system is when it combined with extended producer responsibility, and then the packaging waste management will extend the scope of boundary on product life cycle to Measure V, allocating responsibility. The position of extended producer responsibility is already embedded in Measure V which tries to allocate the responsibility in managing the environmental burdens of product system. The limitation of this principle in practice so far is that the focus of its implementation is put in the end-of-life cycle of products. On the contrary to the packaging waste management, the extended producer responsibility is narrowing the scope of boundary on product life cycle from Measure V to the Measure I. The other limitation about the extended producer responsibility in practice is regarding the shared and non-shared responsibility within all stakeholders in the supply chain. The important thing to be concluded is that the integrated product policy in the European Union is being established in the basis of extended producer responsibility.

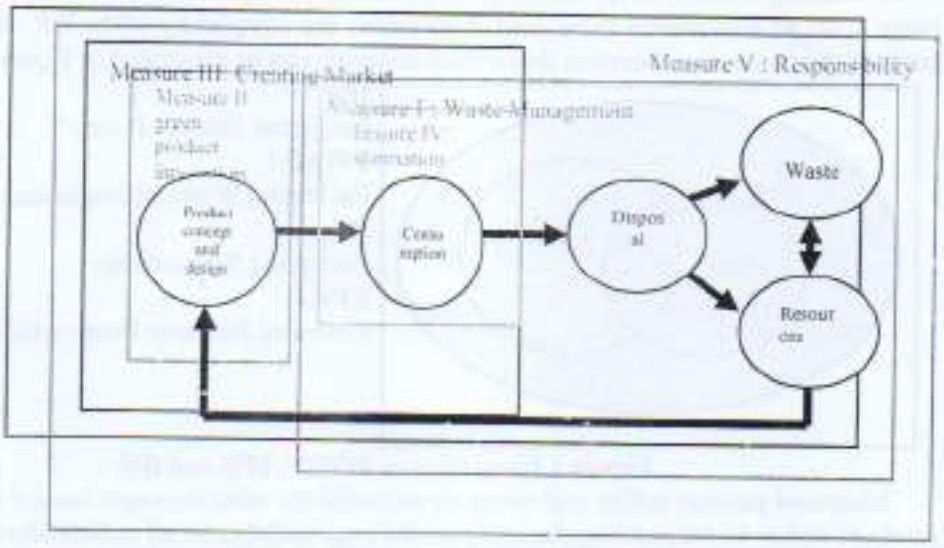


Figure 2 Product Life Cycle and Its Measure of IPP
Adjusted from Building Blocks Diagram, European Commission DG XI, March 1998 and Life Cycle Product Scheme, Commission of the European Union Community, 2001.

There is a similar symptom in introducing the new concept concerning the aim of reducing / mitigating the environmental impact due to the consumerism / economic activities. Many existing instruments which are being applied today are still not integrated and each of them acts as a singular event. The goals of integrated product policy is to try to make and set up the framework where the measures are combined together, without overlapping and conflicting each other, to mitigate the environment impact due to products in an effective way. IPP acts as an effective and integrated framework of other environmental measures regarding the life cycle of product.

One of the building blocks of IPP is about the waste management measures, and the packaging waste management is one of the instruments involved in this block. The European Commission gives a guideline for the implementation of the integrated product policy which concern about many kind of measure that can be introduced in achieving its objectives.
Some key factors that need to be considered in this process are as follows:

- The emphasis of measures in each member states due to its waste management
- The approaches in implementing the system
- The responsibility of stakeholders involved in the system
- Monitoring process to make sure the target and objective are being achieved

The Member States places the factors above differently, and the task of IPP as the framework is trying to integrate them to achieve its objectives in mitigating the environmental impact of product. It also challenges to extend the objectives to wider target as a part of the sustainability.

Integration of criteria which being used in studies for the evaluation of the implementation of packaging waste management emphasizes on the qualitative criteria. Main criteria are based on the process of compliance to the directive and divided into three big parts, which are: the set up, the process and the result. Each part consists of sub criteria which has a qualitative and quantitative characteristic. These sub criteria are linked to each other.

