



## Minutes of the Meeting

### Webinar on

# E-Wastes Management in India

Organized by IIT-Madras - SAICM held on 11<sup>th</sup> May 2021 – 3 pm to 5.30 pm

(This research project is supported by the MoEF&CC, Gol.)

The webinar on "E-Wastes Management in India" is a part of a larger project on the "Strategic Approach to International Chemical Management (SAICM)," supported by the Ministry of Environment, Forest and Climate Change (MoEF&CC, Gol). The webinar is to build a knowledge base on scientific/technical research undertaken by various Institutions/researchers - specifically in e-waste management, lead in paints, pharmaceutical pollutants, endocrine-disrupting chemicals, and nano-technologies - and to create a network of researchers working on topics related to it. Several experts were invited to this Webinar. Annexure 1 contains participants name and their affiliations.

#### **Chairperson:**

Prof. V. R. Muraleedharan, Department of Humanities and Social Sciences, IIT Madras, chaired the webinar.

#### **Welcome Speech:**

Professor B.S. Murty, Department of Civil Engineering, IIT Madras, welcomed the participants. After a brief round of self-introduction by participants, he highlighted the objectives and scope of the SAICM project. The specific objectives of this webinar were (a) to have a consultation on the various challenges we face in India concerning effective management of "Hazardous substance within the life cycle of electrical and electronic products", and (b) to suggest policy measures to enable the MoEF&CC to fulfil the goals of SAICM.

#### **Introduction:**

The introduction and status of the ongoing project were presented by Dr. J. Senthilnathan, Department of Civil Engineering, IIT Madras. He presented the mandate and the status of the ongoing project, and the following key questions



which this Webinar will address:

1. What are the critical challenges in e-waste management in India?

Under this broad question, the important sub-issues are:

- Ways to strengthen the e-waste reporting process and to maintain state-wise inventories on e-wastes generation.
  - Ways to enhance awareness among consumers concerning e-waste recycling, environmental hazards, and public health consequences
  - Ways to integrate informal and formal sectors in e-waste collection and reuse/recycling;
2. Effectiveness of existing Rules/policies concerning e-waste management in India?
  3. Are there lessons from other countries?

The Webinar had two sessions. These are summarised below:

## **Session 1:**

### **Moderator: Prof. Ligy Philip (3.15 to 4.30 pm)**

**Topic:** E-wastes in India: Health/Environmental impact and Recycling Technologies

Professor Ligy Philip, Department of Civil Engineering, IIT Madras, moderated session 1. Prof. Ligy Philip provided the background of the session 1 topic, "E-wastes in India: Health/Environmental impact and Recycling Technologies," to the participants and invited the speakers to present their views:

**Expert talk 1:** Prof. Kurian Joseph, CES, Anna University

**Topic:** Hazardous substances present in e-waste - Indian scenario

Prof. Kurian Joseph mentioned that electronic components are made up of different materials. Some contain hazardous substances that have an adverse impact on the environment and human health. He described the nature of the hazardous substances present in the e-waste and pointed out the dismantling/recycling step is the weakest step in India's e-waste management. Hence, he insisted that more focus is needed in this area.



### **Concluding Remarks of Prof. Kurian Joseph:**

He emphasized that the e-waste policies should encourage the integration of recycled content into newly developing products. The long-term goal should be to redesign electronic products to use less or non-hazardous materials. In addition, it is essential to design products, which need to be reuse and eventually for recycling. The scrap materials from the manufacturer should be reintroduced into the new products. Improve the collection of end of live electronics policy to encourage recycling and integration of recycled materials into the new products.

### **Discussions:**

**Q.1: Prof. Ligy Philip** referred to informal sector's primary focus on recovering precious metals and dumping or discarding other non-valuable materials like plastic, glass, and other waste. She asked "Do we have any data-base on quantum of dismantling and disposal of non-valuable materials in formal/informal sectors?"

