Chapter 8

Policy Framework for International Collaboration Towards Sustainable Resource Circulation and Management in Asia

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1. Introduction

This chapter highlights the need for further bilateral and multilateral collaborative efforts to increase resource efficiency and sustainable resource management in developing Asia. In this chapter, the term "international collaboration" covers both bilateral and multilateral collaboration either at the regional level or in the context of global environmental cooperation in Asia.[1]

As Asia more or less functions as the "world's factory," there will be an increasingly greater need to utilize solid waste generated from used consumer products made of composite materials, hazardous industrial waste, and the by-products and solid waste from business establishments as resources. The potential for the recovery of metal resources, in particular, from the increasing number of waste electrical and electronic products has led to renewed interest from Asian countries on the 3R concept of reduce, reuse and recycle and the circulation of materials. This waste, it should be noted, contains a variety of substances that are characterized by both hazard and utility.

To develop sustainable circulation of materials in Asia, improved policy implementation capacity on the part of Asian developing countries is considered necessary to ensure sound waste treatment streams and the healthy commercialization of recycled

Key Messages

- Political support for a green economy is only one of the first steps for sustainable development. A political framework starting at the international level is needed for many sectors, in particular sustainable resource circulation and management, to avoid the risk of a global resource crisis.
- There is an increasing need to promote sustainable resource circulation and management as Asia is leading the increases in global resource demand as a major production centre.
- Priority challenges for developing countries related to institutional capacity, industrial capacity, and market stability have been identified to improve the operation (or governance) of 3R and materials circulation systems.
- Different countries face different challenges in the management of waste and materials. Programmes should be country-specific and reflect the level of economic development, recycling industry implementation capacity and enforcement of regulations in policies and actions.
- International policy collaboration is crucial to ensure coordination and harmonization, as unilateral or unstructured approaches may raise unintended economic and transboundary environmental outcomes. The quantitative modeling analysis conducted in this chapter supports this argument.
- Reflecting resource efficiency/productivity with pollution prevention measures to existing climate-related financial mechanisms and project appraisal by multilateral aid agencies would be a practical approach for international collaboration for sustainable resource management. An international fund is proposed to stimulate the evaluation of resource efficiency criteria to assist in socioeconomic development with a lower material burden and environmental pollution.

resources, as sustainable circulation embodies the two aspects of being both hazardous and useful at the same time. In the wider context of continuing economic growth and increasing resource demands in Asia, countries in Asia will urgently need to focus and invest more on integrating economic development and environmental conservation, and decoupling economic growth and resource use.

A recently published report by the United Nations Environmental Programme (UNEP) showed that the Asia-Pacific region has clearly shifted from a less resource intensive to a highly resource intensive economy (UNEP 2011a). Until the mid-1980s, per capita material consumption in the Asia-Pacific region was about one-third (four tonnes per capita) of the world average (about 13 tonnes per capita). However, in 2005, per capita material consumption in the region reached approximately nine tonnes per capita, almost the same level as the global average. This heralded a warning that material consumption in the Asia-Pacific region could triple by 2050 as compared with 2005 figures, under the business as usual (BAU) scenario. The UNEP report also observed that the amount of resources required to generate one unit of gross domestic product (GDP) in the Asia-Pacific region is on the rise, resulting in a shift towards a less resource efficient economy over the last two decades, indicating the need for more policy attention on promoting a resource efficient development pattern. This would not only be beneficial in terms of environmental objectives, but for economic competitiveness and sustainable economic development of the region as well as globally.

A report by the Asian Development Bank (ADB) and the Institute for Global Environmental Strategies (IGES) on resource efficiency outlined the multiple benefits of resource efficiency approaches for national economies (ADB and IGES 2008). The list includes solving local environmental problems, mitigating climate change, preserving natural capital, minimizing disposal costs, improving national competitiveness, developing new business opportunities, pursuing social benefits, ensuring energy security, and avoiding resource conflicts (ADB and IGES 2008). UNEP (2011a) also elaborated on the necessity of serious policy intervention and investment efforts to initiate innovation in social and economic systems so as to avoid regional crises associated with resource shortages. In this context, although the Green Economy—a low carbon, resource efficient, and social inclusive economy (UNEP 2011b)—can be an important policy slogan for this region to direct investment to synergize economic development and environmental conservation (in other words, expansion of markets for environmental technologies and products), serious policy attention is needed to promote international efforts to position sustainable resource circulation and management to avoid a resource crisis, looking as well to the global issues of climate change and the creation of a low carbon society. In other words, in the context of increasing resource demands and associated environmental impacts in Asia, increasing resource efficiency and decoupling of economic development and resource use would be an important focus for the transformation of socio-economic systems towards sustainable consumption and production, in addition to achieving a low carbon society.

Since the launch of the 3R Initiative in 2005, the Government of Japan and international organizations such as ADB, Organisation for Economic Co-operation and Development (OECD), United Nations Centre for Regional Development (UNCRD) and UNEP, as well as many bilateral aid agencies, have promoted various forms of assistance and conducted policy dialogues with a view to helping Asian countries develop more coherent waste management and 3R policies. Asian countries are also making serious efforts on their own to build and develop the legal frameworks and policies related to waste management and materials circulation.

Improving resource efficiency has always been a key objective of 3R promotion in Asia. Indeed, since 2005, key policy dialogues of the 3R Initiative in Asia including the Asia 3R Conference in November 2006, the 2nd Asia 3R Conference in March 2008, and the Inaugural Meeting of the Regional 3R Forum in Asia in November 2009, have continued to emphasize improved resource efficiency as a key objective of the 3R Initiative. These objectives go hand-in-hand with the globally advocated policy agenda of OECD's sustainable materials management (SMM), UNEP's sustainable resource management, and the concepts of green growth, green innovation, and green economy being widely discussed in the Rio+20 process.

While the development of legal frameworks and international cooperation for improving resource efficiency in Asia are moving forward, challenges remain with respect to policy implementation and systems operation, which can be categorized as governance issues. As well, it is increasingly being pointed out that the pursuit of resource efficiency alone cannot reduce the total environmental impact from industrial/production/consumption activities as discussed in Section 4 below. To achieve decoupling through sustainable consumption and production, it is necessary to consider policy packages that take the whole life cycles of resources, materials, products and wastes into consideration. Such material life cycles have expanded beyond national borders, which has led to the necessity of considering innovative, international collaborative measures to supplement and maximize the positive effects of domestic and local actions.

Based on the following flow of argument, this chapter discusses the future direction of international collaborative efforts for sustainable resource circulation/management in Asia, especially those of developed economies, which will need to gradually shift from a resource efficiency approach into "material reduction" or absolute decoupling.

First, we show that there has been significant progress in policy development for resource circulation and management in developing Asia both at the national and international level, and in particular, at the end-of-life stage of material and product use.

Second, by arguing the needs for developing Asia to promote further efficient use of resources and sound waste management, we identify four priority challenges related to institutional capacity, industrial capacity, and market stability to be addressed to improve the operation (or governance) of 3R and materials circulation systems in Asian countries. The limitations of resource efficiency approaches is noted, along with the need for strong policy intervention for material reduction or absolute decoupling, in particular to allow developed economies to form a model green economy, envisaging the urgent need of leapfrogging for sustainable resource management in the region.

Third, a phased approach for introducing policies for increasing resource efficiency according to developmental stage of recycling market and economy is briefly introduced. The issues surrounding a gradual shift of focus from end-of-life to the upper stream of production are discussed to initiate practical improvements for resource efficiency in developing Asia.

Finally, the potential benefits of international collaboration for sustainable resource circulation and management based on quantitative analysis are outlined. Policy recommendations are presented, including the establishment of an international fund for sustainable resource management, as one possible approach to institutionalise sustainable resource circulation and management, and maximize regional benefits for policy interventions in the region.

2. Progress in policy development for resource circulation and efficiency in Asia

As shown in Table 8.1, Asian countries began to emphasize 3R and materials circulation policies in the latter half of the 2000s. The significant progress in domestic policies is credited to increasing interest in recyclables as a cheaper alternative to virgin materials due to rapidly increasing resource prices, and environmental concerns from increasing product consumption, increasing waste generation, and environmentally-unsound waste management practices such as water and soil contamination from open dumping, air pollution from open burning, loss of life from landslides in waste dumping sites, and increasing public opposition to final treatment sites (Kojima, ed. 2008). Thus, governments in this region are under strong pressure to reduce wastes going to final treatment sites and to prevent environmental pollution resulting from recycling activities. At the same time, developed economies such Japan, Republic of Korea and Taiwan have increased exports of recyclable materials due to high resource demands in emerging economies such as China.

