

## Summary report on the 8<sup>th</sup> 3R International Scientific Conference on Material Cycles and Waste Management (3RINCs2022) online

3RINCs2022 steering committee  
(JSMCWM)

Opening and Plenary sessions: 14 March 2022 | Special and general sessions: 14 – 18 March 2022 |  
Creative session: 14 – 17 March 2022

### I. Introduction

Japan Society of Material Cycles and Waste Management (JSMCWM) has been hosting a successful world congress of the “3R International Scientific Conference on Material Cycles and Waste Management” (3RINCs), since 2014 held in Kyoto, followed annually in Daejeon, Hanoi, New Delhi and Bangkok, respectively. In the 3RINCs, experts and concerned parties from all over the world are participating to discuss the latest scientific findings and outcomes on waste management from the aspects of the 3Rs, resource circulation and circular economy as well as the latest information and trends in policy development, private sector technology development, and NGO activities. In particular, in recent years, efforts to deal with global issues such as climate change and marine plastic pollution have become more active, and unique research, activities and trials have been introduced. Moreover, JSMCWM are keen to strengthen knowledge sharing and network building with related parties around the world through the platform of 3RINCs.

The 8th 3R International Scientific Conference on Material Cycles and Waste Management (3RINCs2022) was held virtually on 14 - 18 March 2022 by JSMCWM through collaboration with Korean Society of Waste Management (KSWM), Society for Solid Waste, Chinese Society for Environmental Sciences (SSW-CSES), Solid Waste Management Association Thailand (SWAT) and National Institute for Environmental Studies (NIES). Ministry of the Environment Japan (MOEJ), Japan International Cooperation Agency (JICA), United Nations Centre for Regional Development (UNCRD), Institute for Global Environmental Strategies (IGES) and International Solid Waste Association (ISWA) and 25 sponsors also supported the 3RINCs2022.

The five-day conference consisted of four sessions (right figure): Plenary lecture (3 lectures), Special session (5 sessions), General session (14 sessions) and Creative session (5 sessions) with highlighting a variety of topics on 3Rs and waste management in driving scientific knowledge and technologies, advancing policy and behavioural changes, and increasing outreach and awareness to accelerate the sustainable society to achieve the SDGs. The expansion of its scope to critical issues such as COVID-19 pandemic, climate change and plastic pollution, and new opportunities such as UNEA discussion on an internationally legally binding instrument and a new trend of the Digital Transformation (DX) was also showcased.

In result, more than 300 participants including academia, experts, national authorities, international

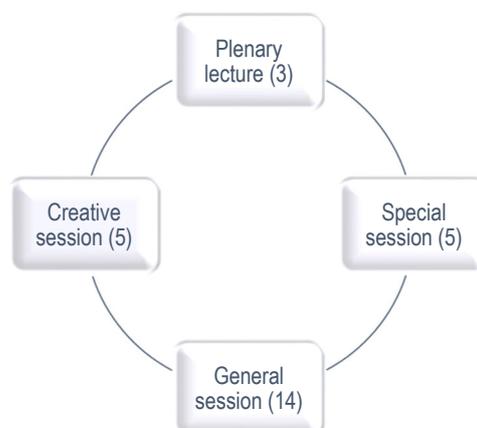


Figure. Sessions in 3RINCs2022

agencies, private sector, and civil society from 22 countries/regions joined the 3RINCs2022.

More information is shown in the following links.

- Homepage: <https://www.3rincs.org/>
- Materials and videos: <https://www.3rincs.org/3rincs-2022/>
- Programme: [https://www.3rincs.org/wp-content/uploads/2022/03/3RINCs2022-Program\\_220311.pdf](https://www.3rincs.org/wp-content/uploads/2022/03/3RINCs2022-Program_220311.pdf)