The set up process in transposing the directive is to conduct the life cycle assessment to set the hierarchy of packaging process. It also sets up the legal basis of the packaging waste management system. It includes the national target, specific provision as a quantitative target to be achieved; institutional arrangement and the distribution of responsibility as qualitative criteria. These are necessary process in achieving the target.

The setting up process discusses more about the link on how the responsibility is implied in the directive and being transposed in the regulation for packaging. The operation part in

implementing the system has to take into account the responsibilities stated in the Directive: that all stakeholders are responsible in taking care of the packaging waste within the spirit of shared responsibility and polluter pays principle. The sub criteria of the operation part give the qualitative arrangement of the system. The focuses on the responsibility implied on these criteria are: system of compliance, implemented measure, collection and recycling system, prevention, monitoring, acceptance and financing. Integration of criteria used in studies regarding the evaluation of packaging waste management system.

Based on the integration of:

- Key factors from the concept of IPP on the scheme of the existing implementation of the packaging waste management above, and
- Integration of criteria used in studies regarding the evaluation of packaging waste management system

It can be concluded that the key in the implementation of the system that can be used as a criteria to assess the case study are as follows:

1. Legal Basis which describe the national regulation that exists in each country with its development. It also describes about the approach and emphasizes on measures used in the packaging waste management.
2. System of Compliances which describe how the system works, the measures and instruments used and the description of implementation based on principle approach they used in packaging waste management system.
3. Distribution of Responsibility which can describe how the responsibility is being distributed is also specific for its implementation. This section will describe about stakeholders involved in the system and how they contribute their responsibility in it.
4. Monitoring which describe how the monitoring system is conducted and gives the current achievement of the target so far.

It is assumed that there are differences in these aspects in the compliances of the system in every Member States. The effectiveness of packaging waste management system can be improved by evaluating it using these aspects to find facts and to construct recommendations in improving the existing packaging waste management system. The recommendation will be used to effectively adjust the system in the implementation of integrated product policy.

4. Conclusion

Basically, IPP gives a framework for integration of instruments to improve resource efficiency and reduce environmental impact of goods and services throughout product life cycle. In the conceptual framework, PWMS could be considered as one part of measures in IPP implementation. Another result of this analysis was the assessment criteria for case studies; they are legal basis, system of compliances, distribution of responsibility and monitoring aspects

5. References

Bailey, Ian. 2003. New Environmental Policy Instruments in the European Union. Politics, Economics, and the Implementation of the Packaging Waste Directive. England. Ashgate Publishing Limited.

California Integrated Waste Management Board (CIWMB), Available at http://www.ciwmb.ca.gov/Packaging/, Consulted on April 2007

Ernst and Young, 2000, Developing the foundation for Integrated Product Policy in the European Union, DG Environment, European Commission.

European Commission DG XI, March 1998, Integrated Product Policy, Final Report, Ernst and Young, Sciences Policy Research Unit.

European Commission DGXI.E.3, 2001, European Commission DGXI.E.3. European Packaging Waste Management Systems, Main Report, ARGUS in association with ACR and Carl Bro als

European Environment Agency, 2005, Effectiveness of packaging waste management systems in selected countries: an EEA pilot study, EEA Report No 3, Copenhagen, EEA.

Jordan, Karin, J.Gonser, F.Rademaker, R.Jorgensen, 2001, European Commission DGXI.E.3. European Packaging Waste Management Systems, ARGUS in association with ACR and Carl Bro als

List, Dennis, 2006, a Quick Guide to Audience Research, Original Books, Wellington New Zealand.

Malcolm, Rosalind, 2005, Integrated Product Policy – a new regulatory paradigm for consumer society?, European Environmental Law Review.

Packaging Commission, October 2005, Packaging Commission, Annual Report 2004, Retrieved From Www.Svm-Pact.Nl/Upload/122105_8820_1135346148481-Annual_Report_2004.Doc -

Packaging Committee, October 2001, Annual Report 2000 Retrieved From Http://International.Vrom.Nl/Docs/Internationaal/Annual.Pdf, 12 August 2007

The Environment and Heritage service, Available at www.ehsni.gov.uk, Consulted on April 2007

Yin, Robert K., 2003, Case Study Research, Design and Methods, Third Edition, Applied Social Research Methods Series, California, Sage Publications, Inc.