Against this background, national legal systems concerning the 3Rs, materials circulation, and international cooperation have been strengthened and are being promoted in Asia. For example, China have positioned the concept of a "circular economy" as one of the key concepts under its overall national development plans: both the 11th (2006-2010) and 12th (2011-2015) five-year development plans and framework law to promote the circular economy in 2009. As well, Japan proposed the launch of the 3R Initiative at the G8 Summit in 2004 to facilitate policy dialogue and international cooperation on the 3Rs. This international initiative was not limited to G8 countries, but is inclusive of developing Asian countries as well.

On the other hand, developing countries face increasingly complicated challenges with regard to the effective implementation and systems operation for resource circulation policies. For example, among the countries shown in Table 8.1, the authority and responsibility for municipal waste management, industrial hazardous waste management, and promotion of recycling policies are scattered among different governmental ministries, agencies and departments in China, Malaysia, Indonesia, Thailand, and Viet Nam.

Even countries with legislation for resource circulation may not be able to clearly identify proper business sectors and facilities carrying out the collection, management and recycling of recyclable resources due to the informal nature of recycling markets. This identification is necessary to ensure the proper implementation of related policies.

Table 8.1 Formulation of 3R and materials circulation policies in Asian countries

Japan	**Fundamental Law (2000) and Fundamental Plan (2003, revised in 2008) for Establishing Sound Material Cycle Society** Japan developed a framework law to give overall direction to the country's resource circulation policy by enacting a fundamental law for establishing a sound material cycle society. The Fundamental Plan sets targets and indicators to monitor the overall progress of Japan's Policy for Sound Material Cycle Society, including those related to resource efficiency. It also specifies the expected roles to be played by different stakeholders.
	Product-specific recycling legislation Based on the concept of Extended Producer Responsibility (EPR), Japan developed five product-specific recycling laws: Container and Packaging Recycling Law (1995, revised in 2006), Electric Home Appliance Recycling Law (1998), Construction Material Recycling Law (2000), Food Waste Recycling Law (2000, revised in 2007), and End-of-life Vehicle Recycling Law (2002).

Japan	**Eco-town programme**[i] From 1997 to 2007, the eco-town programme was jointly implemented by the Ministry of the Environment (MOEJ) and the Ministry of Economy, Trade and Industry (METI) as a subsidy programme for local planning to develop recycling businesses or facilities. The programme generated a recycling capacity of 5.89 million tonnes and contributed to 20% of the average annual increase in national recycling capacity.
China[ii]	**Circular Economy Promotion Law** (enacted in January 2009) The advancement of a circular economy has been established as a major policy task.
	Rules on the Administration of the Recovery and Disposal of Discarded Electronic and Electrical Products (promulgated in 2009, effective in 2011) These rules tightened the management of waste electronic products.
	Eco-Areas Approx. 50 areas (provinces, cities, towns) were designated as model Eco-Areas. Twenty model cities were designated for the promotion of a local level circular economy (as of February 2011).
Malaysia[iii]	**2007 Solid Waste and Public Cleaning Management Act** (2007) Responsibility for solid waste management was transferred from local governments to the central government and the 3R principles were introduced. This Act encourages the privatization of waste management.
	The Five-year Plan "Malaysia 2011 - 2015" The Five-year Plan calls for a raise in the rate of resource recovery from household waste from 15 to 25% by 2015.
Philippines[iv]	**Ecological Solid Waste Management Act** (2001) This Act introduced the 3R principles. All municipalities were required to achieve 25% diversion of solid waste (recycling and reduction) by 2006. The recycling rate in Manila was 33% in 2010.
	National Solid Waste Management Commission (inaugurated in 2001) This body coordinates the ministries and other related parties at the national level to improve solid waste management.
	National Framework Plan for the Informal Waste Sector in Solid Waste Management in the Philippines (2009) This framework plan was established as a result of support for the formulation of a 3R national strategy. It features an action plan to improve the conditions of the informal sector engaged in solid waste management.
Republic of Korea[v]	**Green Growth National Strategy** The Republic of Korea has set the concept of "Green Growth" as its national strategy, which also includes the following key terms: "Mitigation of Climate Change and Energy Independence," "Creation of New Engine of Economic Growth," and "Improvement of Quality of Life and Enhancement of International Standing."
	Reduction and recycling of food waste This strategy resulted in an increase in recycling rates (1997=9.8%, 2000=45.1%, 2007=92.2%), and prolonged the remaining useful life of landfill sites from seven to 11 years.
	Volume-based municipal waste charges As a result of these charges, the per capita solid waste generation declined 26% in the 13 years from 1994 to 2007.
	Extended producer responsibility system This system raises the recycling rate of used products (waste home appliances, end-of-life vehicles) covered by the EPR system.
Thailand[vi]	**Take-back programme for used products** The take-back programme began with containers and packaging, used lead-acid batteries, mobile phones and batteries, in cooperation with manufacturers and retailers. Fluorescent lamps have also been included in cooperation with the Japan External Trade Organization (JETRO).
	Initiation of a recycling-oriented society This programme resulted in the implementation of the 3Rs in more than 200 communities. In some communities, a 30 to 50% reduction or more in waste generation was achieved.

Thailand[vi]	**Industries Waste Exchange Program** This programme registered over 450 firms by 2005.
Viet Nam[vii]	**3R-related laws and policies** Under the 2005 Law on Environmental Protection, 14 decisions were newly taken related to the 3Rs and solid waste management, including Decree No. 57 on integrated solid waste management in 2007 and Decision No. 1440 on the planning of solid waste management in three central economic regions by 2020 in 2008.
	3R National Strategy (approved by the Prime Minister) This strategy sets targets for the year 2020: 30% recycling of collected waste; 30% separation-at-source rate for households and 70% for firms.
Taiwan[viii]	**Resource Recycling Fund** Currently, ad valorem fees are collected from firms for 14 kinds of recyclable products and are pooled in the Fund. Recycling operators and treatment contractors become entitled to a subsidy from the Fund if they conform to environmental and quality standards. The Fund is also used to adjust for any volatility in the recycling market.

Notes: [i] For the effects of the eco-town programme, see METI's report: (http://www.meti.go.jp/policy/policy_management/14fy-jigohyouka/14fy-5.pdf)

[ii] See the official website of the Sino-Japan Friendship Centre for Environmental Protection (http://www.china-epc.cn /japan/CNE/CNE.htm). For model Eco-Areas in China, see: http://kjs.mep.gov.cn/stgysfyq/m/200807/t20080718_125900.htm

[iii] For Malaysia's 2007 Solid Waste and Public Cleaning Management Act, see: http://faolex.fao.org/docs/texts/mal74261.doc. For solid waste targets in Malaysia's Five-Year Plan 2011- 2015, see Charts 6 - 16 in Chapter 6: http://www.epu.gov.my/html/themes/epu/html/RMKE10/img/pdf/en/chapt6.pdf.

[iv] See: http://emb.gov.ph/nswmc/pdf/iec/R.A.%209003.PDF. The recycling rate in Manila is based on presentation materials from the Executive Director of Philippine's National Solid Waste Management Commission, as presented at the Second Meeting of the Regional 3R Forum in Asia held in October 2010 in Kuala Lumpur, Malaysia. http://www.uncrd.or.jp/env/3r_02/presentations/BG2/2-5%20Philippines-2nd-3R-Forum.pdf
For National Solid Waste Management Commission, see: http://emb.gov.ph/nswmc/Default.aspx. National Framework Plan for the Informal Waste Sector in Solid Waste Management in the Philippines, see: http://www.3rkh.net/3rkh/files/Final_IS_Report_07152009_(NSWMC)_.pdf.

[v] Presentation by a delegate of Korea to the October 2006 meeting of the Regional 3R Forum in Asia: http://www.env.go.jp/recycle/3r/en/asia/02_03-3/09.pdf and the official website of Korea's Ministry of Environment http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol_rec_pol_rec_food http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol_rec_pol_system

[vi] For take-back programme for used products, see: http://www.uncrd.or.jp/env/3r_02/presentations/BG1/RT1_04_Thailand_rev.pdf. For initiation of a recycling-oriented society, see: http://www.chem.unep.ch/mercury/Sector-Specific-Information/Docs/waste/S1_10_Thailand.pdf. For Industries Waste Exchange Program, see: http://infofile.pcd.go.th/waste/waste_Thai3RsPortfolio.pdf?CFID=3567354&CFTOKEN=18170873.

[vii] For 3R-related laws and policies, see UNCRD, UNEP/RRCAP, and IGES: National 3R Strategy Development—A Progress report on seven countries in Asia from 2005 to 2009— (IGES 2009), and http://www.uncrd.or.jp/env/3r_02/presentations/BG1/1-5%20Vietnam.pdf. For 3R National Strategy, see: http://www.moc.gov.vn/site/moc/cms?cmd=4&portionId=88&articleId=38547&portalSiteId=6&language=en_US

[viii] Interview with an official of the Taiwan Resource Recycling Fund, conducted by the author in December 2010.

Source: IGES (2011).