### **Response:**

Prof. Kurian Joseph responded that the data is available only for formal system. In a formal system, materials like plastic, glass, and other items are properly disposed of after recovering valuable metals. However, he remarked, the important question is how much e-waste is reaching the formal system. Formal systems are not getting sufficient e-waste materials to operate. However, we do not have any data regarding the informal system.

**Q.2: Prof. Ligy Philip** asked, still complete dismantling and recycling are not happening in most of the formal system operating in different states of India. In addition, most of the formal recycling units focusing mainly on the recovery of precious metals like Ag and Au. She further posed this question", to what extent is recycling or dismantling taking place in the formal sector? What are the existing policies to address these issues?



**Response:**

In the formal system, complete segregation of components such as glass, plastic, takes place. The separated materials are sent to the appropriate recycling units present either in India or other countries. The enforcing agency has to ensure complete cycle of the separation and recycling process.

**Q.3: Profile Ligy Philip** replied that most of the e-waste is going to the informal sector as per the data. Is there any data available for where these unauthorized or informal unit are operating?

**Response:**

Getting such data is very difficult, and some NGOs may have studied it. However, the pollution control board is focusing mainly on the bulk generators. We have a good database on the consumption of electronic goods, on the total amount of e-waste likely to be generated and the amount of e-wastes that reach the formal system. We can therefore make an estimate of the amount of e-waste reaching the informal sector.

**Q.4: Dr. Rangarajan** raised the question on the star rating of e-components available in the market, indicating the energy-efficient and other features. Is there any plan to introduce environmentally friendly electronic products with the appropriate ratings?

**Response:**

Yes, our electronic waste management goal envisages eco-labelling of electronic goods. The existing framework, mandates that electronic waste manufactures should indicate the nature of compounds or chemicals present, in their brochure. Already the framework is there, but it will take some time to implement in the field.

**Q.5: Prof. Muraleedharan** asked about trace elements' presence -- some of them are valuable. How easy to recover or reuse such trace elements present in the e-waste?



### **Response:**

All these trace elements are recoverable. However, do we have enough quantity to set up a plant to make such recovered trace elements economically viable? The answer is NO. We have to consider this issue while we consider recovery of trace elements present in the e-waste.

- 1. Expert talk 2:** Prof. H.T. Pandve, Department of Community Medicine (PSM) PCMC YCMH & PGI

**Topic:** Environmental and Health Hazards of E-wastes in India

Professor H.T. Pandve talked about the release of toxic metals, persistent organic pollutants, dioxin, PAHs, and other materials during the process of dismantling of e-waste. In addition, he pointed out that the health impacts of such toxic compounds, on humans, and on air, soil, and water.

### **Concluding Remarks of Prof. H.T. Pandve:**

He also emphasized the importance of technological advancement, institutional arrangement, operation plan, awareness, and safety protocol for workers for more effective management of e-waste in India. He further emphasized the need for studies on health impacts of e-wastes in India.

### **Discussions:**

- Q.1: Prof. Muraleedharan** asked whether 5G technology might affect human health, as reported in some studies.

### **Response:**

We frequently change our mobile phones and other gadgets for our technological advantages, without realizing how it will affect our environment and public health. It is essential to educate our general population about electronic products and e-waste.

- Q.2: Prof. Ligy Philip:** How much information is available on the health impact among children dealing with e-waste in the informal sector?



**Response:**

Prof. H.T. Pandve responded, such studies are not available in Indian context but might be available in other developed countries.

**Q.3: Dr. Rangarajan:** Is there any initiative to educate or create awareness in the informal sector to use safe technologies to recover materials?

**Response:**

Prof. H.T. Pandve responded that the Informal sector is highly neglected, and people are working without any proper protective equipment. This situation must improve by through a robust policy.

Prof. Kurian Joseph further added that our law envisaged that the producer should take responsibility for appropriate waste management practices.

**2. Expert talk 3:** Dr. Sandip Chatterjee, Director, Ministry of Electronics and Information Technology, Govt. of India.

**Topic:** Recycling Technologies for e-wastes in India: What are the current options?

Dr. Sandip Chatterjee outlined the initiatives of Ministry of Electronics and Information Technology (GoI) towards sustainable management of e-wastes in India.

