Building the Link: Leveraging Formal-Informal Partnerships in the Indian E-Waste Sector

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Executive Summary

To date, India is the world's fifth largest generator of Waste from Electrical and Electronic Equipment (WEEE or e-waste) and, due to its rapid development and expanding middle class, generates approximately 1.85 million tonnes of WEEE annually. As of today, some 95% of these wastes are managed by the informal sector which operates under inappropriate working conditions and relies on crude techniques for dismantling and recycling. Despite being highly effective in collecting WEEE, such techniques yield low extraction rates and result in large-scale environmental pollution which negatively affects the physical well-being of thousands of people.

The importance of the informal sector for maintaining employment levels and increasing collection of WEEE is widely recognised. Previous analyses suggest that there is a need for formalising actors from the informal economy in order to increase the amount of e-waste channelled to authorised recyclers. Through recent years, a number of initiatives have tried to achieve exactly this, yet with mixed success. Hence, scrutinising formal-informal partnerships as to why formalisation occurs or fails can deliver valuable insights for effective implementation of the recently passed E-Waste Management Rules, 2016.

Against this background and on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ), the GIZ advisory project on Sustainable Solid Waste Management and Circular Economy commissioned this study to look at a number of prominent case studies which are (or were) positioned at the nexus of the formal and informal sector in order to identify the drivers for and barriers to a continued process of formalisation. Over the course of three months, adelphi and its project partners conducted numerous in-depth interviews with representatives from initiatives which carry out collection, dismantling and/or recycling of WEEE. Based on these interviews, the expert team developed suggestions for the design of partnerships and provides recommendations for their longevity, replication and scale-up.

The case studies which were investigated were:

INITIATIVE	LOCATION, ACTIVITY STARTING DATE
Green E-Waste Recyclers	Delhi, 2011
SWaCH	Pune, 2008
Saahas Zero Waste	Bangalore, 2013
E-WaRDD	Bangalore, 2009
GIZ-Microsoft	Delhi, 2011; Kolkata and Ahmedabad, 2013
Chintan	Delhi, 2007

The case studies show a number of different attempts to partner with the informal sector in India in differing local contexts and stakeholder constellations. The 2011 e-waste rules have contributed to the setup of various recyclers and partnering initiatives, however, they have not lead to an additional flow of financial resources from producers or consumers to cover formal recycling costs. As a result, the economics of recycling have remained dependent on the material value in e-waste, and the majority of the case studies analysed here have been dependent on good will of civil society, informal sector and formal sector actors to achieve progress. The partnerships in the case studies have often centred on aggregation of informal collection activities in the form of a collection agency. Often the organisation of the informal sector took place via a civil society organisation, often supported by GIZ or other international development organisations, and was based on having established long term-presence, contacts and trust in the local informal community. However, the collection agency function alone often does not provide sufficient profits to finance its activities, particularly since e-waste generators still expect payment for their e-waste and informal recyclers can offer more competitive buying prices than compliant formal recyclers. In a number of cases it therefore became difficult for initiatives to continue collecting e-waste past the initial funding phase, or the collection was continued on a small

scale. The majority of collaborations were reliant on non-binding agreements with informal sector actors, as additional financial incentives beyond market prices were mostly unavailable. These agreements included, for instance, protective gear, trainings and social benefits, which partly offset the financing gap, though agreements tended to be verbal in nature and not always followed through. For such partnerships to be successful in the long term, a certain degree of formalisation can be useful – but this is not always wanted by the informal collectors, which may hamper the formation of such partnerships.

In the majority of case studies, the collected e-waste was mostly from bulk consumers as opposed to private households, and the annual volumes were small compared to the scale of e-waste generated across India. The cases investigated were mainly focused on collection and not on partnerships aiming at upgrading or formalising actors engaged with the more dirty and dangerous activities of informal recycling. Ultimately both parts of the value chain will likely need to be included in formalisation strategies in order to channel e-waste into controlled and safe recycling activities, since left to market forces, the competitiveness of informal recycling will continue to dominate. There are some plans for grouping recyclers in industry parks which might lead to some experiences in this area.

For partnerships to reach maturity and scalability in future, widespread engagement at the local level with trusted local actors will be necessary, as well as financing mechanisms which enable collection of all e-waste fractions, and not just those which present higher value to collectors. Benefits to both informal and formal actors appear to be possible, however the study shows that the long-term implementation of informal-formal partnerships remains a challenge in practice when not accompanied with additional financing from producers or other sources. In particular the absence of examples of a working financing mechanism set up by producers within their EPR obligations for partnering with the informal sector makes assessment of this scenario speculative, but it could still hold the key to channelling e-waste effectively to controlled facilities. Novel payment interfaces such as mobile banking are being established by stakeholders in India and could present new opportunities, but there were no experiences with this yet that could be analysed. Nevertheless, the analysis should bring useful insights on how engagement with informal actors has so far taken place, and what function civil society, recyclers, producers and other actors can play in developing partnerships. These findings have particular relevance for the implementation of the 30% collection targets for producers set by the 2016 e-waste rules, and will be useful to producers, governments, NGOs and international organisations looking to involve the informal sector in their e-waste strategies. The Indian e-waste sector is characterised by highly dynamic market environment and high degree of fragmentation. At times, the research team was confronted with contradictory information and needed to cross-check various sources in order to verify findings and produce warranted results. Therefore, the findings presented in this paper should be interpreted carefully. One-to-one extrapolation to different geographical contexts may not always be applicable. Nevertheless, following analysis of the case studies the recommendations from this research can be summarised as follows.

1 **First,** **the organisational structure of partnerships should be designed in such a way that they respect the entrepreneurial character of informal collectors**. Often, informal collectors are used to work individually and view themselves as autonomous entrepreneurs. If partnerships introduce strict top-down hierarchies, conflicts may arise and create frictions among parties involved. This was a key learning from the Saahas case study which set up a cooperative of e-waste collectors which quickly disintegrated thereafter. Analysis suggests that the underlying reasons pertain to strong personal ambitions of individuals who felt that being part of a larger organisation would compromise their personal autonomy. A positive example is SWaCH where the network-like structure of more than 100 informal collectors is effectively harnessed for e-waste collection under the umbrella of rag-picker union KKPKP. Yet, for some organisations, clearly defined responsibilities and hierarchies can become necessary to ensure efficient coordination of collection activities; again, Saahas can be mentioned as an example as it maintains a large network of about 150 collectors. Whether to introduce strict hierarchies or not needs to be decided on a case-by-case basis and should take into account the needs and expectations of the affected stakeholders.

2 **Second,** to increase the success of formal-informal partnerships, key individuals within a particular community and the e-waste value chain should be identified, approached and included. The analysis suggests that trust is an important pre-condition for the creation of formal-informal relationships and should be seen as a valuable resource when connecting to informal collectors. Integrating key stakeholders which are perceived as reputable and reliable business partners within the target community is necessary to render the partnership trustworthy and ensure that producers can fulfil their obligations under the current EPR scheme. Doing so can increase the rate of formalisation by bringing additional informal workers on board. In case such key individuals cannot be identified within the target region, locally embedded civil society organisations can be approached and used as vehicles for roll-out of activities.

3 **Third,** civil society organisations can be useful interfaces for connecting to informal actors and should be included in partnerships. These organisations often work for the public benefit of the community, thus enjoying a strong standing and good reputation among local stakeholders. Hence, they can help producers and PROs in fostering relationships to informal actors. Within formal-informal partnerships, civil society organisations may assist to establish trust, can offer additional benefits to informal collectors in form of trainings, educational activities or advocacy of workers' rights and have the ability of raising awareness for proper handling of e-waste among the informal sector.

4 **Fourth,** agreements between formal and informal actors need to provide some degree of flexibility in order to adapt to changing local conditions. The e-waste sector is characterised by a highly dynamic market environment and consists of a wide range of heterogeneous stakeholders with diverse socio-cultural backgrounds. The relationships between those stakeholders are predominantly based on trust. These characteristics need to be mirrored by agreements between formal and informal actors. More specifically, including legally binding provisions may hamper formalisation because it induces transaction costs for negotiation of contractual details and may even repel workers from signing such agreements in the first place.

5 **Fifth,** producers should offer long-term support and technical assistance to partnering institutions. Bearing current conditions across the Indian e-waste sector in mind, sudden formalisation is unlikely to occur but needs to be fostered in an incremental fashion. Hence, when producers engage with partnering organisations which are mandated with collection (e.g. Disha, Chintan or SEWA in the Microsoft case study), providing long-term support as part of the Extended Producer Responsibility (EPR) regime is absolutely paramount. Frequent interactions and close monitoring by producers or PROs is mandatory to assess the quality of materials, recommend changes in organisational set-ups and prevent leakages of collected e-waste towards informal channels. Considering that the price gap between formal and informal transactions cannot be bridged completely by offering additional benefits alone (see point number six below), financial support needs to be provided to partnering organisations.

6 **Sixth,** the analysis suggests that providing additional benefits and establishing trust to informal actors can help offsetting the price gap between formal and informal transactions. Depending on the set-up of partnership models, these could either be directly provided by producers or by the collection agency itself. Additional benefits can materialise in the form of trainings for proper handling and/or dismantling of WEEE or by offering social securities and paying fixed salaries to employees. Here, Sahaas Zero Waste (SZW) presents a valuable case study. On the other hand, Delhi-based Chintan established educational centres for workers' children and actively advocates the rights of informal actors through the Safai Sena secretariat. By issuing IDs to the informal workers, they are able to access e-waste from bulk consumers and avoid scavenging for materials under unsafe working conditions. As for Green E-Waste Recyclers and most other cases, the good reputation of Mr Mohammad Sabir can be understood as an asset for maintaining a low-but-steady rate of formalisation despite the inability to provide competitive prices. However, the limited scale of these case studies indicates that offering additional benefits alone is insufficient for securing formal-informal relationships in the long-term and suggests that additional financial resources need to be provided by producers or PROs to fulfil their obligations under the current EPR regime.

7 **Seventh, it is paramount that producers and PROs assess local conditions when entering partnerships across different regions in India.** Given the high degree of heterogeneity and fragmentation across the Indian e-waste sector, it appears that there is no one-size-fits-all approach to the formation of successful partnerships. As such, implementing standardised models is ill-suited and will likely fail to achieve long-term formalisation. Hence, PROs and producers need to pay due attention to the prevalent context factors and contingencies within the target region. Key parameters to be considered include the (often volatile) price structure of e-waste fractions, the expectations of stakeholders involved as well as the outreach and capacity of partnering institutions. A key aspect is to determine the magnitude of financial flows from producers or PROs to collectors/dismantlers/recyclers.

8 **Eight, diversifying the activities of interface agencies beyond mere collection (to include, for instance, refurbishment) can contribute to sustainably linking informal stakeholders to formal value chains.** Collection agencies essentially act as intermediaries between formal and informal actors. While the value of this function has been highlighted by a number of authors (e.g. Williams et al. 2013; Lines et al. 2016; Niyati 2014; Khetriwal Sinha et al. 2016), its implementation has not yet reached the needed scale. Possibly, this may be attributed to the fact that the largest revenue potential lies within other parts of the e-waste value chain, such as recovery of precious resources and/or refurbishing of used equipment. Hence, diversifying the range of activities beyond collection of WEEE may be considered to create additional value, e.g. by offering waste management, consulting or recycling services. Alternatively, additional financial resources from producers need to support collection agencies in bridging the formal-informal price gap and acquiring sufficient amounts of e-waste. Yet another alternative would be that other stakeholders (e.g. a designated PRO or recyclers which partner with informal collectors) fulfil this function and serve as an interface for formal-informal transactions. In this case, these need to receive adequate support from producers to help meeting EPR plans as per stipulations of the E-waste Management Rules, 2016.