Along with the efforts by the Government of Japan under the 3R Initiative launched in 2005 as well as international collaborative efforts, a number of policy dialogues and project-based initiatives have emerged since the mid-2000s to facilitate international collaboration for sustainable resource circulation and management. Table 8.2 presents an outline of the major international cooperation programmes and frameworks in Asia, or where Asian countries are actively involved, that have been established to address the international issues of waste management and recycling, as well as the need for capacity development of each country. At the core of these programmes and frameworks are the various policy dialogues and international cooperation measures that were triggered by the 3R Initiative. Asian countries are thus engaged in regular information exchange and discussions on waste and recycling issues, as well as resource efficiency questions from a regional perspective. However, with the exception of policy dialogues and bilateral technical cooperation, more concrete mechanisms, including financial incentives, have yet to be developed. Another critical issue of concern is the lack of technologies and the lack of access to or slow pace of diffusion of required 3R technologies in line with the 3R laws and policies enacted by developing countries in Asia.

Table 8.2 Selected international cooperation programmes on 3R and materials circulation policies

Regional 3R Forum in Asia[i]	Inaugurated in November 2009, this regional forum holds periodic policy dialogues, promotes 3R projects in collaboration with donor organizations, and cooperates with 3R research networks, among other activities. The Tokyo 3R Statement agreed upon by Asian countries at the inaugural Regional 3R Forum provides the necessary political and institutional framework for the promotion of the 3Rs in Asia.
TEMM and policy dialogues on the 3R/circular economy[ii]	Following an agreement at the Tripartite Environment Ministers Meeting among Korea, China and Japan (TEMM), working-level officials of the three countries meet every year to exchange information at seminars and from time to time, and conduct bilateral policy dialogues on wastes/recycling and the 3R/circular economy. The sharing and exchange of information are thus progressing at the working level.
Asian Network for Prevention of Illegal Transboundary Movement of Hazardous Wastes[iii]	Officials of Asian countries in charge of the Basel Convention meet to form a network for information sharing among countries. The network has been active since 2004.
Asia Pacific E-Waste Project[iv]	The pivotal role played by the Basel Convention Secretariat is to build up an E-waste inventory, offer training and hold local workshops in Asian countries.
Partnership on Computing Equipment (PACE)	The Partnership for Action on Computing Equipment (PACE) was established at COP9 of the Basel Convention in 2008 to tackle the management of obsolete and used computers. PACE brings together the Secretariat of the Basel Convention, industries (through several industry associations) and civil society to establish methods to divert used and obsolete computers away from land disposal and burning into commercial recovery operations.
Thematic Working Group on Solid and Hazardous Waste of the Regional Forum on Environment and Health in South-East and East Asian Countries[v]	WHO and UNEP serve as the secretariat of the Regional Forum on Environment and Health in South-East and East Asian Countries. Under its umbrella, government officials and experts gather and analyse the best practices and challenges concerning urban waste and medical waste.
UNEP International Panel for Sustainable Resource Management[vi]	UNEP launched this international panel in November 2007, inviting world-renowned scientists and experts. The panel collects the latest information on sustainable resource management and is building a knowledge base on the use of natural resources and environmental impacts, in addition to developing policy recommendations.

Notes: [i] http://www.uncrd.or.jp/env/spc/regional_3r_forum.htm
[ii] http://www.env.go.jp/earth/coop/temm/project/3r.html
[iii] http://www.env.go.jp/en/recycle/asian_net/
[iv] http://www.env.go.jp/recycle/3r/en/asia/02_03-4/02.pdf
[v] http://www.environment-health.asia/twg.cfm?themeid=3
[vi] http://www.unep.fr/scp/rpanel/

Source: IGES (2011).

3. Priority challenges for developing Asia: Increasing resource efficiency and policy implementation

In parallel with this progress in sustainable resource management both domestically and regionally, it is becoming increasingly clear that there are governance challenges to be addressed in relation to the implementation of pertinent policies and the effective application of systems and programmes. Important policy documents such as the Singapore Recommendations agreed at the 3rd Regional 3R Forum in Asia in October 2011 and submitted to the Rio+20 Process by the Government of Singapore, for example, shows that policy makers are well aware of these challenges. The Singapore

Recommendation calls for “a holistic approach for resource management and resource efficiency” and “mainstreaming and integrating the 3Rs into the policies and programmes of relevant ministries and agencies”.

The challenges for effective policy implementation can be grouped into three categories: (i) government capacity and interagency coordination, (ii) industrial infrastructure and technology transfer for recycling, and (iii) a well-organized recycling market for local economy and green jobs. Of course, to overcome these challenges, it is not enough to set the appropriate policy incentives, such as economic instruments for establishing a sound market for recycling including collection of recycling fees or landfill levies. These incentives should be backed by embedding the 3Rs into a country’s socio-economic system through public awareness, mass media, school education programmes, eco-clubs, NGOs and the like.

3.1 Government capacity and interagency coordination

For effective collection and treatment of recyclable materials, it is necessary to enforce environmental and labour standards, and clarify role sharing between local and central governments, as well as among different governmental agencies/departments and establish a mechanism to facilitate collaboration.

To set recycling policies that contribute to sustainable resource management and the concept of a “green economy,” it is essential to prevent collected recyclable materials from flowing into environmentally-unsound treatment processes. Adequate environmental and labour standards should be enforced effectively through improved collaboration between central and local governments in order to lower socio-economic incentives to carry out strong acid treatment, open-air burning and other environmentally high-risk and low-cost treatments and recycling methods. To this end, the 3Rs and materials circulation should be given a high priority in the national strategy so as to facilitate collaboration between the central and local governments, as is done in Japan’s enactment of the fundamental law for a “Sound Material-Cycle Society” and China’s national policy of a “Circular Economy.”

In the absence of a comprehensive law or policy to promote resource circulation, there is a tendency for central governments to miss the opportunity to issue general and coherent directions for policies to be implemented by local governments. Under such circumstances, what is often observed are only scattered cases of local good practices. In other words, the purpose of legislation for resource circulation should be to clarify the roles of central and local governments as well as set out a national direction and specific milestones in policy implementation.

The development of national legislation and strategies for resource circulation cannot be separated from budget allocation for infrastructure to enable the operation of mechanisms for resource collection and treatment. For example, although Viet Nam has developed the “National Strategy of Integrated Solid Waste Management to 2025, vision to 2050,” by Ministry of Construction (MoC) and Ministry of Natural Resource and Environment (MoNRE) governmental officials expressed that it was better to also have the Ministry of the Finance involved in the policy making process in order to secure the necessary budget for implementation of the strategy.[2]

Therefore, in terms of improving governance, it is important to secure the involvement of relevant stakeholders from initial planning stages right through to the final review stage for various policies and strategies. Ensuring the involvement of relevant stakeholders from the outset would help improve the feasibility of policy implementation after its formulation.

More importantly, there is a need for effective cooperation and collaboration among the key line ministries and between government, private and research/scientific institutions in order to mainstream resource efficiency in overall policy, planning and development. In other words, sectoral policy approach in 3R promotion is a challenge. Conventionally, the 3Rs is seen as mainly the responsibility of environment agencies, i.e., Department of Environment or Ministry of Environment, whereas efficient promotion of 3Rs depends on how it is addressed or practiced in key development sectors, such as industry (including small- and medium-sized enterprises (SMEs)), energy, trade and commerce, agriculture, water resource, tourism, and other relevant areas. It is imperative that the responsible line ministries or agencies lay out policies and programmes to mainstream the 3Rs in these sectors so that there is a nationwide consensus on the beneficial aspects of the 3Rs.

3.2 Industrial infrastructure and technology transfer for recycling

Industrial infrastructure, i.e., the systematic construction of facilities and development of technologies for treatment and recycling of collected recyclables, is equally important for effective resource circulation. Industrial waste expelled as by-products during manufacturing processes accounts for a large proportion of the solid waste generated. More often than not, such waste is hazardous, but at the same time, it is potentially useful as a resource. In economically growing Asia, the increase in the generation of industrial waste and by-products, as well as waste discharged by business establishments, is expected to pose problems for the generators of such waste, as they often find it difficult to treat the waste themselves. Thus, it is also necessary for this reason to promote the growth of a reliable industrial sector consisting of waste management contractors and recycling operators.

Japan's eco-town programme is an example of putting policy into action to develop industrial and technical infrastructure to sustain the development of a sound material cycle society. The Government of Japan is now working to transfer this experience to China, Thailand, Malaysia and India.

In terms of international cooperation to develop such industrial infrastructure in Asia, facilitating technology transfer or foreign direct investment for recycling from developed to developing countries is not enough. Technology transfer should be associated with and supported by the development of environmental and resource circulation policies. Thus, to ensure effective technology transfer, institutional and policy mechanisms for resource circulation are prerequisites.