He highlighted the importance of developing cost-effective, environmentally sound processing technologies, creating awareness among stockholders, skilled workforce, and promoting<sup>4</sup> He also emphasized the importance of technological advancement, institutional arrangement, operation plan, awareness, and safety protocol for workers for more effective management of e-waste in India.

He further pointed out the need for encouraging start-up and entrepreneurship. Dr. Sandip Chatterjee reemphasised the need to integrate the formal and informal sectors.



The informal sector has to play a critical role in managing e-waste in India. Informal collection networks play a vital part in the e-waste management system, giving India one of the world's most effective e-waste collection mechanisms. It is estimated that the informal sector handles 90 percent of the e-waste. However, on the recycling side, the informal sector focused mainly on the recovery of precious metals with primitive technology and discards other parts such as glass, plastic, rubber into the landfill – of these, they can achieve only 20-30% recovery, whereas more than 90% of gold is recovered by the formal sector. He also mentioned that informal units are driven by profit motives with very little (practically no) capital investment, giving low priority to safety and sustainable e-waste recycling.

Dr. Sandip Chatterjee mentioned that it is unfortunate that the e-waste regulation amended in 2016 did not mention the informal sector. It is important to integrate the formal and informal sectors, which can happen only if the law acknowledges the existence and contribution of the informal sector. He pointed out that MoEF&CC has to review the current regulation and recognize the role of the informal sector. The government can also play a role in creating awareness. With proper recognition, informal collectors can be an extended arm of the producers and recyclers to provide the huge amounts of e-waste to be recycled in a non-compliant way.

### **Concluding Remarks of Dr. Sandip Chatterjee:**

Formalize the informal refurbished market. Extended Producer Responsibility in India mainly focused on the downstream process that is the end-of-life management process. However, we should consider the upstream process, which minimizes the presence of toxic materials in the electronic products; the design also shows refurbishment of the product should be encouraged, and the product should not force obsolete. Create an ecosystem for the dismantling and appropriate segregation of separated materials/components based on their properties and market values.

Provide affordable technologies, adequate tools, machinery handholding, and skillset/training to the informal sector and make them formal. Create adequate



infrastructure for the recycling of products. Benchmarking the created facilities and auditing the standard.

### **Discussions:**

**Q.1: Dr. Rangarajan** observed that most of the e-waste contains a very low concentration of precious metals (Au, Pd, and Ag). Given this, "What do you think about the overall economy of the process?" he asked

### **Response:**

Dr. Sandip Chatterjee responded that if you are talking about a high-grade circuit board, we have a processing unit at C-MET costing Rs. 20,000 for 100 kg. Some of the metals are in the salt form; we are not further extracting them. We will stop our process if it is not feasible to recover the trace metals.

**Q.2: Dr. Rao:** Why government could not subsidize the informal sector to treat e-waste from the public health budget?

### **Response:**

Dr. Sandip Chatterjee responded that MoEF&CC has to amend the rule to include the informal sector as a stakeholder. MoEF&CC has not considered the informal sector as a stakeholder, even though they treat 90% of the e-waste generated in India. However, MeitY is working with the Manufacturing Association of IT products and are organizing many awareness programs.

**Q.3: Prof. Rama Mohana Turaga:** Is there any engagement with the informal sector by the MeitY? Is there any forum to engage with the informal sector? Traditionally informal sector working without any regulation and suddenly exposing them to formal one may create apprehension among themselves.

### **Response:**

Dr. Sandip Chatterjee responded that from 2015 to 2020, a series of awareness programs were conducted as directed by the Honorable Prime Minister Narendra Modi. In Muradhabad, which is a major hub for the informal sector, we





have conducted 72 awareness programs. We had extensive discussions and encouraged them to visit C-MET laboratories. The MoEF&CC should recognize the informal entity otherwise; it is very difficult to engage with them. The informal sector has a very good collection network. However, their recycling process is very poor; for example, the recovery of gold is only 30%, and the rest of the materials are wasted. The Ram Ganga River is highly polluted with heavy metals because of the pollution from Moradhabad.