## II. Opening session including Plenary lecture 1

At the beginning of the conference, the welcome addresses were delivered to the participants from the representatives from organizers of 3RINCs 2022, Prof. Toshiaki Yoshioka, President of JSMCWM, Prof. Jae Young Kim, President of KSWM, and Prof. Orathai Chavalparit, President of SWAT. Following to the introduction of partners and sponsors of 3RINCs2022 by Prof. Shin-ichi Sakai, Steering Committee Chairperson of 3RINCs2022, the committee members highlighted the upcoming sessions and activities in the conference. Once enthusiasm of the participants was high, Prof. Takeshi Fujiwara, Okayama University, was invited to deliver the first plenary lecture entitled “Strategic Biomass Waste Recycling for Carbon Neutral and Regional Vitalization in A Local Town: Practice of Maniwa City in Okayama, Japan”. The challenges to develop the sound material cycles in the region taking into consideration of local industrial situation were right in the core interests of participants, and the informative presentation followed by the interactive discussion were fruitful and essential opportunity to kick off the 3RINCs2022.

## III. Plenary lecture 2

As a regional launching event in Asia and the Pacific and Japan for OECD's Global Plastic Outlook (GPO), this session was co-organized by OECD Tokyo Centre, Institute for Global Environmental Strategies, Economic Research Institute for ASEAN and East-Asia, and the 3RINCs steering committee. Dr. Shardul Agrawala, Head of the Environment and Economy Integration Division, OECD, provided a summary of major findings from GPO report including 1) full-scale overview of lifecycle impacts of plastics including production, consumption, waste, recycling, disposal, leakage, and GHG, 2) economic modeling analysis of plastic production and consumption including impact assessment of COVID-19 pandemic, and 3) assessment of innovation on environmental plastic technologies from 1990 to 2017. It was followed by the panel discussion among experts from OECD, ASEAN Secretariat, Teracycle, and Nikkei Asia. The panel emphasized the important role of innovation in business models and technologies to reduce plastic consumption and pollution.

## IV. Plenary lecture 3 (developed by Dr. Kawai)

“Solid waste management in low- and middle-income Countries - Challenges, trends and sector development approaches” was presented by Mr. Frank van Woerden, Lead Environmental Engineer of the World Bank. He is leading the recently approved China Plastic Waste Reduction Project and Indonesia National Solid Waste Management Project. As the co-author, He introduced extensive solid waste data at the national and urban levels aggregated in What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050 (<https://openknowledge.worldbank.org/handle/10986/30317>). He mentioned that supporting low- and middle-income countries with the development of their municipal solid waste sectors was a key portfolio for the World Bank. This program, which provided close to \$4 billion for lending operations since 2010, has been increasing in recent years with a trend that shifted from an infrastructure investment focus to reforms that are more targeted to address typical sector challenges such as operational finance, institutional capacity, and land issues. Also, circular economy approaches such as waste recycling and waste reduction policies are increasingly integrated as parts

of municipal solid waste management projects.

#### V. Special Session

In the 3RINCs2022, addressing the new era of a sustainable society, five special sessions were held every day during the conference from 14 to 18 March. In response to a strong need for a paradigm shift towards a sustainable society in all sectors by an integrated approach, the topics of special sessions covered the circular economy, 2Rs (reduce and reuse), decentralized treatment of MSW, construction waste, and carbon neutrality addressing SDGs 7, 8, 9, 11, 12 and 13 in particular. All sessions, including presentations, panel discussions, and Q&A with audiences were successfully conveyed with the latest information sharing and insightful discussion from wide perspectives.

##### **Session 1: Circular Economy – Transformation of Policies to Actions**

Currently, great enthusiasms and efforts to accelerate the circular economy (CE) for sustainable waste management have been shared in common among stakeholders including national and local governments, the private sector and NGOs in Thailand.

Many relevant policies and initiatives are raised, such as Roadmap on Plastic Waste Management and Bio-Circular-Green (BCG) Economic Model, in line with the key Thai principle on Sufficiency Economy Philosophy (SEP) and the SDGs. The special session on "Circular Economy -Transformation of Policies to Actions" was moderated by Dr. Chindarat Taylor, Vice President, SWAT, and five panelists delivered their practices and experiences on how to implement activities on the ground to promote CE. The panelists highlighted the action-based measures with practical and sustainable options that can be taken in their own responsibilities for a sustainable society.