3.3 A well-organized recycling market for local economy and green jobs

The promotion of resource circulation is feasible only if it is accompanied by activities to collect and transport recyclable resources to treatment facilities and activities to make use of the post-collection recyclable resources. A recycling economy with an effective supply/demand balancing function should be established that, together with the industrial infrastructure and technological base, would help make feasible the sound circulation of the collected materials in compliance with the regulatory regime. The ambivalent nature of recyclable resources is in many cases not properly considered in recycling markets, which only look at the economic value of a used product and treat it as such. The markets pay attention to its potential utility as a resource, but much less to its attribute of being a potential pollutant. Sole attention to the utilitarian aspect of used products and recyclables as resources could result in an incentive to ensure cost recovery by adopting inappropriate and low-cost treatment methods. In addition, as was observed during the period of volatile resources price fluctuations in the latter half of the 2000s, reliance on

market adjustment mechanisms of supply/demand balancing alone sometimes leads to the malfunctioning of materials circulation, since recycling activities are transferred from developed countries to developing countries in periods of resource price hikes and these activities stagnate in periods of market softening.

Accordingly, Asian countries are faced with the need to shift focus from the formulation of legal systems to the construction of schemes that could support the effective integration of regulations, development of the required industrial infrastructure, and establishment of a stable recycling market and economy. Thus, recycling mechanisms that use economic instruments such as Extended Producer Responsibility (EPR) for specific end-of-life products would help shift the underlying economic concept from that of informal, "dirty" recycling to a well-organised market with stable job opportunities.

To improve resource efficiency at the global level, further international collaboration would require overcoming the above challenges faced by rapidly industrializing and urbanizing Asia. International/regional collaboration to promote the 3Rs must encourage countries to construct such schemes to develop the capacities needed for their implementation in terms of regulatory regimes, industrial development and stabilization of the recycling market and economy.

3.4 Upcoming challenges: Limitations of resource efficiency approach and needs for decoupling

Throughout the 1990s and 2000s, increasing resource efficiency has been considered an effective approach, especially among OECD countries, to realize sustainable resource circulation and decoupling (OECD 2008). Japan has utilized resource productivity as a nationwide indicator for Japan's national policy to realize a sound material cycle society. Indeed, advancement of a resource circulation system in Japan has coupled with an increase in resource productivity at the national level. In emerging/industrializing Asia, resource efficiency policies (efficiency at industrial facility level and product level) shall be pursued further by promoting resource circulation.

However, there are several reasons for reconsidering the policy paradigm of resource efficiency and productivity, especially for developed economies. Firstly, the limitations of the eco-efficiency/resource productivity approach for sustainable resource management are becoming apparent. Pursuit of efficiency in the industrial sector and products would minimize the environmental impact at unit-level of production and consumption activities, but increasing efficiency does not necessarily reduce the total environmental impact of the whole product life cycle. It is known that efficiency gains either in energy use or material use are generally offset by higher demand in such resources (Ayers 2005; Herring 2008). By comparing 65 countries from 1960 to 2003, Jorgenson and Clark (2011) concluded that there is no evidence of a relative decoupling of ecological footprint and economic development. Jorgenson and Clark (2011: 240) suggest that we cannot assume that "improvements in eco-efficiency equate to environmental sustainability when it corresponds with increases in the scale and intensification of production." Also, on the concept of resource productivity, some argue that improvement in resource productivity is the flip-side of economic growth and is not representative of decoupling of material use and economic development (Steinberger and Krausmann 2011).

More practically, there is an increasing recognition of the limitations of recycling to fulfil increasing resource demands. Over the years, there has been a continuous growth in resource demands from emerging economies, and new demands have emerged for rare-metals and rare-earth metals for low-carbon technologies (Halada 2010; Halada 2011).

However, because of the increasing demand for metal, some suggest that it is crucial to maintain less than 1% annual growth in metal demands to fill supply and demand gaps with metal recycling in the near future (Grosse 2010).

Increasing needs for new technology for low carbon development may increase hidden environmental risks associated with extraction, mining, and importing of metal resources. Halada (2010) warns that discussions on low carbon technologies and society lack a perspective on resource management. For example, according to estimates by Halada (2010), if half the number of Japanese automobiles were replaced with fuel-cell vehicles, the current technology would require 250 tonnes of platinum. This figure can be re-calculated as 300 mega tonnes of mining ore, thus requiring a "reduction" of residues (or hidden flow) from such vast mining activities.

To respond to these limitations and achieve absolute decoupling of resource use and economic development, policies for resource use reduction should be considered in addition to developing resource efficiency approaches. The necessity of reduction policies such as a natural resource tax has been the focus of discussion by select national governments, and a number of countries including Australia have already decided to introduce a natural resource tax (proposed Mineral Resource Rent Tax) (Australian Government Policy Transition Group 2010). Moreover, this requires a systematic change for decoupling and dematerialization. In the wider context of transforming the current practices of resource use and socio-economic situations, this challenge corresponds to those responding to climate change and the needs of a low carbon society.

4. Phased approach for improving national policy implementation

To overcome the priority challenges mentioned in section 3.1-3.3 above, we propose a phased approach for improving domestic policy implementation aiming at sustainable resource circulation.

If the industry's capacities for environmentally sound resource circulation remain insufficient and the activities of a recycling economy, based only on the market adjustment mechanisms of supply/demand balancing, continue uncorrected in developing Asia, numerous problems associated with solid waste could be aggravated in future. Accordingly, Asian countries are faced with the need to shift their focus from the formulation of legal systems to the construction of schemes that could support the effective integration of regulatory regimes, development of required industrial infrastructure and stabilization of the recycling economy.

In Japan, the policy and industrial strategy of increasing resource efficiency or making use of waste as a resource received public attention in the mid-1990s, mainly through the initiative of manufacturing industries in what was called the "Zero-Waste Factory" campaign (Mitsuhashi 2000). In addition, through the enactment of various product-specific recycling laws and the introduction of the Fundamental Law for the Establishment of a Sound Material-Cycle Society, as well as the ensuing formulation of the Fundamental Plan, phased policy steering was accomplished from the appropriate collection and management of "garbage" to the reorientation of the socio-economic system toward the efficient use of resources.

Japan's experience in creating a sound material-cycle society that may be useful as a reference for 3R promotion in Asia includes: i) involvement of stakeholders in the development of product-specific recycling laws and clear definitions of their respective

roles; ii) evaluation of the implementation progress of specific policy measures in light of the basic plan and the continual review of policy objectives; iii) collaboration between the central and local governments; and iv) the establishment of the industrial infrastructure required for the operation of materials circulation policies, based on Eco-Town programmes and other measures. It is imperative for the 3Rs and materials circulation in Asia, both nationally and internationally, to provide international aid and policy implementation assistance, while continually bearing in mind that the effective integration of regulatory systems, the appropriate industrial infrastructure and a stable recycling market and economy are prerequisites.

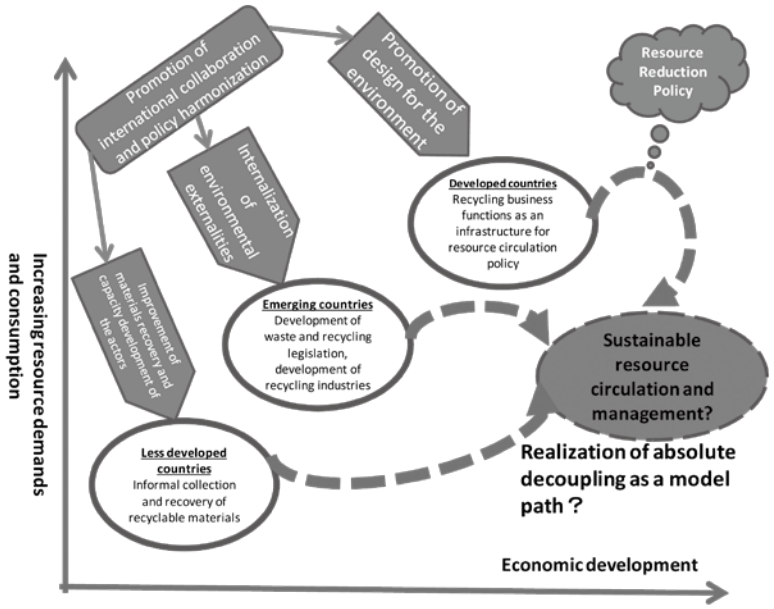
However, there are significant disparities and diversities among and within Asian countries in terms of the growth of the recycling market and economy and the level of development of the associated social systems. Accordingly, the priority tasks in the operation of 3R-related schemes and programmes naturally differ between the developed economies of Japan, Taiwan and Korea, the emerging economies of China and Malaysia, the less developed countries of Cambodia and Laos, and even within a country.