**Q.4: Prof. Ligy Philip** raised two important questions (1) what initiatives have the MietY taken to deal with upstream or design change in the electronic products?, and (2) As the composition of electronics products are changing every year, how easy is it to adopt your technology for treatment of these materials?

**Response:**

Dr. Sandip Chatterjee responded that India is a very competitive market for our producers. They are not readily interested in taking up upstream initiatives, as most of them are assembly manufacturers. They will get the electronic parts from other countries and assembling here. We are trying to make a strategy for a circular economy as directed by the NITI Aayog, which has taken several initiatives to encourage producers to adopt best practices, and to design better to refurbish easily, and for the products to have a longer life. In addition, technology that we offer to a few of the companies have to be augmented. For example, the pyrolysis process is good for the high-value load. However, if they are facing problems in yield and other issues to improve their process, they have to come back to the centre of excellence C-MET.

**Session 2:**

**Moderator: Prof. V. R. Muraleedharan (4.30 to 5.30 pm)**

**Topic:** E-Waste Management in India: Policy Options

Professor V. R. Muraleedharan presented the background for the second session "E-Waste Management in India: Policy Options." In addition, Prof. V. R. Muraleedharan reiterated the questions addressed during the introductory session. The purpose of this session is to deliberate upon existing policy measures and suggest a set of policy



measures to enable MoEF&CC (GoI) to strengthen the regulatory regimes towards e-waste management in India.

**3. Expert talk 4:** Prof. K. K. Pant, Department of Chemical Engineering, IIT Delhi.

**Topic:** Role of informal sector for dismantling and recycling of e-wastes in India.

Professor K. K. Pant mentioned that the development of technological solutions to e-waste management should be environmentally friendly. In addition, it is important to find cost-effective recycling technology, which causes no toxic compound emission to air, land, and water. He also mentioned that hydrometallurgy and pyrometallurgy are the most commonly used recycling technologies to recover valuable metals from e-waste. However, the important drawbacks of these technologies are creating pollution, high cost, high consumption, and slow rate of metal recovery. On the other hand, the greener technologies such as ionic liquid, hybrid, and chelation techniques are novel ones but not widely used to recover valuable metals from e-waste. He also highlighted the need to integrate the informal sector with formal sector, in line with observations made by Sandip Chatterjee. The formal and informal integration promote employment, income opportunities in the informal sector, increase waste collection targets, which in turn requires appropriate recycling.

### **Concluding Remarks of Prof. K. K. Pant:**

Informal sector's important strength is that it segregates the e-scrap into high and low values categories and provides raw materials for large recyclers, and creates job opportunities in local economy. Informal sector's weaknesses are unskilled labour, lack of sound infrastructure, polluting the environment, landfilling hazardous residues, and producing toxic fumes and effluents. More training and workshops should be organized for informal workers to spread awareness about the e-waste management rules, 2016. Informal e-waste collection and dismantling should be linked with the formal recycling sector through an authorized platform like NGOs/PRO. Effective implementation of



extended producer responsibility policy to increase formal collection and dismantling of e-waste.

### **Discussions:**

**Q.1: Dr. Sandip Chatterjee:** Have you done any upscaling?

#### **Response:**

Prof. K. K. Pant responded that we have a 50 kg/day capacity unit in our IIT Delhi laboratory. We are currently working on a different design and connected to various industries interested in taking this technology further.

**Q.2: Dr. Sandip Chatterjee:** If you go to the larger scale, like 1000 kg/day, a little bit of tweaking in the process has to be made. The nature of materials also affects the recovery of gold.

#### **Response:**

Prof. K. K. Pant responded that recovery of gold contains up to 50 ppm in printed circuit boards and mobiles. Currently, we are collecting e-waste from Nehru Place; it has diverse kinds of e-waste. Working with a 50 ppm concentration of gold waste is not economical. Now we are trying to tie up with Samsung to focus on one type of brand.