9 **Ninth, policy makers should ensure (financial) resources are in place to enable sound enforcement of E-waste Management Rules, 2016.** Until today, the price gap between formal and informal transactions presents a major challenge to achieve formalisation on a larger scale. In order to alleviate this challenge, policy makers should ensure resources are in place for sound enforcement of E-waste Management Rules, 2016; this may be achieved by dedicating additional funds and/or redirecting human resources towards enforcement of the Rules. In fact, the inexistence of a level playing field subjects formal actors to intense and unfair competition, thereby inhibiting the formation of durable partnerships. Particular attention should be directive to monitoring producers' compliance with individual EPR plans. Periodic review of EPR plans need to assess the credibility of producers' pledges before authorisation is granted. In case non-compliance with collection targets is detected, legal consequences need to be drawn.

10 **Tenth, producers and policy makers should offer entrepreneurial and organisational-development training and capacity building to formal organisations.** Based on the analysed set of case studies, it appears that entrepreneurial and innovative thinking within partnering institutions is a key success factor for long-term existence of partnerships. Valuable learnings can be extracted from the GIZ-Microsoft case studies which were implemented under the German develoPPP programme. Here, Disha decided to abandon collection from repair shops mid-way through the project because financial returns were lower than initially expected; instead, Disha decided to focus on expanding relations to informal actors and was subsequently able to create a viable collection model. Such abilities need to be fostered systemically, e.g. by providing trainings on technical know-how and management skills, such as profit and loss calculations, marketing of business activities as well as organisational coordination and communication.

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List of Abbreviations

CPCB	Central Pollution Control Board
DPCC	Delhi Pollution Control Committee
EEE	Electrical and Electronic Equipment
E-waste	Electronic waste
EPR	Extended Producer Responsibility
INR	Indian Rupees
PRO	Producer Responsibility Organisation
SPCB	State Pollution Control Board
SZW	Saahas Zero Waste
TSDF	Treatment Storage and Disposal Facility
WEEE	Waste from Electrical and Electronic Equipment

1 Introduction

The market for electronics is expanding rapidly; short cycles in innovation and product life time result in increasing amounts of waste from electrical and electronic equipment (WEEE or e-waste) which needs to be disposed of and recycled responsibly. According to a recent study by ASSOCHAM-KPMG (2016), India represents the fifth largest producer of e-waste and generates approximately 1.85 million tonnes of WEEE annually, with other estimates ranging from 1.64 (United Nations University 2014a) to 1.7 million tonnes a year (Toxics Link 2015). Considering India's highly dynamic market environment, this amount is projected to grow even further and will place a significant burden on the country's waste management system in the intermediate to long-term future.

In order to tackle this issue, the Indian Government adopted the new E-Waste Management Rules in 2016, repealing the former E-Waste Management and Handling Rules from 2011 (Government of India 2016). Extended Producer Responsibility (EPR) represents a core feature of this legislation. According to this widely applied policy principle, producers are held financially and/or physically responsible for the professional treatment and disposal of generated wastes (OECD 2016). Within the context of the Indian e-waste management, this may be achieved either by setting up take-back systems for electronic equipment at the end of life or by mandating dedicated organisations – so called Producer Responsibility Organisations (PROs) – with collection and recycling services which are in turn financed through levies paid by producers.

Informal dismantling of e-waste. © adelphi

While some take-back systems and PROs were put in place through recent years, collected amounts are still negligible and environmentally sound recycling of e-waste remains limited. This is mainly due to the fact that 95% of this waste is managed by the informal sector (MAIT-GTZ 2007). This sector consists of a wide spread network of informal collectors, intermediaries, scrap dealers and dismantlers which are highly effective in door-to-door collection and manual disassembly of post-consumer electronics. Yet, a lack of decent environmental health and safety standards among these actors results in massive environmental pollution and negatively affects the physical well-being of thousands of people; in fact, harmful activities such as open burning of cables for retrieval of copper and improper dismantling of used lead-acid batteries still represent widely applied practices across the Indian e-waste sector. As a result, the externalised costs are borne by the local communities and particularly e-waste workers who are exposed to significant occupational health and safety hazards (Wath et al. 2011).

Previous analyses suggest that large-scale collection and disposal of WEEE can only be achieved if the informal sector is integrated into formal waste management activities. Various studies (see for instance (Lines et al. 2016; Williams et al. 2013; Chaturvedi et al. 2012) have provided some basic theoretical considerations for establishing links between the formal and informal actors. They have pointed out that creation of such partnerships offers the opportunity of channelling large quantities of WEEE to authorised recycling institutions while maintaining employment levels, improving environmental conditions and increasing the physical well-being of the local population. However, the current state of knowledge as to why and how such partnerships succeed or fail is still insufficient and it remains unclear which of their features are most suitable to be scaled up and replicated in the pan-Indian context. This study aims to fill this knowledge gap by presenting findings from several in-depth interviews with initiatives which are (or were) positioned at the crossroads between the formal and informal sector, highlighting the elements for scaling up learnings and initiatives of formal-informal integration.

1.1 Objectives

This study was conducted as part of a ten-month project which was financed by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ). Based on the insights presented in this paper, adelphi and its partners will advise public and private institutions on approaches to sustainable management of WEEE regarding options for producers and formal recyclers to partner with informal collectors under the new Indian E-waste Rules, e.g. by providing guidance on EPR implementation, facilitating workshops and consulting stakeholders from both formal and informal sectors.

In terms of content, the paper is built around a number of prominent case studies which succeeded or failed in maintaining formal-informal partnerships across the Indian e-waste management system. By conducting in-depth interviews with representatives from various organisations, the study seeks to highlight the success factors and challenges in replicating and scaling up functioning approaches. In doing so, it assesses the needs of various stakeholders across different organisational settings, analyses the advantages and drawbacks of different modes of interaction and explores the drivers for and barriers to a continued process of formalisation.

As of now, linkages between formal and informal actors in India are scarce and have not been implemented on a broader scale. Having this in mind, the objective of this paper is to examine past and current formal-informal partnerships in order to determine the factors which have led to their long-term success or failure. From this analysis, conclusions will be drawn for the establishment of new initiatives to support the implementation of EPR principles and the set-up of PROs across India.

1.2 Methodology

Interviews present the primary method for data collection in this study. Representatives were deemed eligible if they had experience in partnering with the informal sector and had sufficient access to internal information. Subsequently, a series of interviews was conducted between January and April 2017. Additional information was acquired through a number of complementary interviews with other organisations. Preferred modes of interactions were face-to-face interviews and physical meetings; if this was not possible, interviews were conducted via phone. A list of interviewees who participated in this study is presented in Annex II.

In order to facilitate the conversation with experts, a semi-structured interview guide was developed (see Annex I). This approach was chosen in order to adapt the questions to participants' knowledge and to explore issues of particular interest which would arise throughout the conversation. The interview guide contained a broad set of questions across seven topical areas, covering background information, key incentives, agreements, challenges, solutions, impacts and lessons learnt. The questions were peer-reviewed by the project consortium and GIZ. Recommendations from this process were incorporated before the guide was finalised and the first round of interviews was conducted.

Upon completion of an interview and receiving prior consent from the participants, the answers were shared and discussed among the project partners. After completion of the first round of interviews in March 2017, the preliminary results were jointly reviewed by the project consortium and presented to GIZ. Following this review process, another round of interviews was conducted which provided additional inputs for the final results of the study.

1.3 Limitations and Scope

Selection of initiatives and interview candidates was based on three selection criteria, namely relevance, accessibility and experience. First and foremost, the interview sample comprises initiatives which are relevant for the task outlined above. Hence, only those initiatives were approached and interviewed that promised to deliver meaningful insights regarding the challenges and opportunities in the process of formalisation. In addition to internal discussions among the project partners, relevance of interviewed initiatives was cross-checked with GIZ and cleared for subsequent analysis.

As for accessibility, selection was based on two aspects: first, interview representatives had to be willing to participate and share internal information; and second, interviewees needed to have access to required information in sufficient detail. The latter point is strongly linked to the third and last selection criterion (experience), which describes the participants' ability to provide in-depth information due to a long-standing track record in working with the analysed initiative.

By taking these aspects into consideration, this paper seeks to provide insights regarding the drivers for and barriers to formalisation of informal structures across the Indian e-waste sector. Given that formal-informal relationships are still poorly understood, exploring the challenges and opportunities of formalisation processes from a qualitative point of view presents a significant opportunity; as such, the primary added value of this study lies in delivering a more fine-grained understanding of the personal motivations of different actors within the e-waste value chain.

However, it should be noted that the underlying methodology is inherently exploratory and does not claim to be statistically representative. Hence, inferences should be drawn carefully and may not be extrapolated on a one-to-one basis to different contexts beyond the sample of analysed initiatives. While this limitation does not undermine the general validity of the findings, it surely emphasises the need for further research on a broader scale.

1.4 Report Outline

This paper is divided into five chapters and several corresponding sub-sections.
Chapter 1 provides some brief background information regarding the topic, objectives and methodology of the study.

Chapter 2 presents detailed findings from six prominent case studies in the e-waste value chain.

In Chapter 3, the implications of the new E-Waste Management Rules, 2016 are discussed and, based on analysis of literature and the case studies, a number of different partnership models are presented.

In Chapter 4, recommendations are provided with regards to the design of partnership models and the overall strategic approach in scaling and replicating similar models.

The study concludes in Chapter 5 which summarises the findings and provides a brief outlook on the actions needed for advancing formal-informal partnerships.

Case Studies

2.1 Overview

The case studies presented in the following sections have been implemented across India starting between 2007 and 2013. Table 1 gives an overview of the initiatives.

The case studies show a number of different attempts to partner with the informal sector in India in differing local contexts and stakeholder constellations. In the majority of case studies, the collected e-waste was mostly from bulk consumers as opposed to private households, and the annual volumes were small compared to the scale of e-waste generated across India. Hence, findings cannot be seen as representative and should be interpreted carefully. The following sections provide an in-depth presentation of this research endeavour.

INITIATIVE	LOCATION, ACTIVITY STARTING DATE
Green E-Waste Recyclers	Delhi, 2011
SWaCH	Pune, 2008
Saahas Zero Waste	Bangalore, 2013
E-WaRDD	Bangalore, 2009
GIZ-Microsoft	Delhi, 2011; Kolkata and Ahmedabad, 2013
Chintan	Delhi, 2007

Table 1: Overview of case studies investigated.

2.2 4R and Green E-waste Recyclers; Delhi

4R (for Reuse, Repair, Recycling, Recovery) is an e-waste cooperative which was established in 2009 and consisted of some 35 informal actors based around the area of Shastri Park in Delhi, India. Shastri Park is located in East Delhi and is a hub of informal sector e-waste recycling. There are more than 2,000 households involved in e-waste collection and processing activities, the majority of which rely on rather crude and environmentally harmful methods for dismantling and resource recovery. 4R was formed as a result of a GIZ-led project on formalising the informal actors involved in recycling of WEEE and was founded by Mohammad Sabir.

After inception, 4R applied to receive a license for collection and dismantling of e-waste at the Delhi Pollution Control Committee (DPCC). After a lengthy process of about two years, DPCC denied the provision of a license. Consequently, the initiative was unable to carry out economically viable collection, dismantling or repairing activities and eventually terminated its operations. According to informal comments from DPCC, this resulted from a lack of precedence for awarding a license to a non-profit entity.