Taking into consideration this diversity in Asia, Hotta (2011a and 2011b) as well as Akenji et.al. (2011) proposed the following phased approach in the case of EPR application to used electronics, in relation to the introduction of 3R policies and the corresponding assistance to be provided in Asia in a flexible manner:

1) Improvement of materials recovery and capacity development of the actors
2) Internalization of environmental externalities
3) Promotion of design for the environment
4) Promotion of international collaboration

Figure 8.1 below is a conceptual illustration of the proposed phased approach.

Figure 8.1 Conceptual illustration of the phased approach for the implementation and operation of 3R and materials circulation policies



Source: Modification of Figure 1 in Hotta (2011b).

The first phase, i.e., the improvement of materials recovery and the development of the capacity of the actors involved, is the basis for the successful implementation of 3R-related schemes and programmes. This is the case since the effective operation of 3R and materials circulation policies in Asia requires a core group of industrial sectors and business enterprises for sound recycling that should be identified and nurtured to emerge from the conventional informal recycling market and economy. The organization and recognition of the informal sector is considered particularly important for the improvement of collection (Medina 2007; Atienza 2010). Recognizing high-grade recycling enterprises and extending some form of financial assistance is an effective step toward the improvement of waste treatment. Without some identification and nurturing of these responsible business actors, there can be no improvement in waste management and materials recovery. It is thus important to assign these business actors their due role in local and national 3R policies.

For an emerging economy such as China that is making ongoing efforts to organize a recycling market and economy and is building its legal frameworks for the 3Rs and materials circulation, the proposed process of phase 2, namely, the internalization of environmental externalities into production and consumption would be an effective policy to provide solid economic incentives for more environmentally sound recycling. Mechanisms should be developed to motivate the recycling industry to improve its processes. The setting of adequate environmental and labour standards is also a key to nurturing high-grade recycling industries. One specific example is a scheme, such as the EPR mechanism, whereby the various actors involved share the responsibilities and the associated economic burden of treating end-of-life products as recyclable resources. Based on Japan's experience in formulating and implementing a number of product-specific recycling laws, it is desirable that the central government take the lead in organizing a policy advisory council so as to involve and engage experts, trade associations, large retail chains and importers in discussions to design workable product take-back and cost-sharing mechanisms. The Resource Recycling Fund of Taiwan is a useful reference case (Chung et al. 2009) when considering how to secure the funds required to operate sound resource circulation; in Taiwan, a recycling fund was created by collecting recycling fees from the product manufacturers and importers. Furthermore, if such a fund is combined, for example, with a certification scheme for recycling operators, those that qualify will be entitled to a subsidy from the fund, and thus the introduction of appropriate technologies and training as well as the capacity development required for environment, health and safety compliance will be made easier. The United Nations and regional/sub-regional organizations such as UNESCAP, UNEP, UNCRD, the Association of Southeast Asian Nations (ASEAN), and the South Asia Co-operative Environment Programme (SACEP), among others, could work towards coordinated EPR-related policies across the region.

For countries that have large assembly-type industries and other manufacturing activities, such as Japan and Republic of Korea but also gradually for emerging economies such as China and Thailand, the policy should be focused on phase 3, that is, the promotion of design for the environment and the construction of new 3R-driven business models. Often abbreviated as "DfE," design for the environment represents efforts to promote designs that are conducive to the safe and easy dismantling of products and resources recovery. The creation of a solid industrial base for recycling is effective in encouraging the production of easy-to-recycle products and the construction of more resource-efficient new business models. The concept of design for the environment in products has been positioned as an important objective of EPR in OECD discussions. It is unlikely, however, to be given high priority in less developed countries that, unlike the OECD countries, have no large-scale manufacturing industries. Also, the kind of EPR mechanism

introduced by OECD countries characterized by the sharing of responsibilities within the same industry has had only a limited effect on promoting design for the environment. It is therefore desirable that policies for the promotion of design for the environment be adopted by countries that already have in motion programmes for the nurturing of high-grade recycling operators, systems designs for take-back and financial mechanisms, and large-scale manufacturers. From the perspective of promoting the 3Rs at the level of the whole of Asia, it is desirable to utilize international guidelines for easy-to-recycle designs with a view to encouraging voluntary private-sector activities on an international scale.

It is incumbent on developed economies to contribute to the creation of international cooperation frameworks oriented toward effective policy implementation in developing countries. This is why phase 4, promotion of international collaboration, has been proposed. The arrow suggesting phase 4 cross-cuts with other phases in Figure 8.1 representing the greater importance of policy coordination and collaborative approaches than unilateral assistance by developed countries to developing countries, as will be discussed further in section 5 below.

The phased approach introduced in this section is a hypothetical direction of international collaboration for the 3Rs to introduce resource efficiency/productivity approaches into developing Asia to enable the aspect of sustainable resource circulation and management under the much-debated international agenda of the Green Economy. However, as discussed in section 3.4, the increasing concerns expressed for the simple and gradual pursuit of improving resource efficiency and productivity may not contribute sufficiently to the reduction of ecological footprints or total environmental burden from material consumption. Considering possible global resource crises in the coming decades implied in UNEP's recently published REEO report (UNEP 2011a), gradual reform towards resource efficient economies may not be enough for developing Asia. Thus, some sort of leapfrogging towards decoupling and sustainable resource circulation and management may be required for Asia. Considering the looming resource crisis, developed countries need to take a bold direction with policy and greater responsibility towards dematerialisation and socio-economic reform for a globally less resource-intensive society. This would act as a role model for other economies at lower levels of development to find innovative, less resource-intensive development pathways (see Figure 8.1).

5. Promotion of international collaboration and international fund for sustainable resource management

5.1 Rationale of international collaboration for sustainable resource management

International resource circulation, especially those of secondary materials, is considered to be subject to the existing frameworks of the Basel Convention. It has also been considered a negative phenomenon associated with environmental and health impacts from improper recycling activities and dumping of residues from resource recovery. This is still true to a certain extent. However, the issue of creating a more sound method for international circulation of materials and sustainable resource management discussed in this chapter is not confined to that of the illegal transboundary movement of hazardous waste. As Michida has argued, today's structure for the international movement of resources is no longer the simple flow of recyclable materials from developed countries to developing countries (Michida 2010). In other words, an international division of labour is also progressing in the field of materials circulation and recycling. In this context, the Secretariat of the Basel Convention has started discussions on the need to revisit the

role of the Convention, not only from the perspective of controlling the transboundary movement of hazardous materials, but also from one of securing precious or rare resources and promoting environmentally sound recycling (Kummer Piery 2011). Thus, this policy issue of international resource circulation shall be contextualized under the agenda of sustainable resource management.

As a consequence of globalization of consumption and production, international policy harmonization is necessary to make product-specific environmental policies, including recycling policies, effective. This is because increasingly, the life cycle of materials, products, and end-of-life products spreads over national borders. Terazono (2005) showed an example of an unintended, transboundary spill-over effect of domestic policy by investigating the dynamics of international trade of used polyethylene terephthalate (PET) bottles between Japan and China. Although Japan promoted used packaging recycling policies and establishment of related domestic recycling facilities since the mid-1990s, used PET bottles have been exported to China as a result of increasing demand for used PET bottles as a material resource for manufacturing clothes and toys. This was due to the high cost of domestic recycling systems established for used PET bottles in Japan. A similar situation occurred when Germany introduced the German Packaging Ordinance in 1991. In this case, the amount of collected waste plastics was beyond domestic recycling capacity in Germany. Thus, a significant amount of collected recyclables were exported to other countries and the international price of plastics slumped. This was recognized as “serious internal market problems” by the European Commission (European Commission 1994). One of main objectives of introducing the European Directive on Packaging and Packaging Waste was to “harmonize national approaches across the EU so that market disruptions could be overcome and avoided in the future” (Tyson 2009).

As one of the roles in sustainable resource management for developed economies such as Japan, a country is expected to introduce strong incentive mechanisms to reduce total environmental impacts from material consumption and reduce environmental load related to material consumption in its lifecycle from material extraction to recycling and final treatment. On the other hand, such strong policy incentives such as virgin material tax or taxing for inefficient use of resources in industrial sectors, may raise economic concerns such as decreasing the international competitiveness of the manufacturing sector, increasing dependence on foreign supply of natural resources, or a move by the domestic industrial sector outside the country due to an increased financial burden. There are also several environmental concerns such as increasing incentives for illegal dumping and exports of wastes caused by increasing waste treatment costs and a potential increase in the export of natural resources without the application of an export tax. In addition, as social concerns, there may be increasing unemployment in the mining sector in resource export countries or in the manufacturing sector due to increasing production costs and industrial hollowing out. For example, increasing domestic control and management of rare earth and metals in China caused global concern on resource enclosure (The Parliamentary Office of Science and Technology of UK 2011) and has been the subject of WTO dispute mechanisms. Also, a virgin material tax for aggregates introduced in the United Kingdom (UK) resulted in a reduction of the amount of mining of virgin resources in the UK, but an increase in Ireland because of “an unintended trade-distorting effect, due to the proximity of Northern Ireland, which introduced aggregate tax, to Ireland that does not introduce the tax” (EEA 2008).