**Q.3: Dr. Sandip Chatterjee:** 100 kg/day is not economical to recover gold from e-waste; however, from 300 kg/day onwards, this process is economical, and 1000 kg/day is good and economical to make some profit.

#### **Response:**

Prof. K. K. Pant agreed with Dr. Sandip Chatterjee and said our technology could recover 90% of the gold.

**Q.4: Dr. Rao:** Why are we allowing importing of e-waste into India?

#### **Response:**



Indian laws currently do not allow electronic and plastic waste to be imported into the country. India is the signatory of the Basel Convention, which prevents the Trans Boundary Movement. However, some electronic products are coming as a donation; now, India stopped importing donated electronic products.

**5. Expert talk 5:** Prof. Rama Mohana Turaga, IIM Ahmedabad.

**Topic:** Effectiveness of existing rules/policies with respect to e-waste management in India?

Prof. Rama Mohana Turaga presented an over view of E-waste (Management) Rules 2016 in India. These rules have high compliance among producers. However, we are still a long way from developing a policy framework that could facilitate a robust e-waste management system in the country. He mentioned that more innovative mechanisms and alternative policies are needed to engage with the consumers. In addition, we should improve the awareness using some popular sources, and it is important to find a more convenient and easy way to deposit e-waste and refund system for consumers. He mentioned that informal collection networks are very effective, but their end-processing techniques are inefficient, dangerous, and polluting. Informal collectors are still receiving the major volume of e-waste disposed and collected.

**Concluding Remarks of Prof. Rama Mohana Turaga:**

Most of the speakers acknowledged that we need a greater engagement with the informal sector and recognizes their right to livelihoods, develops a shared understanding of the problems along with potential solutions, and builds trust. Rama Mohana Turaga emphasised that MoEF&CC should create a platform that facilitated discussion among various stakeholders, including informal sector workers, NGOs working with the informal sector, PROs, and registered recyclers and manufacturers. In addition, the government should revisit the policy instruments under the EPR approach. Regarding extended producer responsibility, a mandatory take-back with collection targets may not be the ideal solution. There are many options available other than mandatory take-back. The government can impose an advanced recycling fee or advanced disposal fee on every unit of the product sold in the market. The revenues



generated to develop markets for the end-of-the-life products. It would relieve the producers' responsibility of physically collecting e-waste materials.

### **Discussions:**

**Q.1: Prof. V. R. Muraleedharan:** Many times, we talk about the effective implementation existing of EPR. What is the existing institutional mechanism and organization structure we have?

### **Response:**

**Prof. Rama Mohana Turaga:** The leading regulatory players are CPCB and SPCB. The SPCB's responsibilities are monitoring and enforcing standards and regulations for each recycler, like PROs and dismantlers.

**Q.2: Prof. V. R. Muraleedharan:** Almost every such waste comes under SPCB. Within SPCB, is there a separate wing for each of subsector? How is it organized?

### **Response:**

**Prof. Rama Mohana Turaga:** Both CPCB and SPCB lack in the workforce and infrastructure. It is essential to improve the infrastructure and efficiency of the CPCB and SPCB to deal with the current e-waste management problem in India.

**6. Expert talk 6:** Ms. Rishika. D. and Mr. Tarun Philip – E-Serve - IGCS, IIT Madras.

**Topic:** E-Waste Business in India: Perspectives of an Entrepreneur

Ms. D. Rishika, and Mr. Tarun Philip presented the intelligent e-waste exchange platform they have developed -- which will reduce improper handling or disposal of e-waste and damage to the environment. The main idea of this concept is the consumer can deposit their e-waste at designated collection facilities and collect a reasonable price based on the nature of the materials present in the products.



## **Concluding Remarks of Ms. D. Rishika, and Mr. Tarun Philip:**

As of 2019, the country generated about 3.2 million metric tons of e-waste. Some of them are recycled, but with little regulation, In India, only 2% of the e-waste is being recycled. There are still roadblocks to the effective handling of waste, a lack of investment, infrastructure, and consumer awareness. Recently, several start-ups and companies have come forward to help India's informal sector collect, process, and recycle electronic waste seamlessly.