FIGURE 1: Green E-waste Recyclers case
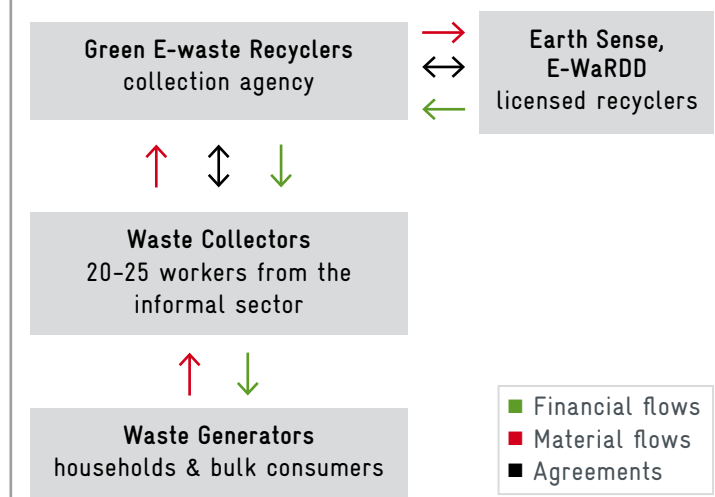
4R and Green E-waste Recyclers
Delhi

Consequently, Mr Mohammad Sabir founded a private limited company termed *Green E-waste Recyclers Pvt Ltd* in 2011 which was granted a license to collect e-waste in Delhi by the DPCC in the same year. In order to be granted this license, an agreement with formal e-waste recycling companies had to be signed and presented to DPCC so as to ensure that the collected waste fractions are sent for environmentally sound recycling and disposal. During the establishment of Green E-waste Recyclers, GIZ assisted in building a website[1] and helped setting up an initial collection centre in Jhilmil Industrial area (east Delhi). Since from a legal perspective, processing of WEEE is classified as a severely polluting activity (red category), dismantling and recycling operations must not take place within Delhi. Consequently, the collection site did not receive a license for dismantling and recycling and had to be shut down, resulting in significant economic loss through sunk capital costs and terminated relationships to a number of informal collectors.

To date, Green E-waste Recyclers engages some 20-25 informal collectors who were initially part of the 4R cooperative. The business model of the company is largely built around collection and channelisation of WEEE; upon delivery to Green E-Waste Recyclers, the incoming fractions are screened and separated. Payments to collectors are based on the quality of collected materials. In addition, larger amounts of WEEE are acquired from bulk consumers by means of competitive bidding. Depending on the state and condition of the purchased goods, products are either repaired and sold for reuse or, in case of more severe damages, sent to formal recyclers for environmentally sound resource recovery. In the former case, revenues from refurbishment contribute to the financial sustainability of the partnership model. In the latter case, Green E-Waste Recyclers collaborates with two authorised recycling companies, namely Earth Sense and E-WaRDD. As of today, collaboration with producers has not been established; hence, the link between the formal and informal economy pertains to formal recyclers and informal collectors only.

Initially, informal collectors collaborated with 4R by becoming official members of the cooperative. However, there was no formal agreement that collected goods would be purchased from the collectors at fixed prices or quantities. With collection now being carried out through Green E-waste Recyclers, written agreements to informal collectors do not exist. Instead, it is interviewee long-standing track record as an acknowledged e-waste dealer due to which formal-informal linkages can be maintained.

To date, the initiative has only had a limited impact. While some 1.5 tonnes of WEEE were provided through GIZ and EU-funding to Green E-waste Recyclers at no cost whatsoever, the company managed to collect an additional 2.5 tonnes of used products by itself. This amount was purchased through competitive bidding from bulk consumers or purchased from informal actors in Shastri Park. According to an interviewee, the impact of formal collection could be further increased by allowing social enterprises to operate as dismantling and recycling organisations. This would ensure greater access to e-waste in other areas and hence, would increase the outreach of such activities.

Despite the limited quantities collected, some impact does manifest in the learnings and the capacities that the company managed to build across the informal sector through recent years. Having undergone trainings from GIZ on (for instance) sound e-waste dismantling practices, Mohammad Sabir successfully conducted multiple trainings with collectors from the informal economy through Green E-waste Recyclers and provided inputs to government officials. This has contributed to increasing awareness around e-waste among both consumers, collectors and policy makers.

With the implementation of the new E-waste Rules in 2016, the government abolished the need for maintaining private collection centres. With principles of EPR being implemented, the responsibility of collection now firmly lies with the producers of electronic and electrical equipment. As such, Green E-waste Recyclers currently needs to tie up with a producer or establish a contract with a PRO in order to continue e-waste collection. Another option is to apply for a recycling license and setting up a processing plant. However, due to legal stipulations and significant upfront expenditures; this would, according to Mr Mohammad Sabir, incur significant capital costs to the tune of INR 10 million.

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1 For more information please refer to http://greenewasterecycler.tradeindia.com/
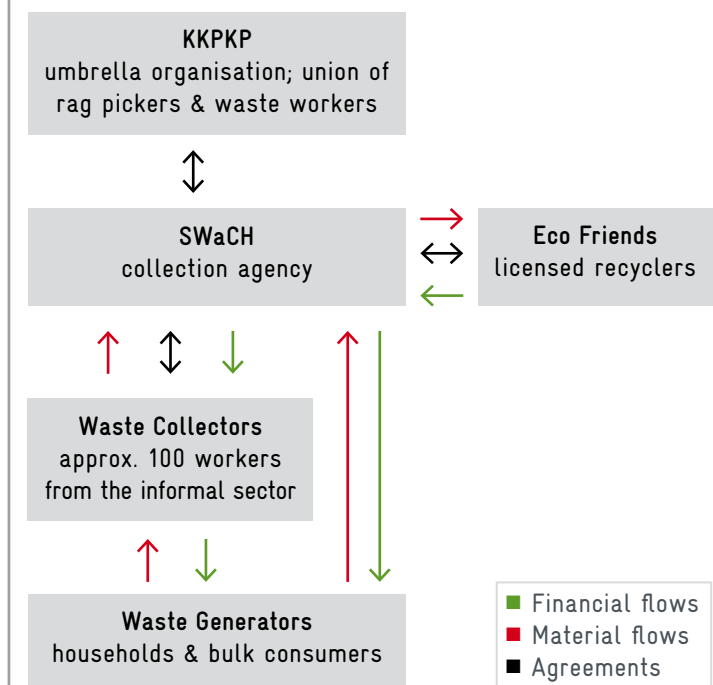
2.3 SWaCH; Pune

SWaCH[2] (for Solid Waste Collection and Handling) is a Municipal Solid Waste (MSW) collection initiative based in Pune. It formed under the trade union Kagad Kach Patra Kashtakari Panchayat (KKPKP) which was set up in 1993. SWaCH was formed between 2006 and 2008 and subsequently diversified into various vertical branches. One of these branches deals with the management of e-waste and became operational as part of the EU – SWITCH-Asia WEEE Recycle project implemented by GIZ, adelphi, Toxics Link and MAIT. From a legal perspective, SWaCH is a cooperative which is owned by around 1,500 waste collectors in Pune. The key stakeholders around this initiative include waste collectors, civil society organisations, the Pune Municipal Corporation, industries, Maharashtra Pollution Control Board (MPCB), licensed recyclers and the citizens of Pune.

Traditionally, waste material in Pune is managed through a door-to-door collection system run by informal collectors. These primarily collected paper, plastic, glass and metals which are purchased from individuals or group at usual market prices. As the market for consumer electronics expanded throughout the last decade, issues around collection and recycling of WEEE became more pronounced. Among informal collectors, it was understood that these items presented significant value and needed to be collected and disposed of. During the course of the WEEE Recycle project, some 100 waste collectors agreed to become members of the SWaCH initiative and were trained on collection and handling of e-waste.

FIGURE 2: SWaCH case

SWaCH can be classified as a collection agency. In order to ensure sound recycling of the collected materials, it has signed an agreement with *Eco Friends*, a formally registered WEEE recycling company. However, this agreement does not specify the amount of goods channeled to Eco Friends but merely serves as a joint declaration of intent for collaboration in the management of e-waste streams. Agreements with Pune Municipality Corporation are articulated in written form and ensure sufficient provision of space for setting up WEEE collection centres in four different locations around Pune.

According to the interview participants, the link of the initiative to the informal economy is based on the long-term involvement of SWaCH on issues of MSW, its ongoing activities across Pune's civil society as well as the relationship with the municipality. This essentially translates into outreach and credibility of the organisation. In addition, SWaCH proposes value to informal collectors primarily through financial incentives, e.g. by paying prices for collected goods which are subsequently channelled to authorised recyclers. The relation to informal waste collectors is characterized by mutual respect. Although some written agreements do exist, membership is formally acquired by signing an open ended document which does not specify legal mandates or stipulates that in case of violation of this agreement, the parties would be held liable for penalty. As such, the process of formalisation essentially relies on trust formed between SWaCH and the informal collectors.

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2 The initiative runs a website which can be reached via http://www.swachcoop.com/index.html

SWaCH Pune

The biggest challenge for maintaining this linkage is the weak financial returns to waste collectors. While at an earlier stage, SWaCH was perceived as a promising and reliable partner in channelling WEEE to formal recyclers, the initiative was not able to offer competitive prices to informal collectors and consequently lost momentum. In turn, this compromised the amount of e-waste channelled through SWaCH, as selling it to informal recyclers promised higher profitability. Although interviewees were unable to provide detailed information, some rough quantities on the amounts of WEEE collected were mentioned; this was estimated at some 10 tonnes per annum. Moreover, interview candidates perceived that awareness among citizens for sound disposal of WEEE has in fact increased. This was partly attributed to the prominence of SWaCH and its active role in managing MSW within the local community of Pune.

The lack of enforcement and resulting non-compliance with regulatory mechanisms posed another challenge to formalise collectors. According to the interviewees, MPCB's efforts to implement and enforce the 2011 E-Waste Management Rules appeared inadequate and hence, were not able to provide a level playing field to all operators. While initially, the Rules were perceived as one of the major drivers for the inception of SWaCH, the improper enforcement of the e-waste legislation is now being viewed as one of the key barriers to a continued process of formalisation among informal collectors.

Due to the challenges mentioned above, quantities have decreased significantly as informal collectors have shifted towards selling e-waste mainly to unauthorised recyclers. Hence, SWaCH and informal collectors now operate independently from one another. Yet, a number of consumers and households continue to dispose of dysfunctional electronic equipment directly through SWaCH instead of handing it over to informal waste collectors. The interviewees perceived that this is feasible because SWaCH is well-known and respected among the citizens of Pune.

Sorting e-waste components for futher treatment. © GIZ develoPPP / Vostry.

2.4 Saahas Zero Waste; Bangalore, Chennai

Saahas[3] was founded by Wilma Rodrigues as a non-profit organisation in Bangalore in 2001 and seeks to build capacities and support policies for sound management of MSW. Saahas Zero *Waste*[4] (SZW) is a socio-environmental enterprise which offers integrated waste management services, including collection and dismantling of WEEE as well as corresponding consultancy services. It was founded as a sister organisation of Sahaas in 2013 and is classified as a start-up under the Department of Industrial Policy and Promotion, Government of India. It currently operates in Bangalore and Chennai.