To avoid such negative consequences and unintended negative transboundary spill-over effects of a domestic policy for sustainable resource management, it is crucial to continue international efforts for policy coordination and harmonization among Asian countries. Since emerging economies in Asia have begun to move away from their status as

Overseas Development Assistance (ODA) recipients, new models emphasizing mutual collaborative approaches, rather than one-way aid from aid countries to recipients, are needed in such international collaboration efforts. For instance, bilateral cooperation in the future should be promoted as a model project for international cooperation endeavours of emerging countries, thereby positioning these economies under the international effort of developing sound 3R/materials circulation at the Asian regional level.

5.2 Quantitative study on regional policy coordination for sustainable resource management

To demonstrate the potential benefits of such mutual collaborative approaches, a quantitative analysis was conducted on options to reduce natural resource consumption using an economic model of Japan, China, Korea and Australia. The Asian economy is gradually shifting towards a resource intensive structure, and material efficiency has not improved in this region even as the global average has steadily improved (UNEP 2011a). As per capita resource use is still relatively low in this region, without serious efforts to decouple economic growth from resource consumption, Asia will soon face serious resource and environmental constraints (UNEP 2011a; Kojima 2011). Considering this rising need for examining possible policy options for decoupling, the analysis tried to demonstrate the benefits of international collaborative, rather than unilateral, approaches. Thus, a scenario of inaction was not reflected as a base-line. This is partially because of limitations of the model analysis.[3]

The quantitative analysis was conducted with empirical data focusing on the steel industry just for illustrative purposes and not with an aim to propose reduction policies for steel making. To obtain general implications for typical effects of different materials reduction as well as recycling policies, this sector was chosen mainly because steel is one of the major recyclable materials and this sector is represented in the input-output table with sufficient disaggregation levels necessary for modelling analyses. The four countries selected are major players in the iron and steel industry in the Asia-Pacific region. Australia is one of the world largest iron ore exporters, exporting iron ore to Japan, China and Korea. China also produces large amount of iron ore but most is consumed domestically. Japan and Korea are major steel producers and their iron ore supply is almost totally dependent on imports.

In this setting, coordinated efforts to reduce total iron ore consumption in four countries with the efforts of single country are compared. Namely, the following three policy scenarios are assessed using a four-country dynamic computable general equilibrium model (see Box 8.1 for a description of the model):

- Single country efforts by Japan (J): Impose a uniform volume-based waste disposal charge on steel scrap on all sectors except for steel (blast furnace and electric arc furnace) and recycling sectors. The collected revenue is used to subsidise the recycling sector.
- Coordinated efforts by Japan and Australia (JA): Japan implements the above policy “J” and Australia imposes a natural resource tax on the sales of iron ore with a lump sum transfer of the tax revenue to households.
- Coordinated efforts by Japan, Australia, China and Korea (JACK): Japan and Korea implement a uniform volume-based waste disposal charge on steel scrap (the same as the policy scenario “J”) and Australia and China impose a natural resource tax on sales of iron ore with a lump sum transfer of the tax revenue to households.

Box 8.1 Model description

Our model is a four-country dynamic computable general equilibrium (CGE) model based on the detailed input-output tables of Japan in 2005, China in 2007, Korea in 2005, and Australia in 2007-2008. The model employs the 23-sector aggregation scheme for all four countries, in which the iron ore mining sector is separated to explicitly treat iron ore consumption. Further, two steel production processes, i.e., blast furnace steel production (of which major input is iron ore) and electric furnace steel (of which major input is steel scrap) are distinguished.

The model is a multi-sectoral Ramsey-Cass-Koopmans type growth model, in which saving is endogenously determined based on dynamic utility optimisation with a unique assumption on households' expectation formation process in which households assume that exogenous variables will stay constant at the current levels (Kojima 2007).

Production technology is specified as Leontief function of intermediate goods (except for steel products) and constant elasticity of substitution (CES) function of factors of production. Production factors are capital, skilled labour, unskilled labour, land and natural resources. Capital and labour are mobile across sectors, while other factors are sector specific. The model introduces substitutability between blast furnace steel and electric furnace steel intermediate inputs through CES function. We assume lower elasticity of substitution for the sectors relying on high quality steel (e.g., automobile, machinery and equipment) than for other sectors.

The model estimates sectoral as well as nationwide CO_2 emissions following the methodology and data of Lee (2008). The iron ore consumption is estimated based on the assumption that the iron ore prices in the four countries are the same.

The scenarios are standardised in terms of reduction in total iron ore consumption of the four countries in 2015 compared with the business-as-usual (BAU) scenario. First, we determine the rates of volume-based waste disposal charges in scenario J such that Japanese iron ore consumption in 2015 is 10% less than BAU. The consequent reduction in total iron ore consumption of the four countries in 2015 becomes 1.29% less than BAU. To achieve this benchmark reduction target, the rates of policy instruments are determined as shown in Table 8.3, considering the balance in iron ore consumption reduction of each country.[4]

Table 8.3 Employed tax and charge rates of each scenario

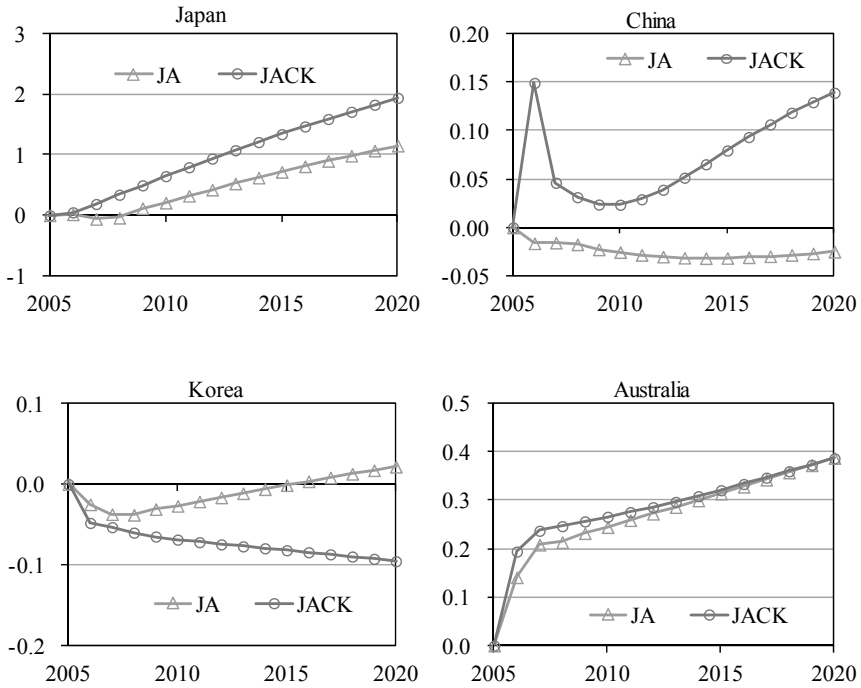
Policy instrument policy scenario	J	JA	JACK
Waste disposal charge in Japan [USD/tonne]	3722	2638	968
Natural resource tax in Australia [%]	0	20	10
Natural resource tax in China [%]	0	0	21.5
Waste disposal charge in Korea [USD/tonne]	0	0	968

Source: Author

Based on the simulation results, we assessed the impacts of coordinated efforts as differences between the results under the coordinated scenarios (JA and JACK scenarios) from those under single country efforts (J scenario).

Figure 8.2 shows the economic impacts of coordinated efforts on the real GDP of individual countries.

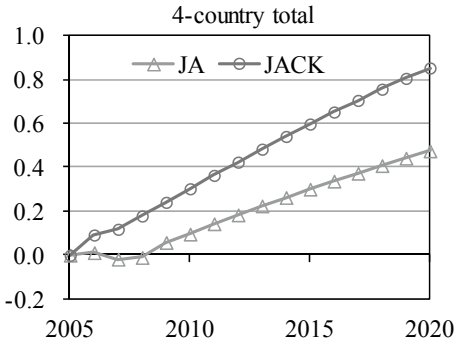
Figure 8.2 Impacts of coordinated efforts on real GDP (%)



Source: Author

The findings indicate that natural resource taxes in resource producing countries (i.e., China and Australia) are economically beneficial in the implementing countries, and coordinated efforts by four countries (the JACK scenario) bring economic benefits not only to Japan, who can loosen resource consumption reduction burdens, but also to China and Australia. Korea slightly reduces real GDP under the JACK scenario, but it seems possible to design proper compensation schemes as the total economic impacts as a whole group are positive (see Figure 8.3).