### **Discussions:**

**Q.1: Prof. B.S. Murty:** Have you registered your company?

#### **Response:**

**Ms. D. Rishika, and Mr. Tarun Philip:** No, we have not yet registered our company.

**Q.2: Prof. B.S. Murty:** How is this platform working?

#### **Response:**

**Ms. D. Rishika, and Mr. Tarun Philip:** Sellers can enroll for free, and they have to log in to the portal first. Then sellers have to upload what component they have. Similarly, buyers can send the bit request to purchase any component or materials in the portal.

**Q.3: Prof. B.S. Murty:** Is this coming under the formal sector?

#### **Response:**

**Ms. D. Rishika, and Mr. Tarun Philip:** No, it is coming under the informal sector.

**Q.4: Prof. Kurian Joseph:** As per law, those who channel the e-waste for the informal sector are considered an illegal activity. Without registration, the law will not recognize them.



**Response:**

**Ms. D. Rishika, and Mr. Tarun Philip:** One of the features we were trying to build in is to help the informal sector with quality compliance. One of the key roadblocks for them to become formal is that there are many compliance issues, and they need handholding support. Therefore, the platform would do that for them. That is where this platform chips in trying to help them formalize because they do not have an incentive to stay in informal other than the fact that they can skip this compliance with such rules.

**Q.5: Prof. V. R. Muraleedharan:** It is nice to hear from your presentation that many informal sectors are eager to join the formal sector.

**Response:**

**Ms. D. Rishika, and Mr. Tarun Philip:** They look at it as social mobility, and it is one of the incentives for them.

**Q.6: Prof. Rama Mohana Turaga:** How many informal sector workers have you spoken to so far?

**Ms. D. Rishika, and Mr. Tarun Philip:** Almost 40 informal workers.

**Q.7: Dr. Sandip Chatterjee:** The main problem with the informal sector is the trust level. They are the best collectors, and they know where the materials are available. However, we have also not created a very vibrant market model that the informal can hand over the materials to the formal system. Because we do not have a Government laboratory, which can assess the materials and give the right price, they are not interested in losing the circuit board to the formal fold as they know the value of the printed circuit boards. If you can have a market-driven mechanism, then this formal and informal unification can happen. Can you build the trust level of those in informal sector with your model?

**Ms. D. Rishika, and Mr. Tarun Philip:** One of the platform's attributes would be in terms of third-party quality assessment and where value certification would be given. We have not got in there yet.



**Q.8: Prof. Ligy Philip:** The informal sector separates the valuable materials, and you will get lots of unwanted materials. Who will be responsible for that unwanted materials?

**Ms. D. Rishika, and Mr. Tarun Philip:** The platform does not deal with the informal sector. We only act as a facilitator.

**Q.9: Dr. Rao:** 90% of informal recycling is so huge, and the only way to go is formalization. There are many reasons why the formal sector makes money. Therefore, the regulation very intelligently recognizes it. My suggestion is that money can be given as an incentive to make the informal sector formal. Dr. Sandip Chatterjee added to Dr. Rao's observation that IITM team could propose training program for enhancing the skills of those in informal sector.

## Recommendations

1. Formalize the informal refurbished market to a formal one.
2. Create an ecosystem for dismantling and appropriate segregation of separated materials/components based on their properties and market value.
3. Provide affordable technologies, adequate machinery, handholding, and training to the informal sector and make them formal.
4. Create good infrastructure for the recycling of products: Eco-parks to recover their precious metals/materials.
5. Create awareness among all the stakeholders to channelize the materials to created infrastructure.
6. The government should consider providing initial financial support for capital equipment and providing adequate training to create awareness about the e-waste management rules (2016 rules).
7. Benchmarking the created facility and auditing the standards.





## Annexure 1: List of participants

Sl. no	Name and Address of the Expert	Contact Details
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