##### **Session 2: 2Rs - How to Promote Actions and Policy for the 2Rs (Reduce and Reuse) Towards the Circular Economy?**

The session discussed necessary policy supports for promoting 2Rs (Reduce and Reuse) actions by consumers and business sectors to realize the circular economy. The session introduced case studies on actions to reduce single-use plastic wastes as well as food wastes from Japan, EU, United Kingdom, Viet Nam, Thailand and India. The session highlighted that there is a needs for non-technological aspect of circular economy including socio-economic aspects, consumer behavior, and business and service models. The panelists particularly emphasized the rising needs for policy studies to better understand effective incentive mechanisms and regulations on consumer behavior and business models as well as important role played by third-party organization to mediate intended policy impacts and stakeholders.

##### **Session 3: Decentralized Technologies, Equipment and Its Techno-economic Assessment for MSW Treatment**

Economic growth and social development are leading to the generation of large amounts of solid waste, especially in counties and rural areas where less attention is paid on. Improper waste management such as open-dumping or open-burning for unclassified solid wastes, as well as industrial-scale incineration with a high cost of waste collection and transportation in these regions have been considered not to be satisfied with sustainable development goals. Therefore, decentralized technologies and equipment for solid waste treatment in these regions are increasingly required.

This session was organized by Special Committee on Rural Waste Management (SCRWM), China Association of Urban Environmental Sanitation (CAUES), and moderated by Professor Pinjing He, Tongji University, China; Head, SCRWM-CAUES.

The session discussed and introduced the viable technologies for decentralized treatment, as well as the relating equipment, case practice, and techno-economic assessment when compared with the

centralized mode. The experts from Japan and China presented up-to-date progress regarding technologies and equipment for decentralized treatment of solid waste.

#### **Session 4: Material Cycles in Construction Works**

The Journal of Material Cycles and Waste Management is currently running a Special Issue entitled “Material cycles in construction works” to explore the contributions of construction industry to material cycles and waste management, since construction industry has a big potential to accept a large amount of solid waste from other industries as construction materials. This session was organized by Japan Society of Material Cycles and Waste Management, collaborating with the special issue. First, Prof. Katsumi from Kyoto University, Japan, gave a comprehensive review on Japanese status on sustainable management of waste, by-products, and surplus soil by construction industry, including the national policy, the regular survey and action plans implemented by the national government. Then, four speakers from Japan, France and India were invited among the authors of accepted papers in this special issue, and they presented some latest and innovative achievements in reuse and recycle of municipal and industrial wastes in construction works.

#### **Session 5: Resource Circulation Strategy for Carbon Neutrality**

Resource circulation strategy for carbon neutrality become a platform in the field of solid waste management to raise the significance and consequences of resources recovery from waste materials, to discuss the scientific solutions for carbon reduction by circular activities, and to inform the new aspect of waste management in the world. The session was organized by the Korea Society of Waste Management (KSWM) and chaired by Prof. Yong-Chul Jang, Chungnam National University, Korea. Three speakers from Korea (Yong-Ho YU from Ministry of Environment, Korea), Japan (Ms Madoka Yamamoto from Pacific Consultant Co), and EU (Prof Junbeum Kim, University of Troyes, France) were invited and made excellent presentations on recent efforts and plans for resource circulation strategy for carbon neutrality in each countries, followed by Q&A session. The session promoted the academic knowledge exchange in the field of resource circulation and carbon neutrality towards a net-zero society.

#### **VI. General Session**

A total of 15 general sessions, including 65 academic presentations and 8 presentations and movies from the sponsors, were successfully held from the 15<sup>th</sup> through the 18<sup>th</sup> of March. International presenters from 17 countries (Argentina, Austria, Bangladesh, Brazil, Cameroon, Canada, China, Indonesia, Japan, Malaysia, Nepal, Palestine, South Korea, Spain, Taiwan, Thailand, Vietnam) presented cutting-edge research and activities, all of which were related to material cycles and waste management. Many of the presentations were future-oriented topics with their high motivation for the building of a sustainable society. Each session was successfully managed by an international distinguished chair, and the presenters and audience actively discussed. A highlight excellent point in each session was there are many questions from students and young researchers who will be taking over our society to come. After closing each session, excellent presentations and outstanding works were recommended by each session chair, those presentations will be invited to submit their works to the Special Issue of Journal of Material Cycles and Waste Management (JMCWM) on the 8th 3RINCS 2022.