Saahas started working on e-waste awareness and collection in 2003 and engaged with informal waste collectors by helping them to form loosely-coupled associations which eventually came together under the legal entity of a cooperative. Due to internal frictions, some of these actors later re-grouped into Eco-birdd Recycling and E-WaRDD in order to become licensed collectors. As of today, SZW sells services for compliance with E-waste Management Rules, provides professional support to waste generators and sells recycled waste (excluding WEEE). In total, the company employs about 150 workers. Thereof, one person works on the management of e-waste through dedicated collection centres, while the rest of the staff is only partially involved in WEEE-related operations.

SZW operates three business units: Zero Waste, Extended Producer Responsibility (EPR) and Recycling. Under the Zero Waste unit, SZW offers on-site and off-site waste management services; the EPR unit

FIGURE 3: Saahas Zero Waste case

supports companies and waste generators in meeting compliance through direct consultancy services, hence functioning as a PRO; lastly, the Recycling unit focuses on recycling of used products and selling the recovered materials, mainly from organic products which are subsequently turned into compost (notably, e-waste is not recycled by SZW itself). The incoming waste is mainly collected from large apartments and households, some minor fractions are received from bulk consumers, including offices, tech-parks and educational institutions.

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3 Website can be accessed via http://saahas.org/home/

4 Website to be reached at http://saahaszerowaste.com/home/

Saahas Zero Waste
Bangalore, Chennai

The company employs former rag pickers, including poor women who previously worked in hazardous conditions by (e.g.) scavenging through landfills and other trash dump sites for any items that could be sold to scrap merchants. Each employee is provided with a reliable salary as well as healthcare, pension, insurance benefits and the opportunity to build new skills and knowledge. The company emphasises decent occupational health and safety standards and provides adequate protective gear as well as training for proper waste handling practices. By paying a fixed salary and other benefits, SZW is able to provide financial and social security.

The largest e-waste streams are obtained from households and individual consumers. In order to incentivise responsible recycling of WEEE among this target group, SZW has set up a network of collection centres (so called Waste Management Units) where individuals can drop off WEEE free of charge. All waste collected through this channel is sent to authorised recyclers, namely *4R Recyclers* (based in Bengaluru and not to be confused with the case study in this paper) and E-Parisara. For bulk consumers, SZW offers a one-stop solution for complete compliance with the current e-waste management regime. This includes regular collection and channellisation of WEEE to licensed recyclers, documentation and reporting as well as filing of annual returns to the respective State Pollution Control Board.

Internal agreements with the workforce are based on employment contracts which entail the above mentioned benefits. Besides this, relationships to other stakeholders are based on trust. Agreements between SZW and formal recyclers exist in written form but do not entail specific figures, numbers or qualities in terms of WEEE collected. Instead, these documents are designed in non-binding fashion and merely represent a joint declaration of intent. Previous collaboration with E-WaRDD was based on oral agreements and was terminated for unspecified reasons.

Before forming SZW and entering the e-waste business in 2013, a major challenge was to convince informal workers to unite under a formal system. Saahas was able to overcome this issue due to a strong standing within Bangalore's community and its recognition as an established organisation in the field of MSW. Eventually, these efforts resulted in the formation of a cooperative for management of e-waste. However, conflicts of interest among the workforce resulted in internal friction and gave rise to confrontation. As a consequence, the cooperative disintegrated. Subsequently, some employees regrouped and formed their own independent entities, namely Eco-birdd Recyclers and E-WaRDD.

According to an interviewee, the underlying reasons for these internal tensions were manifold. From the perspective of the workers, the incoming quantities were too low to make an actual impact within the e-waste sector. This was attributed to a lack of awareness for pertinent issues in the e-waste sector in which ad hoc transformation is unlikely to occur and change needs to be fostered on a step-by-step basis. This went unnoticed by a number of employees which were disappointed by the low quantities of WEEE collected. In addition, the cooperative also faced organisational issues, such as a lack of clearly defined hierarchies and operational processes. Together with ill-suited ambitions of individual workers and conflicts of interest regarding sharing of revenues, this led to increasing fragmentation and ultimately resulted in the disintegration of the cooperative.

After disintegration of the cooperative, SZW was formed in 2013. The company is able to sustain its operations without external financial support and serves around 50 clients who channel e-waste to SZW for safe recycling and disposal. By offering both collection and consulting services in addition to mere collection, SZW is able to exploit several value points at once and can deliver holistic services to customers. Moreover, by employing collectors and providing fixed salaries, SZW avoids negotiating prices with other intermediaries in the value chain and enables the employees to purchase WEEE from bulk consumers, hence increasing the economic viability of the model.

Although SZW is classified as a start-up under the Department of Industrial Policy and Promotion, it is important to remark that the company does not receive any financial support from the Indian government. It does, however, benefit from support through trainings and other enterprise programmes which appear to be useful for development of management skills and organisational structures. Hence, it appears that receiving such support did have an impact on the successful formalisation of informal actors.

While the largest share of WEEE is collected from domestic households and consumers through Sahaas' Waste Management Units, smaller fractions are collected from bulk consumers which include corporations, tech parks, residential areas, schools and colleges. Expanding to these clients was mainly possible due to increasing outreach activities through newspapers and other media channels. Today, waste streams acquired from bulk consumers account for some four to five tonnes annually. Between 2015 and 2016, SZW further implemented a pilot project in collaboration with a local consultancy through which twelve tonnes of e-waste were collected on behalf of a producer of electrical and electronic equipment.

Although more specific figures on e-waste quantities do not exist, an interviewee confirmed that there is a steady influx of materials. Based on direct interactions with individual and bulk consumers, she was confident to assert that SZW positively impacts WEEE management in Bangalore and Chennai, mainly by creating awareness for sound disposal of e-waste across the local community. Since a number of informal workers are now employed by SZW, it seems that the company had a small-yet-definitive impact on the formalisation of the sector in these areas.

Based on the analysis presented in the previous sections, it appears likely that SZW's ability to unify informal collectors can be attributed to the organisational set-up of the company. This includes aspects such as diversification (i.e. offering both physical waste management and consultancy services for WEEE), social securities and financial incentives through payment of fixed salaries as well as clearly defined responsibilities for efficient coordination of workers. In addition, SZW defines itself as a socio-environmental enterprise and follows entrepreneurial approaches; in comparison to other initiatives, this element appears to be particularly valuable. In fact, the analysis suggests that following such approaches positively affects the process of formalisation which can be sustained and expanded over a prolonged period of time. Given that SZW's development was significantly hindered by internal conflicts at an early stage, close communication and mentoring of workers is necessary to maintain harmony and sustain formalisation.


Left: a bag full of circuit boards; right: an old PC monitor casing. © adelphi.

2.5 E-WaRDD; Bangalore

E-WaRDD & Co.[5] (for Electronic & Electrical Waste Recycling, Dismantling & Disposal) is a licensed collection and recycling company based in Bangalore. It was founded in 2009 by Mr Asif Pasha who, prior to inception of E-WaRDD, operated as an informal recycler and employed around 10 workers in the residential colonies of Bangalore. Receiving technical support from GIZ and Saahas, Mr Asif Pasha started the process of formalisation in 2006 and received a collection, dismantling and recycling license under the Hazardous Wastes (Management and Handling) Rules, 1989 in 2008. The license was renewed under the E-waste (Management & Handling) Rules, 2011 in 2013. According to Mr Asif Pasha, E-WaRDD was the first informal e-waste recycler in India to enter the formal e-waste business with registration from Central Pollution Control Board (CPCB) (as per the E-waste Rules 2011).

E-WaRDD's dismantling and recycling unit is located in Bangalore. In 2011, the company established three collection centres covering the entire southern region in Kochi (Kerala), Hyderabad (Andhra Pradesh) and in Chennai (Tamil Nadu). These facilities are managed and handled by E-WaRDD local staff. Collection of WEEE is predominantly maintained through workers from the informal sector from the above mentioned regions. They collect e-waste from households (door to door collection), offices (mainly IT, but sometimes from government departments, academic institutions) and obtain defective items from manufactures. Depending on the quality and quantity of goods, waste generators are paid in return. Subsequently, WEEE is dismantled and recycled at E-WaRDD's unit in Bangalore.

FIGURE 4: E-WaRRD case
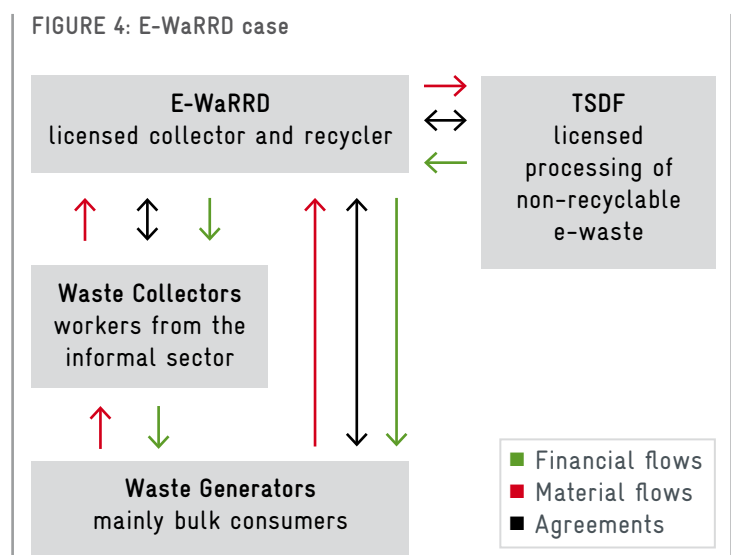
The company is linked to a licensed Treatment Storage and Disposal Facility (TSDF) for management of non-recyclable hazardous wastes which arise as part of the processing of e-waste. E-WaRDD obtains the majority of WEEE from bulk consumers, particularly companies and of government departments. Prices are commonly determined through participating in tender bidding processes. In addition, E-WaRDD maintains formal agreements with selected IT companies which regularly dispose of used electrical and electronic equipment. The agreements are signed for one year in advance and renewed on the basis of the recycler's performance. Performance criteria include, amongst others, frequency of collection, response to communication and reliability of operations. Up until recently, E-WaRDD received materials from Saahas. Agreements for transfer of WEEE were based on oral commitments and face-to-face communications; signed contracts did not exist and the collaboration was ended due to unspecified reasons.

To operate the central processing unit and the three collection centres across other states, E-WaRDD employs some 14 workers which were previously working within the informal economy. Each employee is provided a reliable salary, receives insurance benefits and opportunity to develop new skills and knowledge. The company emphasizes decent occupational health and safety conditions by providing adequate gear (e.g. protective masks, hand gloves, safety boots, eye glasses, first aid kits etc.) and training for sound waste handling

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5 Website accessible via http://www.ewardd.com/

E-WaRDD
Bangalore

practices. As such, key incentives for formalisation are mainly financial in nature but also entail soft benefits in terms of proper occupational health and safety standards.

A major barrier to formalisation was reportedly the process of tying up with large companies. Initially, these companies were less inclined to dispose e-waste to recyclers with informal backgrounds. Hence, Mr Asif Pasha needed to form strong relationship and establish trust between him and his clients. Another major barrier was perceived in receiving assistance from financing institutions. Formal recyclers easily receive loans from banks whereas companies with a long-standing informal track-record face difficulties in applying for a loan.

FIGURE 5: E-WaRDD recycling facility, Bangalore © E-WaRDD 2010

E-WaRDD's aspirations to expand to the pan-Indian context are additionally made more difficult by a lack of entrepreneurial and marketing expertise within the company. Here, the initial technical support provided by GIZ was helpful to some extent. In this context, it was highlighted that maintaining operations as a formal recycler largely depends on successful market penetration. Yet, being a formal recycler coincides with a changing business environment and hence, receiving guidance on how to pitch the business case across different fora was perceived as necessary if operations are to be scaled up to the pan-Indian context.