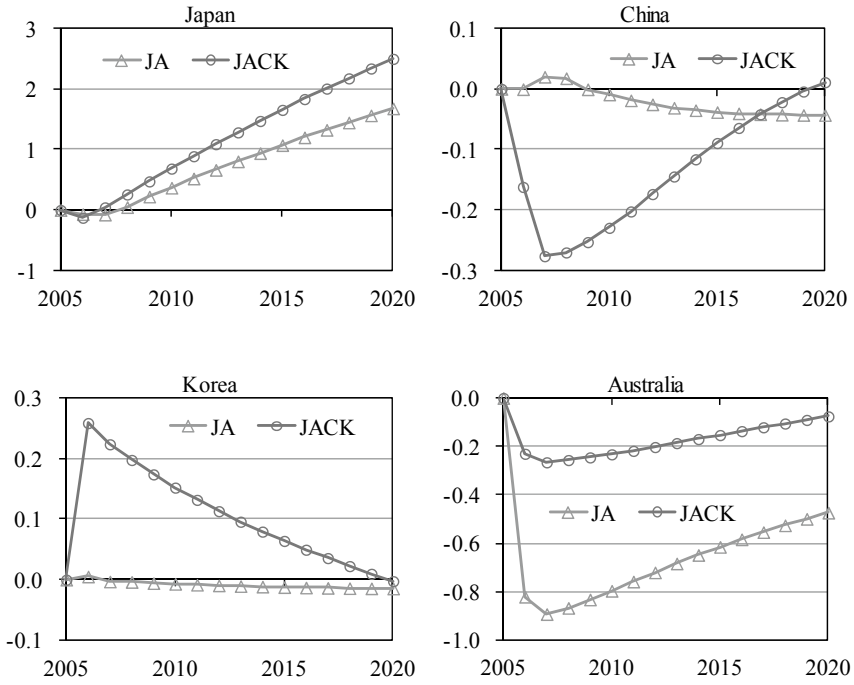
Figure 8.3 Impacts of coordinated efforts on total real GDP of 4 countries (%)



Source: Author

In addition to economic impacts, the impact on CO_2 emissions is assessed, as one of the expected co-benefits of resource consumption reduction policies is greenhouse gas (GHG) emissions reduction.[5] Figure 8.4 shows the impacts of coordinated efforts on CO_2 emissions of each country.

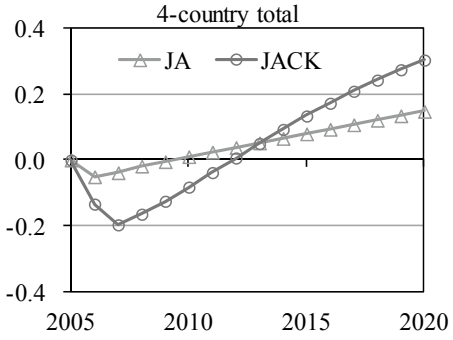
Figure 8.4 Impacts of coordinated efforts on CO_2 emissions (%)



Source: Author

It is found that implementing iron ore consumption reduction measures tends to reduce CO_2 emissions except for the case of Korea. In terms of the total CO_2 emissions of the four countries, coordinated efforts have reduction impacts only at the beginning of the simulation period, but overall impacts are positive (increasing) as shown in Figure 8.5.

Figure 8.5 Impacts of coordinated efforts on total CO_2 emissions of 4 countries (%)



Source: Author

Table 8.4 summarizes the assessment results in terms of overall impacts during the simulation period. The table shows the impacts of coordinated efforts on the net present value (NPV) of real GDP (discounted by pure time of preference in each country) and total CO_2 emissions during the simulation period.

Table 8.4 Summary of assessment results

Region	Indicator	JA	JACK
4-country total	Impact on NPV of real GDP	0.22 %	0.47 %
	Impact on total CO_2	0.05 %	0.06 %
Japan	Impact on NPV of real GDP	0.47 %	0.95 %
	Impact on total CO_2	0.73 %	1.16 %
China	Impact on NPV of real GDP	-0.02 %	0.07 %
	Impact on total CO_2	-0.02 %	-0.12 %
Korea	Impact on NPV of real GDP	-0.01 %	-0.07 %
	Impact on total CO_2	-0.01 %	0.10 %
Australia	Impact on NPV of real GDP	0.24 %	0.26 %
	Impact on total CO_2	-0.64 %	-0.17 %

Source: Authors

Our analysis demonstrates that coordinated efforts, particularly by the four countries, can generate tangible economic benefits without significantly increasing total CO_2 emissions during the simulation period. As well as the total positive impact on the four countries, three of the four countries also individually benefit from the coordinated efforts of the four countries (the real GDP of Korea decreases slightly, by 0.07% under the JACK scenario). The assessment results show that resource consumption reduction measures in non-resource producing countries (i.e., waste disposal charges in Japan and Korea) have negative economic impacts, while those in resource producing countries (i.e., natural resource taxes in Australia and China) have positive economic impacts. In fact, Australia and China are interested in introducing natural resource taxes in terms of either profit tax on natural resource providers or export tax on natural resource exports. China has already implemented resource tax on domestic iron ore mining, which accounts for 20% of the mining cost (China Daily, 6 June 2010). Australia decided to introduce the Minerals Resource Rent Tax (MRRT) from July 2012 targeting coal and iron ore mining (Australian Government Policy Transition Group 2010). The results of this analysis illustrate the potential economic reasons behind such political decisions.

5.3 International fund for sustainable resource management

For international collaboration to be consistent and effective, a sustainable source of funding must exist. What, then, can be done to finance international efforts to respond to the internationalization of materials circulation, recycling, and innovative approaches for dematerialization?

Under the current international collaborative scheme, seeking co-benefits between resource circulation and climate mitigation, as well as biodiversity may be effective, in principle. It would be effective, especially for less developed countries considering the lack of finance and technical needs, to promote co-benefits between the 3Rs and other environmental, social and economic benefits, and address challenges to improve organic waste management in these countries. On the other hand, under the current international

collaborative schemes such as the Clean Development Mechanism (CDM), climate co-benefits of waste management or materials management tends to focus on end-of-pipe technical solutions such as methane recovery from landfill-site or waste-to-energy approaches, thus not providing large incentives to promote the 3Rs, efficient use of resources in industrial sector, and source separation. Therefore, it is desirable to further develop an international collaborative scheme, such as new funding mechanisms, in the context of promotion of the 3Rs and sustainable materials management.

Hotta (2011) presents a hypothetical fund that would have the objective of supporting the programmes needed to ensure that the actual existing international flows of recyclable materials have a sounder base and international efforts for efficient use of resources continue. This would be financed by pooling prepaid recycling fee schemes and recycling funds, especially from exported used products. Similar ideas have been proposed by UNESCAP and IGES (2006) and Hotta et al. (2008), as well as by Kojima (2010). The Regional 3R Forum in Asia, with 23 countries attending from Asia and the Pacific as well as various international organizations including ADB, the Basel Convention secretariat, and the United Nations Industrial Development Organization (UNIDO), took up a similar idea and recommended the establishment of a regional, multi-donor 3R fund "for the promotion of the 3Rs to encourage resource efficiency, resource conservation, waste minimization, and recycling projects" (Third Regional 3R Forum in Asia in 2011).

The Government of Japan estimates that approximately 30% of the country's used home appliances were exported as second hand products in 2006 (Central Environmental Council and Industrial Structure Council 2008). According to this estimate, 7.7 million units of four major kinds of home electrical products were exported in total. Terazano (2010) meanwhile estimates that the quantity of exports was 5.18 million units. In 2010, the OECD recommended that Japan introduce a prepaid recycling fee scheme (OECD 2010). Therefore, this proposal is not one without grounds to support it. If such a scheme were to be introduced, a sum of between around JPY 14.8 billion (calculated from 5.18 million units of Terazono 2010) and JPY 22.0 billion (calculated from 7.7 million units of Central Environmental Council and Industrial Structure Council 2008) (about USD 193 million and USD 287 million as of August 2011) would be collected annually as a recycling fee on exported used products. This policy may result in discouraging the export of used products and directing them to recycling routes within the country. This may result in revitalizing domestic recycling economies for exporting countries and disincentives for environmentally unsound recycling without a command and control type export ban.

It should be recalled, nonetheless, that the above figures are for Japan alone. If other developed economies such as Korea and Taiwan join in, the suggested scheme will have a significant positive impact on international collaboration in role sharing among the countries of Asia for a sounder international circulation of materials. Asian developing countries are also considering introducing systems of recycling fees and recycling funds. If countries came together to use a portion of such funds for international collaboration, it would be possible to create an international fund for the 3Rs, resource efficiency, and sustainable materials management.