#### **VII. Creative Session**

The creative session was newly established at the 3RINCS2022 in the history of 3RINCS with the objective of networking stakeholders and sharing creative and insightful knowledge and actions currently being made on the ground, by a variety of stakeholders (creators) from private sector, NGOs,

international organizations, governments and academia, particularly to accelerate circular economy and sustainably society. The new tools and concepts such as DX, climate-resilient and low-carbon health systems were also introduced in the session.

There were five sessions presented by 30 panelists in total from Indonesia, Japan, Kenya, Nepal, Philippines, Switzerland, Thailand, UK and USA, from Day 1 on 14 March to Day 4 on 17 March during the conference. The schedule of the creative session is shown in the below table.

Table. Schedule of the creative session

	Day 1 14 March 2022	Day 2 15 March 2022		Day 3 16 March 2022	Day 4 17 March 2022
Session	CR-1	CR-2	CR-3	CR-4	CR-5
UTC+9 (JST)	18:15 – 20:10	10:00 – 12:00	18:15 – 19:45	18:15 – 19:45	18:15 – 19:40
Topic	DX in WM towards the CE	Disaster Waste Management	Expo 2025 Osaka Kansai	Greening HCWM	Mercury Waste Management

### Session 1. Digital Transformation (DX) in the field of waste management towards the Circular Economy

Some countries have introduced online applications and electronic manifest systems for industrial waste-related permits and approvals, but in many countries, analogue data management system is still the norm, and creating obstacles to smooth law enforcement and administrative monitoring. In addition, from the viewpoint of prevention of inappropriate disposal, compliance, and reduction of administrative costs, waste generators are also required to strengthen traceability and establish an efficient data management system. In light of these circumstances, the session delivered the latest findings and perspectives from a variety of stakeholders, on the current status, challenges, needs, case studies and prospects for smart resource circulation systems in the context of DX incorporated into waste management.

- **Findings**
  - Introduction of DX tools for a waste management system
  - Current status, challenges, needs, case studies and prospects for DX in a waste management system
  - Knowledge and practices from a variety of stakeholders
- **Discussion points**
  - The role of digital technologies to improve efficiency and efficacy of waste management system based on 3Rs
  - Challenges and bottle necks to promote the DX options in waste management system
  - Possible contribution of DX tools to the vulnerabilities of waste management in developing countries
  - Possible driver to improve serious labor shortage in the waste hauler industry

### Session 2. Disaster Waste Management - Developing a “Simulation-based training tool

In order to support the implementation of the Contingency Plan (CP) and the Management Plan (MP) for Disaster Waste Management (DWM), the JSMCWM is developing a “Simulation-based training tool” based upon the experience in Japan. The session invited experts on DWM to discuss the “Simulation-based training tool” to modify for the practical use in Asia and the Pacific, reflecting the current status, issues, and challenges of the DWM as well as the existing municipal solid waste management system.

- **Findings**

- Introduction and instruction of simulation-based training tool for development of DWM
- **Discussion points**
  - How to use, share and disseminate the tool
  - Practical use of the tool in consideration of the local contexts
  - How to incorporate the tool for development of DWM into the existing solid waste management system

### **Session 3. Countdown to Expo 2025 Osaka Kansai, Sustainable Procurement, Material Management and Resource Circulation in Megaevents**

World Expo is a worldwide event bringing together nations to enable people and nations throughout the world learn by exchanging ideas, showing innovation, and finding answers to urgent global concerns. Despite all these positive impacts, large-scale events may have major negative environmental implications due to the high demand for resources and possible waste generated during the preparation and execution of the event. To address global shared concerns, the worldwide community has committed to attaining the Sustainable Development Goals (SDGs) by 2030. The importance of the Expo is also in line with the attempts to achieve the SDGs. The session highlighted necessary activities and principles including the mindset of event organizers, when the event is organized, and relevant technologies were also introduced in order to accelerate resource circulation and promote a green conference.