Concurrently, E-WaRDD operates a recycling unit with a capacity of 600 tonnes per annum. Due to limited influx of WEEE, the company is merely able to utilise one third of this capacity and currently processes some 200 tonnes of WEEE annually. This represents a value of approximately four million INR. Environmentally sound treatment of such wastes is secured through pollution control equipment which resulted in a marked reduction of the company's environmental burden. Milestones include the installation of a vacuum dismantling chamber for processing of cathode ray tubes (CRTs), a cyclone dust collector as well as separate storage facilities for hazardous wastes. The latter category includes hazardous solid waste and non-recyclable wastes; these are being stored and send for recycling or proper treatment in an associated TSDF. Previously these had been disposed of at the road side or in the municipal solid waste bin.

FIGURE 6: E-WaRDD cyclone and dust collector © E-WaRDD 2010

Before protective equipment was introduced at E-WaRDD, employees frequently suffered from dust infections, coughs, fatigue, headache, irritation of eyes, chronic insomnia etc. which in turn resulted in significant sick-leaves and downtimes. Due to the introduction of occupational health and safety measures, these cases have decreased significantly. Upon inception of E-WaRDD, employees worked extensive overtime; yet, with renegotiation of employee contracts, agreements now stipulate regular working hours. Hence, employees now regularly work up to six hours per day.

In addition to due enforcement of the current e-waste management regime, scaling up E-WaRDD's operations to a larger context will remain unlikely unless due consideration will be directed towards business development and marketing activities. It was repeatedly mentioned that financial support would be required to improve recycling practices and increase the quality of services offered to customers.

2.6 GIZ-Microsoft; New Delhi, Kolkata, Ahmedabad

Microsoft is a multinational communications and information technology corporation. In 2011, the company piloted a collaborative programme with the informal sector through Nokia. Target regions included three different areas in India, namely New Delhi, Kolkata and Ahmedabad. E-waste activities in Kolkata and Ahmedabad were implemented under the Microsoft-GIZ develoPPP initiative. By working with partners from civil society (predominantly NGOs) in these locations, the pilot programme sought to engage with informal waste collectors and showcase that such actors can indeed be formalised over time. The first initiative was launched together with Delhi-based *Chintan Environmental Research and Action Group* in 2011. In 2013, two more programmes were initiated with *DISHA (Full form)* in Kolkata and *SEWA* in Ahmedabad. The programmes remained small in scale and were executed by the partner organisations in each of the above mentioned areas.

Over the course of two years, Microsoft provided technical and financial assistance to set up and operate these take-back programmes for management of mobile phones and accessories at the end of life. Microsoft provided technical expertise on developing the aim, approach and execution of WEEE collection. On the financial side, payments were provided to the NGOs directly, thus enabling them to obtain WEEE at competitive prices and channel the fractions towards authorised recyclers. Over the course of the implementation period, the programme proved to be highly dependent on financial flows which were initially provided through Microsoft. After this support was terminated, two of the three programmes ceased to exist, the only exception being Disha which is able to continue collection efforts until today.

FIGURE 7: GIZ-Microsoft case
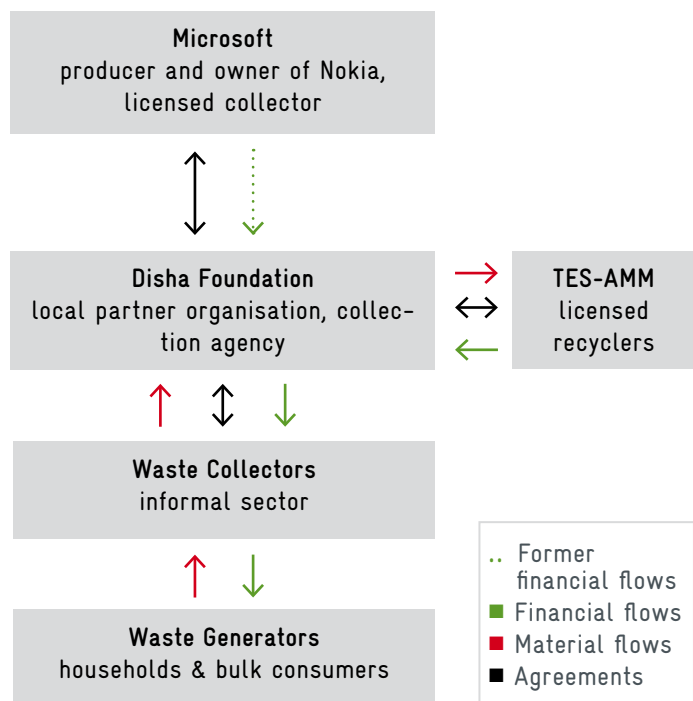
Incentives for partnering organisations to join the programme lay in the promising outlook for collection. The partnering NGOs were hoping to increase the amount of WEEE channelled to formal recyclers, thus achieving their goal in reducing environmental pollution and promoting the well-being of the local population. At the time, Microsoft (through Nokia) was widely recognised as a global sustainability leader and had successfully implemented WEEE take-back systems across other countries. The Indian programme was an extension of the same thinking and was expanded to create a link to the informal economy. As such, partners trusted Microsoft as a credible, well-reputed organisation and hence, decided to join the initiative.

In addition, the partnering NGOs were provided with technical and (initially) financial support during the project implementation period. Moreover, they were able to use Microsoft's collection license and hence, could obtain e-waste from bulk consumers. This presented a substantial incentive to the partners. Moreover, Microsoft offered additional support in negotiating prices with the recycling partners and granted user rights to awareness raising materials which posed additional value to the NGOs.

To date, Disha continues to collect e-waste on behalf of Microsoft and acts as an aggregator by using the company's collection license. Disha is required to sell collected materials to authorised recyclers (which need to be approved by Microsoft) and, in return, can reap the financial benefits resulting from these transactions. As such, the set-up can be understood as a win-win-win situation in which Microsoft is able to comply with legal provisions from the E-Waste Management Rules, Disha generates finances by collecting and selling WEEE to an authorised recycler (TES-AMM) and informal collectors are able to access bulk consumers, thus ensuring a steady supply of material to formal recyclers.

According to the interviewee, no financial incentives were given to informal collectors. Instead, financial support was directed to the partnering NGOs to allow for development of organisational capacities. Moreover, smaller non-financial incentives were also provided, for instance by giving pieces of merchandise (branded caps, t-shirts etc.) to informal waste collectors. Yet, the impact of such non-financial incentives was limited and appeared to be to be much less important than direct financial support.

Contracts between Microsoft and the partnering organisations were set up prior to project implementation; however, specific details of agreements were deemed confidential and were not disclosed to the project team. On a more general level, essential parts of the agreements pertained to the design of the collection model (however entailing some degree of flexibility), locations for collection of e-waste, approach to recyclers, types of WEEE to collect and maximum prices to be paid.

A major feature of these agreements was the non-exclusivity and flexibility in setting up a collection system. In this, partnering NGOs were granted the freedom to work with other organisations or collect WEEE individually by using Microsoft's collection license. While the core collection model was designed and proposed by Microsoft itself, responsibility for execution lay with the partnering organisations. In this, the model could be customised to the needs of the NGOs and adapted to local conditions. The underlying idea was to create a flexible eco-system in which partners would be able to adjust to the local context in order to optimise the collection system and maximise the amount of e-waste channelled to licensed recyclers.

Since the projects were rolled out across different parts of the country, approaches demanded different outlooks and needed to be contextualised to each target location. Despite the flexibility of the written agreements, these were difficult to anticipate and prepare for. From the perspective of Microsoft, there was little knowledge of what was happening on the ground and the corporation was dependent on the NGOs to provide support and communicate barriers to implementation, however, the NGOs often did not provide the necessary information and had difficulty in adapting to the specific institutional contexts. Here, a lack of entrepreneurship skills and the inability to innovate were perceived as central issues which led to inefficient organisational set-ups among the partners.

From Microsoft's perspective, the lack of an efficient monitoring system proved to be a major bottleneck to the smooth implementation of the programmes. Since the informal groups were directly linked to recyclers for material exchange, Microsoft had little knowledge and control over the types of materials channelled to authorised processing facilities. It was pointed out that, especially in the case of Chintan in New Delhi, both qualities and quantities of wastes collected were low and often failed to meet expectations of formal recyclers. Therefore, recyclers were unwilling to receive the collected e-waste fractions as the most profitable materials had been removed beforehand and the residual value of delivered WEEE was minimal. Ultimately, this led to failure of the partnership.

GIZ-Microsoft
New Delhi, Kolkata, Ahmedabad

With regards to external factors, a lack of enforcement of the 2011 E-Waste Management Rules was perceived as another challenge. Since these were not fully implemented and hardly effective on ground, there was little to no incentive for informal actors to join formal arrangements. Consequently, bulk consumers continued to give their waste to informal recyclers who were able to provide higher payments, making formal collection and recycling activities were perceived as less attractive. Against this assessment, it was also mentioned that a significant fraction of WEEE reaching authorised recyclers re-enters informal channels. Such leakages need to be stopped by monitoring of material flows if recycling of WEEE is to be expanded to the pan-Indian context.

Lessons from the initial programme conducted with Chintan were integrated into later partnerships with SEWA and Disha. As such, it was tried to maintain close relationships and regular information exchange with partnering organisations who are responsible for project execution on the ground. For the partnering organisations, employing stronger economic thinking and harnessing entrepreneurial approaches were perceived as particularly important. Among the three different NGOs participating in the project, such approaches appear to be more commonly applied by Disha; in fact, the NGO suggested adjustments to the collection model mid-way into the programme. Having analysed the returns of different programme components, Disha stopped collection from repair shops as this proved to be less profitable than expected. Until today, Disha maintains close relationships with informal collectors and is able to sustain e-waste collection efforts. Hence, it has proven to be the only success story of the Microsoft take-back programme.

Furthermore, Microsoft's ability to understand and address the needs of the partnering organisations, informal workers and formal recyclers seems to be a key determinant for success. Although SEWA did have a wide-spread collection network (yet with a particular focus on solid waste), it failed to expand to collection of e-waste. This was attributed to the fact that collection of WEEE required different skills which were not available within the existing set-up. In such cases, it appears fruitful that the mandating organisations (in this case Microsoft) provides technical expertise and ensures long-term support for enhancing the organisational capacities of partners. Given the limited timeframe of the actions, this lay beyond the scope of the Microsoft take-back system.

A key learning from the programme implementation refers to the selection of partnering organisations. Within the scope of the Microsoft take-back system, selection process was based on outreach and the existence of a functioning network of waste collection. However, over the course of the programme, these did not turn out to be the major success factors for collection of WEEE. Instead, the organisational capacities, first and foremost strategic and innovative thinking, proved to be way more important to the success of the programme. As such, gaining insights into the organisational structures and capacities of the initiative prior to implementation was perceived as particularly important. If similar programmes are to be implemented on a larger scale, partnership models with NGOs need to be redesigned by paying stronger attention to strategic and economic analysis. Moreover, appropriate methods would need to be incorporated to improve monitoring of incoming e-waste fraction as collection quantities increase. Since the implementation of such solutions would have been too costly as part of the Microsoft programme, potential solutions would need to be tested and evaluated beforehand.