The creation of a multi-lateral international fund for the 3Rs and sustainable materials management is not an easy task since it is related, among other issues, to that of the availability of an international organ that would be responsible for the management of such a fund. It is still important to initiate discussions in pursuit of such a multilateral funding mechanism for sustainable resources management and materials circulation, since the existing multilateral funding mechanisms related to international cooperation

in the field of environmental protection, such as the Global Environment Facility (GEF)[6] and the CDM, are heavily oriented toward the issues of climate change and biodiversity. Considering Asia functions as the “factory of the world” and is leading the increase in global resource demands, international efforts to improve resource management and circulation in the region can play a crucial role.

As a short-term approach to raise international consensus and develop strong incentives for sustainable resource management and circulation, it would be effective for existing climate-related financial mechanisms currently focusing more on co-benefits of downstream waste management to reflect the upstream co-benefits of material recycling, productivity or reduction. In addition, it may be useful to reflect resource efficiency/productivity with pollution prevention measures to project appraisal by multilateral aid agencies such as The World Bank and ADB or bilateral aid agencies. Especially, on this point, one may consider the introduction of planning tools for improving product/service/project-level material footprints, such as the Material Input Per unit Service (MIPS) by Wuppertal Institute (Lettenmeier et al. 2009) or communication tools such as ecological footprint. As a long-term approach to achieve sustainable resource management and circulation, it would be worth examining the possibility of combining various economic instruments and funds for resource management to reduce negative transboundary spill-over effects.

Therefore, if Asian countries could reach an agreement, based for example on platforms such as the Regional 3R Forum in Asia, the promotion of regional cooperation for sustainable materials circulation would be an important step forward in the creation of a global multi-lateral funding mechanism over the longer term that could avail itself of the capacity of existing organizations, including ADB, UNEP and bilateral aid organizations, as well as of the experience of the GEF and other similar mechanisms. It is worthwhile exploring the possibility of directing a certain portion of the recycling fees that the countries involved will collect in order to finance bilateral and multilateral cooperation programmes in the 3R/materials circulation field. If the positive effects of a well-managed international flow of recyclable materials on the development of national recycling economies in both the exporting and importing countries can be readily demonstrated starting from a limited number of participating economies or even by multi-lateral industrial activities, then the significance of international cooperation will be understood by a much larger audience. Part of such a fund may also be used to encourage technological development and equipment investment for material recovery activities with pollution prevention measures to modernize and upgrade the recycling industries of Asian developing countries. The use of such a fund increases the likelihood of establishing a realistic basis for bringing the current international circulation of materials up to a new higher level of capacity and stability through the networking of integrated recycling industry complexes (Hashi and Mori 2005). It is also worth considering the feasibility of creating product information flows from manufacturing processes to recycling counterparts so that, as Mori et al. (2009, 2010, 2011) have proposed, the exact location of useful or hazardous substances within the product components and other information required for their safe and efficient recycling would be passed on to the global society.

The present state of Japan playing a leadership role should act as a springboard to boost international efforts to a higher level that involves policy coordination and partnerships among support programmes in each country. This will contribute greatly to reforming and strengthening sustainable resource circulation and management in Asia.

6. Conclusion

Considering anticipated resource crises with continuation of the current pattern of resource use, it is time to start creating innovative approaches to achieve higher productivity in the use of resources, sounder international materials circulation and reduced total environmental impacts of resource utilization. It is very important that a phased approach should be introduced according to the stage of development of the recycling market and economy, so that the legal frameworks and policies can be implemented effectively. In addition, to enable leapfrogging for sustainable resource management and decoupling for developing Asia, the developed countries need to show a bold policy direction for and a path towards dematerialization and socio-economic reform for less-resource intensive society.

To introduce these measures, the current level of international policy collaboration in Asia needs to be raised to a higher level. This should not be pursued by the initiative of Japan alone.

The specific recommendations for achieving sustainable resource circulation and management discussed in this chapter are summarized into those on 1) governance reform at the national level and 2) governance reform at the international level.

6.1 Governance reform at the national level

From the domestic governance viewpoint, it is important to secure the involvement of relevant stakeholders, including ministries and agencies related to resource use and circulation, from planning stages to the review stage of various policies and strategies for sustainable resource circulation and management.

EPR-based policies can be a good example whereby the various stakeholders involved share the responsibilities and economic burden of treating end-of-life products. The National Resource Recycling Fund can be a useful policy tool contributing to securing the funds required to operate sound resource circulation by collecting recycling fees from product manufacturers and importers.

The systematic construction of facilities and development of technologies for treatment and recycling of collected recyclables is important for the effective operation of resource circulation with less environmental pollution. In line with this concern, Japan's eco-town programme is an example of developing industrial and technical infrastructure to sustain the development of a sound material cycle society.

A recycling economy with an effective supply/demand balancing function should be established together with the industrial infrastructure and technological base. On this point, the existence of the informal recycling economy cannot be ignored. At the same time, for emerging countries with relatively high-grade recycling industries, it is desirable to focus on the promotion of the design for the environment.

If the idea of a National Resource Recycling Fund mentioned above can be combined with a certification scheme for recycling operators, this would help establish appropriate mechanisms to introduce technologies and training as well as capacity development. For effective technology transfer, institutions and policy mechanisms for resource circulation are pre-requisites.

6.2 Governance reform at international level

For developing Asia, improving resource efficiency including promotion of resource circulation will continue to be a priority. Increasing needs for products and infrastructure shall be met with efficient use of resources with less environmental pollution.

Considering diversity of circumstances and challenges related to improving waste and resource management faced by developing Asia, a phased approach for achieving sustainable resource circulation and management is proposed, that is, to gradually develop a recycling economy and markets along with the following phases: 1) improvement of materials recovery and capacity development of the actors, 2) internalization of environmental externalities, and 3) promotion of design for the environment, backed up and facilitated by international collaboration.

Over the short-term, from the perspective of sustainable consumption and production, it is desirable to develop international guidelines for resource-efficient products/services with a view to encourage voluntary private-sector initiatives at the international scale. Such guidelines may be useful to reflect resource efficiency/productivity with pollution prevention to developmental project appraisal by multilateral aid agencies such as the World Bank and ADB or bilateral aid agencies.

Expected increases in resource demands in the future and potential resource crises require serious policy intervention and investment efforts for innovation in social and economic systems aiming for material use reduction and “absolute decoupling,” in addition to resource efficiency improvement (i.e., relative decoupling). Developed economies such as Japan are expected to introduce strong incentive mechanisms to reduce total environmental impacts from material consumption, and reduction of environmental load related to material consumption in its lifecycle from material extraction to recycling and final treatment. At the same time, a unilateral approach may raise unintended economic concerns as well as several transboundary environmental concerns, in other words, unintended negative transboundary spill-over effects of a domestic policy. Thus, it is crucial to have policy coordination and harmonization through international collaborative actions. Our quantitative analysis clearly shows the potential benefits of international collaborative actions over unilateral actions.

Over the long-term, the establishment of international fund for sustainable resource management is proposed as a funding source for financing bilateral and multilateral cooperation programmes in the 3R/materials circulation field, as well as encouraging technological development and infrastructure investment for resource efficiency improvement and decoupling by directing a portion of revenues generated through economic instruments for domestic resource management and circulation, such as virgin material taxes and recycling fees.

The multi-lateral funding scheme for international environmental collaboration has been developed to address climate and bio-diversity issues. It is high time to examine the potential of a financial mechanism contributing to international collaboration in sustainable resource management and resource circulation as well to harmonize the efficient use of resources and environmental protection.

Notes

1. Sections 2, 3, 4, and 5.1 and 5.3 of this chapter are mainly based on a revised argument in a previous publication by one of the authors, Yasuhiko Hotta. Hotta, Y. 2011. *Asia ni okeru jizoku kanou na shigen junkan ni muketa dankai-betsu approach - 3R Initiative no kokusai-tenkai no keiken ni motozuite* (Step-wise Approach for 3R Policy Implementation in Asia: Based on the experience of international promotion of the 3R Initiative-). In *Haikibutsu shigen junkan gakkaishi* (Material Cycles and Waste Management Research), Vol. 22, 2. Originally published in Japanese.
2. An opinion from a participant at the "In-country Training Workshop-cum-Policy Dialogue on the National Strategy for Integrated Solid Waste Management and the 3Rs," 28 July 2010, Hai Phong, Viet Nam.
3. This model does not reflect costs of inaction such as economic loss due to resource constraints, and does not justify the net benefit of actions (in this case, iron ore consumption reduction policy) based on a comparison with the results under BAU that does not represent a situation in which action is not taken.
4. These rates are applied from 2006 to 2020 to avoid unfeasible solutions in the base year.
5. In fact, efforts by Japan (the J scenario) reduce Japan's total CO_2 emissions during the simulation period by 0.92% from BAU. In terms of the total CO_2 emissions of four countries during the simulation period, the magnitude of the reduction is 0.14%.
6. GEF provides funding for chemicals issues, mainly persistent organic pollutants (POPs), but in the future will also focus on heavy metals.

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