- **Findings**
  - Expo's planning phase in order to accelerate resource circulation and develop a sustainable society
  - Implementation of (mega)events in line with the attempts to achieve the SDGs
  - Stakeholders' efforts and mindsets to promote green procurement initiatives which may help decrease costs and waste while also influencing production, markets, pricing, available services, and organizational behaviors
- **Discussion points**
  - How to embody the resource circulation system/society in events
  - How to evaluate and assess buying procedures and rules in line with a green procurement initiative/program before implementing
  - A life cycle evaluation of a products or service's environmental implications

### **Session 4. Greening Health Care Waste Management: Policies and Good Practices**

The provision of sustainable health care waste management (HCWM) has been receiving increasing global attention. The spread of COVID-19 has significantly posed a risk of transmission of infection in many countries, particularly in developing nations where proper HCWM is not in place. A lack of infrastructure, inadequate budgets, supportive policy and regulation, and capacity gaps make it difficult to achieve environmentally sound HCWM, which underscore the urgency of realizing sustainable and inclusive HCWM systems and green infrastructure (UNEP and IGES, 2020). The session invited several researchers, practitioners and businesses entrepreneurs in the field of HCWM to present and discuss policies and good practices of greening health infrastructure based on their recent research work and operation.

- **Findings**
  - The provision of sustainable health care waste management (HCWM)
  - A new commitment to take concrete steps towards creating green, climate-resilient and low-carbon health systems (COP26)
- **Discussion points**
  - Climate footprint of the health care sector

- ❑ Sustainable and inclusive HCWM systems and green infrastructure

### **Session 5. Latest development and future perspectives on mercury waste management**

The Minamata Convention on Mercury entered into force in August 2017, with the objective to protect the human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The Article 11 of the Convention requires its Parties to ensure the environmentally sound management (ESM) of mercury wastes. Most developing countries, however, have been facing challenges with capacities to manage mercury wastes in an environmentally sound manner. The Waste Management Area (WMA) of the UNEP Global Mercury Partnership is the area that has undertaken various activities with its objective to promote the ESM of mercury wastes by developing and disseminating relevant materials, enhancing capacities and awareness and providing specific solutions at the global, regional, national, and local levels. The session shared recent activities of the WMA and also provided latest findings on mercury science, regulation and waste management.

- **Findings**

- ❑ Challenges with capacities to manage mercury wastes in an environmentally sound manner (Article 11 of the Minamata Convention on Mercury)
- ❑ Stakeholders' involvement to control the anthropogenic emissions and releases of mercury throughout its lifecycle
- ❑ UNEP Global Mercury Partnership with eight priorities for action (or partnership areas) including Waste Management Area (WMA)

- **Discussion points**

- ❑ Share recent activities of the WMA
- ❑ Outlook on mercury science, regulation, and waste from the viewpoint of the global mercury flow and stock including the mercury use and emission by the social activities

### VIII. Closing session

The steering committee had invited irreplaceable and wonderful speaker from World Bank, Mr. Frank van WOERDEN to deliver the speech entitled “Solid Waste Management in Low and Middle Income Countries – Challenges, Trends and Sector Development Approaches”. The projects led by World Bank’s with their philosophy and experiences were introduced in detail. The discussion and interaction moderated by Ms. Rieko Kubota, NIES and World Bank, gave quite useful and practical information to the participants in terms of the development of the relevant project with available financial scheme. Following to the call for papers to special issue to JMCWM (see below) by Prof. Shin-ichi Sakai, the committee members provided the concise reflection of the 5-day event, by Dr. Yasuhiko Hotta on the special sessions, and Dr. Junya Yano on the general sessions, respectively. The committee member also received several warm greetings from the participants, Prof. Maria Antonia Tanchuling, University of the Philippines Diliman, and young generations. Finally, Dr. Misuzu Asari gave the overall reflection of the whole event on the 3RINCs2022, and the conference with a promise to get together again next occasion was closed.