Furthermore, it was pointed out that a very sound ecosystem needs to be in place in order to improve management WEEE, referring to the interaction and responsibilities of multiple stakeholders, including partners from civil society, formal recyclers, collectors from the informal sector, the municipality as well as other state actors (e.g. secretary of state, Ministry of Science and Environment etc.). Assistance to these stakeholders does not need to be monetary but could entail technical elements as well. Moreover, public support to increase awareness and leverage the outreach of these stakeholders was deemed beneficial.

2.7 Chintan; Delhi

Chintan (short for Chintan Environmental Research and Action Group) is a Delhi-based NGO which started working on e-waste in 2007. At that time, the organisation joined the 'Toxics Coalition' in Silicon Valley, United States, in order to gain knowledge on the subject and identify approaches to effective management of WEEE. Shortly thereafter, Chintan started working on a project with GIZ and had produced a film titled *Citizens at Risk*. When the E-waste Management and Handling Rules entered into force in 2012, Chintan was the first and only NGO to receive a collection license from the Delhi Pollution Control Committee (DPCC). Today, the NGO collaborates with two authorised recyclers (Attero and TES-AMM) to ensure environmentally sound processing of collected materials. Previous collaboration with Microsoft (Nokia) was terminated due to insufficient supply of material.

Today, Chintan closely collaborates with actors from the informal sector through a cooperative of waste pickers called the *Safai Sena* (translating to "An Army of Cleaners"). The cooperative has more than 12,000 members. Within this set-up, Chintan provides training to the workers regarding the composition of e-waste, its toxicity and potential environmental health and safety hazards associated with improper handling of materials. Chintan enables informal workers to access e-waste generators in colonies through provision of ID cards that are issued by Safai Sena, thus enabling them to generate additional income. In the past, the NGO worked on several donor funded programmes, published a number of reports this issue and contributed to the revisions of the E-waste Management Rules in 2012 and 2016 respectively. To date, Chintan is widely recognised for its advocacy efforts and enjoys a strong standing across many communities in Delhi.

FIGURE 8: Chintan case
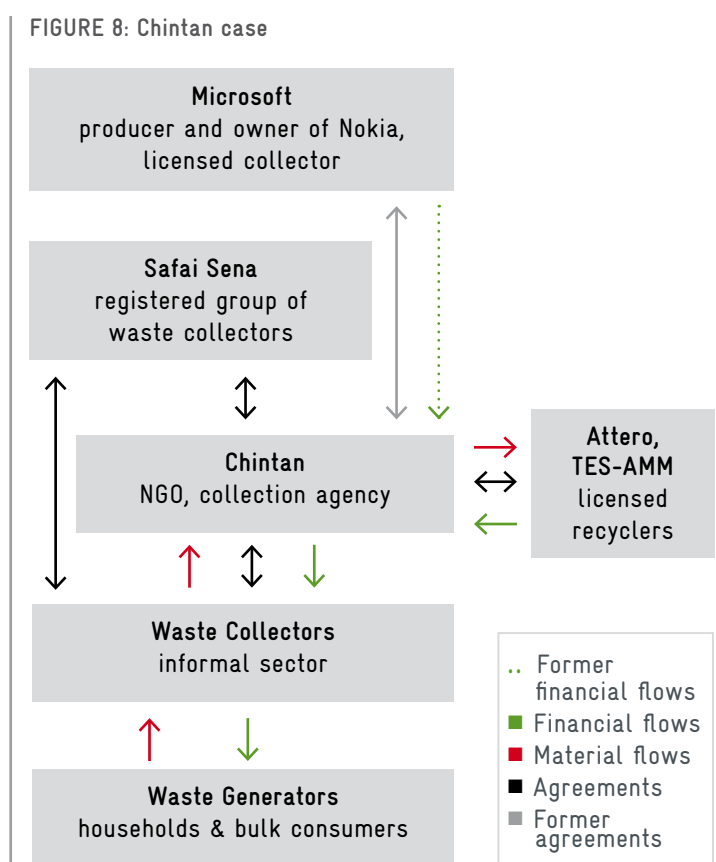
Chintan has been able to establish partnerships with the informal sector by providing direct payments for collected WEEE. The magnitude of these payments depends on the quality and quantity of incoming materials. In return, informal collectors are given access to institutional disposers of e-waste and residential colonies where citizens are willing to give away the e-waste for free. Materials are stored at Chintan's collection office. In case informal workers cannot deposit collected materials at the collection centre (e.g. because of the distance), Chintan retrieves the materials with vehicles which ply across the city and collect waste from bulk consumers. Once sufficient amounts of WEEE are collected, they are channelled to authorised recyclers for further processing.

In addition to these financial transactions, Chintan provides immaterial incentives to workers from the informal economy. The NGO has established education centres for the collector's children. Through a partnership with Safai Sena, formal recyclers and a number of volunteers, Chintan also conducts trainings with informal workers through its "Scavengers to Managers" programme. In this context, the attention is directed towards safe access to e-waste and proper handling potentially toxics materials as well as the benefits of sound occupational health and safety conditions. In addition, Chintan has entered a partnership with Safai Sena. Through the Safai Sena secretariat, Chintan works towards resolving issues faced by the informal sector and seeks to leverage their negotiating power by attracting more waste pickers across different parts of Delhi.

Agreements to the informal sector are based on mutual trust. Such a relationship has evolved due to Chintan's involvement in Delhi's local community, e.g. by providing educational services to children. By joining Safai Sena, informal workers are provided with ID through which they are able to obtain e-waste directly from bulk consumers and other institutional disposers (mainly schools). These cards give a sense of confidence to waste pickers in that the person is recognized for the profession. In case they are prevented at any place from performing their livelihood activities, there are phone numbers of helpline which is occupied by Chintan staff managing the Safai Sena secretariat. Informal collectors can get in touch with the secretariat immediately and Chintan will rush to resolve the issue at any given time, even on Sundays.

With regards to recyclers, Chintan has signed written agreements with Attero and TES-AMM. Despite serving as general declarations of intent, they further stipulate fixed monetary rates for certain e-waste fractions. These agreements secure minimum payments for certain e-waste fractions and hence, are beneficial for maintaining a continued relationship to informal workers.

The biggest challenge for Chintan currently stems from changes introduced by the new E-waste Management Rules, 2016. Putting a stronger emphasis on monitoring and evaluation of targets, the new version of the rules specify that collectors have to tie up with producers so that all collected waste is accounted for and EPR targets of producers are met. Hence, Chintan now needs to establish relationships with producers in order to continue e-waste collection. However, Chintan perceived that producers are usually reluctant to work with both NGOs and the informal sector. Therefore, Chintan has not yet managed to tie up with producers as per current stipulations of the E-Waste Management Rules, 2016.

Financial income is another challenge. It was pointed out that expanding the initiative to a larger geographical context would require considerable investments. These investments would be primarily directed towards improving access of informal actors to WEEE and increasing the outreach of the NGO itself, e.g. through employment of additional staff, increasing marketing activities and implementation of awareness campaigns. The interviewee mentioned that some INR 250,000 per month would be sufficient to employ a team that is able to reach institutions, bulk consumers and manufacturers in order to ensure that EPR targets are met.

Other challenges lie in the lack of skills among informal workers. According to an interviewee, these need to be enhanced so that they are able to repair and refurbish e-waste as well. In turn, this will ensure a higher degree of interest in the e-waste sector as a livelihood opportunity which can create higher incomes, with revenue potentials possibly increasing by 30-40%.

In order to increase the outreach to informal actors, Chintan is collaborating with so called Informal Activation Agents. Having realised that considerable quantities of e-waste are presently recycled by the informal sector, these activation agents create awareness about environmental health and safety hazards from improper handling of WEEE by directly approaching individuals in the e-waste value chain. Hence, they conduct advocacy work on behalf of Chintan and seek to increase the rate of formalisation among informal workers.

Depending on the quantity and weight of disposed materials, door-to-door is not always possible for informal workers. Hence, Chintan has decided to pilot a mobile application in June 2017 called 'Pick my Trash'. The application essentially presents a collection service which allows consumers to order e-waste collection free of charge. In case the location is close by, informal workers will be mandated with collection and paid accordingly; if the location is too far away, Chintan will retrieve the materials by using motorised vehicles. Through this, Chintan is hoping to obtain larger quantities of WEEE and regularise the inflow of materials.

Based on the developed solutions, Chintan currently manages to collect one ton of e-waste a month which is subsequently channelled to formal recyclers. While this is a rather limited quantity, an interviewee pointed out that it positively impacts the livelihood of waste pickers and increases their income by as much as 25%. Moreover, Chintan's involvement across Delhi's communities has unfolded less tangible impacts, e.g. through building capacities of informal collectors, providing education to their children creating new livelihood opportunities among the local population.

The scalability of formalisation under Chintan ultimately relies on the organisational capacities and human resources, especially since advocacy with the informal sector can be a time consuming process and requires building trust on a long-term basis. If these pre-conditions are met, their services can be leveraged towards meeting environmental obligations of producers.

Chintan
Delhi

Women sorting e-waste. © adelphi.

3 Towards Sustainable E-Waste Management in India

3.1 Policy Developments

The new Indian E-waste Management Rules, 2016 entered into force on October 1st 2016. The legislation introduced a number of far-reaching changes to its predecessor, the E-waste (Management and Handling) Rules, 2011. The renewed legislation expands the circle of affected stakeholders to manufacturers, dealers, refurbishers and Producer Responsibility Organisations (PROs) in addition to previously included groups (i.e. producers, consumers, collection centres, dismantlers and recyclers). Further, the types of materials addressed are expanded accordingly and now include components, consumables and spare parts which are listed in Schedule I of the Rules.

For each of the above mentioned stakeholder groups, a detailed list of provisions and responsibilities is laid out. With Extended Producer Responsibility (EPR) being the core feature of the rules, the responsibility to collect e-waste lies more firmly with producers than before. In order to achieve this, the legislation follows a target-based approach and entails specific collection rates which are measured by number or weight. During the first two years of implementation, rates shall amount to 30% with a step-wise increase to 40% (year three and four), 50% (year five and six) and 70% (year seven). Targets are based on EPR plans which are elaborated and published by producers, using the average lifetime and weight across different product groups in connection to sales data as a basis for calculation (Government of India 2016).

To achieve these targets, producers are provided with a number of options. They may, for instance, collect e-waste through designated collection centres, through buy-back arrangements or in collaborations with any authorised agency as long as the fractions are subsequently channelled to licensed recyclers. Since responsibility for collection of e-waste now firmly lies with producers, new challenges arise for previously licensed collection agencies. These organisations now need to tie up with producers to continue their collection efforts and maintain legal status within the ambit of the rules.

The new rules enable an approach to collection via mandating a PRO to fulfil producers' EPR plans. In addition, two new instruments have been introduced which seek to increase e-waste collection rates: Deposit-Refund-Schemes and E-waste Exchange. The former functions as a price premium on electronic products entering the market which is subsequently reimbursed (including interest) to consumers upon return of the same product at the end of life; the latter is defined as an instrument "offering assistance or independent electronic systems offering services for sale and purchase of e-waste generated" from end-of-life EEE (ibid.). This instrument may be facilitated through the Metal Scrap Trading Corporation serving as an e-auctioning platform for different e-waste fractions but has been criticised to be available for large players only. Theoretically, the scope of the instrument could be broadened to include individual consumers and micro-/small-scale enterprises (also comprising those from the informal sector) which handle larger amounts of e-waste (Chaturvedi and Gaurav 2016).

With regards to actors from the policy level, various new provisions have been included in the current regime of the Rules. Whereas responsibility for authorisation for collection, dismantling and recycling previously lay with the respective State Pollution Control Board (SPCB), this process has been centralised and now lies within the ambit of the CPCB. Further, responsibilities for enforcement have been elaborated for the State Governments. As such, provisions are distributed among three authorities: First, Department of Industry in State is responsible for allocation of sufficient industrial space for establishment of new dismantling and recycling businesses; second, Department of Labour in State shall be responsible for ensuring health and safety of workers and conduct industrial skills development; third, State Government needs to prepare an integrated implementation plan and submit an annual progress report to the Ministry of Environment, Forest and Climate Change.

According to MAIT (2016), the target-based approach was introduced on the basis of international best practices which suggest that higher collection rates are achieved among countries with clearly defined EPR targets. However, simply adopting a target-based approach and/or using PROs as vehicles for collection is unlikely to increase returns of e-waste. In addition, sound enforcement is necessary and needs to be complemented with due efforts for integrating the informal sector into existing collection activities. In fact, various authors (see for instance Williams et al. 2013; Khetriwal Sinha et al. 2016; Niyati 2014) have highlighted the role of the informal sector in e-waste collection due to its highly effective network of door-to-door collectors.

Despite the chance of increasing collection rates, Chaturvedi and Gaurav (2016) point out that involving informal actors into formal activities offers various economic, social and environmental opportunities and can indeed be viewed as an essential building block for sustainable e-waste management in India. Yet, the current state of the E-Waste Management Rules essentially neglects informal actors as an independent stakeholder group and falls short in providing them with adequate attention. Nonetheless, the research team aims to highlight the role of the informal sector and, supported by a large body of literature, points out that large scale collection is likely to fail without harnessing their knowledge and well-established relationships across the Indian e-waste value chain.

3.2 Partnership Models

The existing body of literature proposes a number of different partnership models which create linkages between formal and informal actors along the e-waste value chain. Sometimes referred to as "hybrid models", a common feature of such partnerships is that upstream processes (i.e. collection) are predominantly organised through informal actors while downstream processes (i.e. recycling) are managed by authorised organisations. Based on a number of case studies from the e-waste sector in India, Lines et al. (2016: 35) propose five different partnership models which "can be understood as a 'package' of innovative options that might work together – rather than alternatives to each other". Table 2 (page 30) describes their main features.

The authors mention that these partnership models "are based on good practices identified in the informal solid-waste sector in India and elsewhere" and acknowledge that they are neither exhaustive nor empirically verified, thus remaining "largely theoretical" in nature (ibid.: 36). When examining formal-informal interactions as part of the current study, their characteristics did not always coincide with the ones suggested by Lines et al. (2016). Therefore, the case studies presented in this paper shall instead be distinguished along three main characteristics, namely the **types of partnerships** between formal and informal actors (i.e. whether relationships to producers, intermediary organisations, recyclers and informal actors are maintained), **incentives** provided to informal actors (i.e. market price payments, salaries or other benefits) as well as the types of **agreements** entered to maintain a relationship with formal and informal actors (i.e. verbal agreements versus non-binding or binding agreements in written form). Table 3 (page 31) provides an overview of these features among the set of analysed case studies. A more detailed discussion is presented in the subsequent sections.

PARTNERSHIP MODEL	DESCRIPTION
ID Cards	Under this model, waste pickers are provided with ID cards from producers of electrical and electronical equipment (EEE). These ID cards offer external assurance when collecting WEEE from (bulk) consumers and ensure that the materials are channelled towards formal recyclers.
Collection Agency	In this model, informal collectors come together under the umbrella of an independent (not-)for-profit entity. The incoming materials are aggregated and sold to formal recyclers.
NGO Support	In partnerships which follow this set-up, informal collectors are linked to community-based civil society/non-governmental organisations. These organisations facilitate access to (bulk) consumers and build capacities of informal actors on proper collection and handling of e-waste, amongst others.
Dismantling Association	In such associations, informal actors unite under a formal entity and perform dismantling activities which adhere to good environmental health and safety standards. E-waste streams are aggregated and channelled to authorised recyclers. In addition, NGOs may provide training to enhance capacities of formalised dismantlers.
Refurbishment Business	Following this partnership model, individual informal collectors or formal collection agencies channel WEEE to an intermediary organisation which refurbishes the incoming goods. Subsequently, these are resold in stores and markets, thus prolonging the lifespan of electronics. Waste which is created as part of the dismantling process is channelled to authorised dismantling recyclers.

Table 2: Partnership models (definitions from Lines et al. 2016: 37)

Collection of e-waste from households. © GIZ develoPPP / Vostry.

| | TYPES OF PARTNERSHIPS | | | TYPES OF INCENTIVES | | | | | | | | | TYPES OF AGREEMENTS | | |
| | | | | FINANCIAL | | | NON-FINANCIAL | | | | | | | | | |
	Interface agency-informal collector	Producer-NGO-informal collector	Recycler-informal collector	Financial subsidies	Market price payments	Fixed salaries	Protective gear	Trainings	ID cards	Access to bulk consumers	Advocacy of workers' rights	Educational services	No	Non-binding	Binding
Green E-Waste Recyclers	✓				✓					✓			✓		
SWaCH	✓				✓					✓				✓	
Saahas Zero Waste	✓	✓*				✓	✓	✓		✓				✓	
E-WaRDD			✓		✓	✓	✓	✓		✓			✓		
GIZ-Microsoft		✓			✓					✓				✓	
Chintan		✓*			✓			✓	✓	✓	✓	✓		✓	

Table 3: Overview of case studies and corresponding features

*Relationships between the organisations presented in these case studies and producers have been terminated.

3.3 Types of Partnerships

3.3.1 Interface agency-informal collector partnerships

Khetriwal Sinha et al. (2016) suggest channelling WEEE to formal recyclers by means of designated interface agencies. Essentially, these agencies act as intermediaries in the value chain by purchasing e-waste from informal collectors and diverting them to authorised recyclers. A similar set-up is proposed by Lines et al. (2016) who use the term "collection agency". Such organisations are vital for establishing a central contact point and linking informal collectors to formal EPR systems. Looking at the case studies presented in this paper, such a model is employed by 4R, Green E-Waste Recyclers, SWaCH and Saahas Zero Waste (SZW).

Yet, one disadvantage of this model seems to lie within the role of the organisation itself. Essentially, an interface organisation acts as an intermediary for collection of e-waste. In comparison to other models, operating an interface organisation creates relatively little value-added and, from a purely economic point of view, fails to exploit more profitable value points, such as recycling, dismantling or refurbishment. Expanding the scope of operations to more profitable activities may help to form lasting bonds to informal actors and increase the amount of collected materials. Otherwise, it appears that linking informal collectors to collection agencies for channelling WEEE to authorised recyclers can only become viable when additional financial resources are provided by producers. Alternatively, other stakeholders (e.g. in form of a PRO) would need to fulfil this function and act as an interface for formal-informal transactions.

As of today, revenues from collection often do not cover the operational costs of collection agencies. This becomes particularly visible when examining the cases of Green E-Waste Recyclers and SWaCH. Being a formally registered company under the previous E-waste Management Rules from 2011, the accounts of Green E-waste Recyclers need to be audited and returns need to be filed annually at the Indian tax department and the State Pollution Control Board. Due to a lack of experience in such activities, the company needs to hire an accountant which induces additional fixed costs of about INR 50,000 a year.

Moreover, due to legal stipulations of the E-waste Management Rules, 2011 the company needed to operate a collection centre which is located in an industrial area in Delhi. Over a period of four years, rental costs have risen steadily and amounted to some INR 2 million. As a consequence, Green E-waste Recyclers has been driven to the verge of bankruptcy. In order to remain operational, the company had to sell large quantities of e-waste to authorised recyclers at a fraction of the usual price.

The company is at times unable to provide competitive prices to informal collectors. The same issue arises when bidding for used goods from bulk consumers; here, the company competes with large-scale formal recyclers which bypass intermediaries and can afford higher prices. Quality of purchased goods from bulk consumers presents another issue which further compromises profitability of Green E-waste Recyclers. For instance, collected computers often lack the most valuable components which offer the highest revenue potential, including (e.g.) hard drives and mother boards.

Another (or rather additional) approach has been followed by SZW. By offering physical waste management and consultancy services for e-waste despite mere collection services, the organisation becomes more than a mere interface agency and can offer more comprehensive services to producers and bulk consumers.

However, it should be noted that SZW has not yet managed to sell those services on a larger scale. WEEE has predominantly been collected from households by operating a network of collection points around Bangalore. In theory, this entails two benefits: first, consumers can dispose of devices free of charge and second, SZW

avoids purchasing WEEE at current market prices. While this appears reasonable from an economic point of view, the influx of materials has so far been limited. In practice, this can be attributed to the strong presence of informal collectors which offer more attractive services to consumers by purchasing goods right at the doorstep.

Another option for increasing the viability of interface agencies would be to tie up with producers and follow a PRO-like approach. In this, an organisation would be paid by a producer for collection and authorised disposal of WEEE, thus helping the producer to comply with the E-Waste Management Rules. As of today, such set-ups have not received wide-spread support from producers. Considering that prices paid by informal recyclers are often higher than those by formal recyclers, producers would need to step up financially in order to increase the amount of WEEE collected. Yet another option for interface organisations would be to offer additional benefits to informal collectors so as to increase the attractiveness of channelling e-waste towards authorised recyclers, thus partially bridging the price gap between formal and informal transactions. More information on such incentives will be provided in section 3.4 below.

3.3.2 Producer-NGO-informal collector partnerships

This type of partnership relies on similar mechanics as interface agencies but can be distinguished by two main features: first, the partnership with informal collectors is maintained through a non-governmental organisation (NGO) with a strong standing in the respective local community; second, the NGO provides assistance to collectors through training and capacity building measures. Examples for this model include Chintan and the Microsoft case, the latter of which collects e-waste through its local partner Disha. The role of agencies like GIZ as a bilateral intermediary in such model was essential to create a neutral perspective while engaging informal sector agencies and supporting capacity development and dialogue for sharing experience in the long term. Employing such a model entails a number of advantages and drawbacks for establishing a link between the formal and informal economy.

On the one hand, the role of community-based organisations within the value chain is rather similar to interface agencies in that they essentially act as aggregators for channelling e-waste from informal collectors to authorised recyclers. Hence, their core value proposition does not reach beyond screening, collection and channelisation of WEEE. As outlined above, this may compromise their profitability and can inhibit sufficient capital flows towards informal collectors. In the case of Chintan and Disha, collectors are paid based on the quantity and quality of incoming wastes. Due to this the model encourages "cherry picking" of the most valuable materials and potentially neglects fractions of lower quality.

However, community-based organisations often enjoy a good reputation and are perceived as trustworthy by local stakeholders. Despite not being able to compete with the prices paid by informal intermediaries, they are able to increase the attractiveness of channelling WEEE towards formal recyclers by offering support to informal collectors in various ways. With respect to Chintan, this is achieved by conducting trainings and building capacities of e-waste collectors, as reflected by their Scavengers to Managers programme. In addition, Chintan collaborates with Safai Sena, a registered group of waste collectors, in order to increase the outreach to informally employed individuals. In this partnership, collectors who register at Safai Sena are provided with ID cards which can be used to gain access to otherwise restricted generators of WEEE (e.g. schools).