### IX. Public relation, outreach and networking

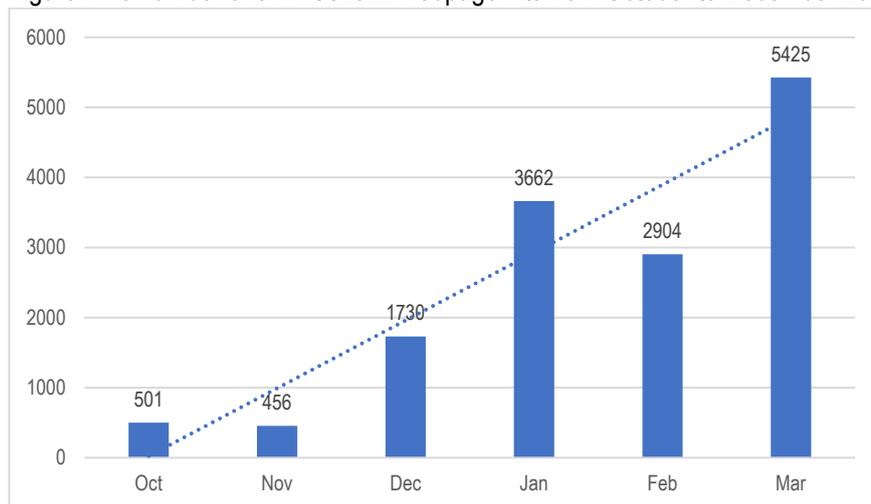
All 3RINCs 2022 communication and outreach materials such as a flyer, a brochure and a video were created and uploaded to the 3RINCs2022 webpage (<https://www.3rincs.org/3rincs-2022/>). Establishment of the “creative session” was the first attempt in the history of the 3RINCs, and it was open for public. The presentation documents were shared prior to the sessions, and the YouTube videos can be also accessible for public from the 3RINCs webpage (<https://www.3rincs.org/3rincs-2022-creative-sessions/>). In addition, a series of 3RINCs2022 newsletters before, during and after the conference, were distributed to all stakeholders such as a member of the JSMCWM, partners,

supporters, sponsors, past participants of the 3RINCs, and international societies all over the world to share the updates of 3RINCs2022 including the event schedule, call for abstracts and papers, registrations in a timely manner, and introduction of sponsors. The sponsor's brochures and videos are also available from the webpage (<https://www.3rincs.org/3rincs2022-sponsors/>).

The website is also linked up with other social networks and channels like Facebook and the ISWA calendar and newsletter. The analysis on access of the 3RINCs website was conducted by a member of the steering committee and the following results were introduced.

- The number of 3RINCs2022 webpage hits showed a growing trend from October to December 2021. (ref. figure below)
- The significant increase was seen after the announcement of registration in December 2022.
- As expected, the number of hits was high during the event. (669, 407, 254, 200, and 136 from 14 to 18 March 2022, respectively)
- After the event, presentation materials and videos of some sessions were released sequentially, and many people browsed these pages.

Figure. The number of 3RINCs2022 webpage hits from October to December 2022



In addition, the steering committee of the 3RINCs updated the list of stakeholders such as international, national and regional organizations and groups who are engaged in 3Rs and waste management in the world, and invited some representatives from the list to strengthen the collaboration and networking with them for further enhancement of the 3RINCs platform.

#### X. Acknowledgement

The steering committee thank especially for the following stakeholders who vitally organized and supported the 3RINCs2022. Their continuous supports enable 3RINCs to play a role of a knowledge platform to share latest findings and experiences, and to enhance networking among stakeholder all over the world to overcome challenges, difficulties, and constraints of the global, regional and local crises on waste management.

##### Organizer

- Japan Society of Material Cycles and Waste Management
- Korean Society of Waste Management

- Society for Solid Waste, Chinese Society for Environmental Sciences
- Solid Waste Management Association Thailand (SWAT)
- National Institute for Environmental Studies (NIES)

#### Supporter

- Ministry of the Environment Japan (MOEJ)
- Japan International Cooperation Agency (JICA)
- United Nations Centre for Regional Development (UNCRD)
- Institute for Global Environmental Strategies (IGES)
- International Solid Waste Association (ISWA)

#### Sponsor

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