Despite these positive impacts on the formalisation of informal workers, local involvement also entails a major drawback for the scale-up and replication of such community-based approaches. In fact, Chintan's outreach ultimately relies on the dedication of human resources, e.g. through deployment of Activation Agents who create awareness among local workers and promote safe disposal of e-waste fraction via authorised organisations. During conversations with Chintan, it was mentioned that some 250,000 INR per month would be needed to employ a team that is large enough to have a tangible impact on the e-waste value chain. When compared to the one-time upfront costs borne by E-WaRDD for setting up a recycling facility (i.e. 800,000 and 650,000 INR in 2007 and 2008 each), this can be seen as significant expenses and raise questions regarding the scalability of community-based approaches.

In the case of Disha, collection of WEEE is conducted on behalf of Microsoft. By using the company's collection license, Disha is collaborating with a number of informal collectors and establishes a link to formal recyclers. After receiving initial technical and financial support from Microsoft, Disha continued to collect e-waste self-sustainably. Notably, Microsoft and Chintan had previously collaborated in 2012 but discontinued their joint efforts shortly thereafter. According to Lines et al. (2016: 41), "the project struggled to get a sufficient supply of material and quickly failed". From the perspective of Microsoft, the core issue for this failure lay in the low quantity and quality of incoming wastes which eventually compromised the profitability of collection activities. In addition, it was mentioned that Disha was able to react more flexibly to changing local conditions and proposed to stop collecting e-waste from repair shops in order to acquire e-waste from informal actors and bulk consumers only.

Since prices paid by informal recyclers are often higher than those from formal recyclers, producers could leverage this type of partnership by providing subsidies to bridge the price gap and ensure a steady influx of materials to the partnering organisation. In addition, NGOs are not naturally geared to work within the e-waste value chain and may even enter unknown territory when partnering with informal workers. Hence, partnering institutions need to receive technical support, e.g. in form of trainings for estimating the value of different e-waste fractions. Such interactions need to go beyond pilot projects, implying that producers need to engage with NGOs on a long-term basis if large-scale formalisation is to be achieved.

3.3.3 Recycler-informal collector partnerships

Another type of collaboration between formal and informal actors is the direct relationship between formal recyclers and informal collectors. This model is best represented by the E-WaRDD case and seems to entail an important competitive advantage for the recycler: in directly collaborating with informal collectors, E-WaRDD can effectively bypass other interface agencies and hence, is able to provide higher prices when obtaining e-waste from (bulk) consumers. However, seizing this economic opportunity is contingent on a number of factors.

For one, processing of WEEE is categorised as a highly polluting activity and may only be operated in designated regions. Therefore, recyclers are often located in peri-urban areas which are – by Indian standards – sparsely populated. Consequently, generation of WEEE in these areas is much lower and the influx of materials is limited. According to Lines et al. (2016: 35), "much of the 'secondary circuits of value' are created in or around Delhi, where much of the chemical processing and recovery of secondary raw materials takes place". As a consequence, the highest value creation potential in the e-waste chain is to be found in these areas, "meaning that far smaller margins of profit are available to collectors, dismantlers and traders in other parts of the country" (ibid.). In addition to this, accessing e-waste from consumers in distant, more populated areas becomes a challenging task and depends on the availability of internal resources in case the materials need to be transported to the recycling facility.

In the case of E-WaRDD, these challenges are reflected by the fact that only minor amounts of WEEE are collected from households. Instead, the largest fractions are obtained from bulk consumers. Since the acquisition of such wastes is typically awarded through tenders in a process of competitive bidding, the company is able to pay higher prices than intermediary organisations which focus on collection only. In fact, this challenge was explicitly mentioned by Green E-Waste Recyclers who were frequently out-bid by authorised recyclers when trying to obtain e-waste from bulk consumers.

Furthermore, setting up a recycling company requires sufficient funds. According to Green E-Waste Recyclers, acquisition and installation of appropriate equipment would entail investments of several million INR. However, the reliability of this number appears questionable. According publicly available information by E-WaRDD (2010), setting up a recycling plant in an industrial area and acquiring pollution control equipment required investments of 800,000 and 650,000 INR respectively. Nevertheless, mobilising the necessary monetary resources for setting up a recycling company is challenging and simply lies beyond the ability of many entrepreneurs in the e-waste business.

Collection rates under this model can be leveraged by cooperating with producers which, for instance, would provide financial assistance for obtaining sufficient amounts of e-waste from informal collectors. According to several interview partners however, entering such agreements is not an easy undertaking. In fact, due to their profit-driven nature and often lax enforcement of the E-Waste Management Rules, producers have little incentives to collaborate with authorised recyclers. From the perspective of E-WaRDD, approaching producers has not yet been successful. The reason for this is seen in a lack of internal resources and, more specifically, low expertise in marketing their services to producers.

Nonetheless, entering such agreements can create important competitive advantages for producers. In fact, a study by the McKinsey Global Institute (Dobbs et al. 2013) argues that, between 2000 and 2013, average annual volatility of commodity prices was almost three times as high as in the 1990s. With regards to metals[6] nominal prices have increased by 176 percent since the turn of the century, thus heralding a "new era of high, rising, and volatile resource prices" (ibid.: 1, 18). Against this background, the business case for producers to enter agreements with recyclers of WEEE is rather clear: by engaging in downstream processes and recovering materials at the end of life, they gain better control over their own resource base and can establish security of supply. Hence, collaboration between recyclers and producers is of mutual interest and presents a viable opportunity for managing e-waste streams on a larger scale.

3.4 Types of Incentives

3.4.1 Financial Incentives

Market price payments present the most common incentive to informal collectors across the analysed set of initiatives. Due to higher fixed costs of authorised recyclers, they are usually unable to purchase materials at the same prices as informal recyclers. As a consequence, this price gap "trickles down" to, for instance, interface agencies and NGOs who are unable to compete with the informal collectors/recyclers and hence, receive very limited amounts of e-waste. This situation presents a major barrier to successful diversion of e-waste towards formal channels and, without dedication of external (financial) resources from producers, appears unlikely to achieve formalisation of informal actors on a broader scale.

The magnitude of market price payments is usually based on the quantity and quality of incoming goods. Therefore, such transactions encourage "cherry picking" of the most valuable parts (e.g. printed circuit boards) and disincentivise collection of low-quality materials. Given that many informal actors live in

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6 These include base materials such aluminium, magnesium, gold, silver, copper as well as rare earth metals commonly used for manufacturing consumer electronics. For more information on volatility of metal prices, please refer to Dobbs et al. 2013, pages 18 to 24.

extreme poverty, even small differences in purchasing prices can have a significant impact on the personal livelihood of affected people. Consequently, valuable components often fail to reach formal channels and are circulated within the informal economy instead. This has been repeatedly illustrated by a number of case studies, including Green E-Waste Recyclers and Microsoft.

Against this background, it appears that large-scale collection of WEEE can only be achieved if a financing mechanism is put in place which effectively bridges the price gap between the formal and informal sector. Under the current regime of the E-Waste Management Rules, this could be achieved through (e.g.) levies paid by producers and collected by Producer Responsibility Organisations (PROs). Notably, none of the case studies presented in this paper follow a model which would effectively bridge the formal-informal price gap. The research team means to highlight that finding a viable model for such transactions will be of utmost importance if long-term integration of informal collectors into the formal economy is to be ensured. Bearing in mind the legal prescriptions of the new E-waste Management Rules, producers need to step up to their responsibility and mobilise sufficient funds for meeting the targets of their EPR plans.

In this light, the options for increasing collection of low-quality wastes in India remain limited. One possible option is to implement more efficient recycling equipment in order to yield higher extraction rates from low-quality wastes and hence, increase the profitability of recycling operations. However, it seems that implementation of such technologies is only profitable at scale and further requires significant investments which, as of now, can seldom be borne by Indian recyclers individually. Potentially, public authorities may provide the needed funding and could implement such technologies in designated eco-industrial parks. Within such a set-up, informal collectors would deliver collected e-waste to the recycling facility and receive weight-based payments once the materials have been recycled.

Another financial incentive applied by Saahas Zero Waste (SZW) is to provide fixed salaries to formalised collectors. Since SZW's employees are not paid on the basis of the amount and quality of e-waste collected, it appears that this model encourages collection of both high- and low-quality WEEE to a larger degree than the other case studies presented above. However, it is highly unlikely that this is economically feasible for every organisation as it would rely on steady sources of income which, with regards to e-waste, are not yet feasible. Should recycling fees be paid by producers in future within the new framework of the EPR rules, then this could establish the necessary means to pay fixed salaries on a larger scale. Nonetheless, in order to increase collection rates, collectors can provide secondary non-financial benefits to informal collectors. These will be discussed in the following section.

3.4.2 Non-Financial Incentives

Non-financial incentives come in various forms. In the case of E-WaRRD and SZW, workers are provided with protective gear. In addition, a number of case studies (E-WaRRD, SZW and Chintan) provide trainings to workers and build their capacities on proper handling of e-waste. Considering the often dire occupational, health and safety conditions in the e-waste sector, this may present a strong argument for informal workers to join formalised organisations and has in fact been mentioned as one reason for achieving a slow-yet-steady rate of formalisation.

In the case of Chintan, the NGO enables informal workers to access e-waste generators in residential colonies through provision of ID cards. These cards are issued by Safai Sena, registered group of waste collectors. Using these cards, informal workers are able to access e-waste generators which were previously unavailable to them (e.g. schools). According to Chintan, this enables informal workers to generate additional income and enhances their livelihood.

Facilitating access to bulk consumers can be seen as another non-financial incentive. Notably, this approach has been followed by every single case study and can in fact be seen as one of the major sources of income for many formalised organisations. WEEE from these stakeholders is usually acquired in a process of competitive bidding. Since bulk consumers dispose of larger quantities at once and informal workers are denied access, participating in such auctions presents a major incentive to join formalised organisations.

In collaboration with Safai Sena, Delhi-based Chintan actively advocates the rights of informal workers and offers educational services to their children. While this cannot be seen as an incentive to channel e-waste through Chintan per se, it may well increase the attractiveness of joining the initiative and increases the trustworthiness of the NGO across the local community. Since the majority of relationships in the informal economy are based on trust, pursuing such options appears worthwhile and can facilitate formalisation among a large number of actors.

Overall, it appears that non-financial benefits can partly – yet not completely – offset the formal-informal price gap. Since transactions within the e-waste value chain often operate at small margins, it is unlikely that offering non-financial incentives alone will achieve formalisation on a broader scale. Instead, the research team means to highlight that additional financial resources need to be provided through individual and/or collective payments from producers.

3.5 Types of Agreements

Oral and written non-binding arrangements between informal workers and formalised organisations (i.e. recyclers, interface agencies and NGOs) present the predominant form of agreements across the case studies. Most often, such agreements serve as declarations for collaboration or are used to formally become part of collection agencies. As such, the involved parties are tied to these agreements due to moral reasons and/or pure self-interest. Due to the absence of sanctions, individuals cannot be held accountable when breaching the commitments.

There are various underlying reasons for entering such non-binding agreements. For one, the low level of consolidation across the e-waste sector makes it difficult to enter contracts in the first place. In addition, interviewees frequently mentioned that trust is essential part of daily interactions in the informal e-waste economy. Essentially, trust functions as a mutually binding regulation due to which most formal-informal relationships do not require external assurance through legal contracts. Some interviewees even mentioned that contracts can even be a hindrance to the formation of partnerships. Considering the written agreements are usually limited in time, their contents need to be re-negotiated on a regular basis. This requires frequent interactions and can induce transaction costs to all parties involved. Hence, making regular efforts to determine specific contractual provisions is uneconomical for most informal collectors.

Notably, binding agreements between informal workers on the one hand and recyclers, interface agencies or NGOs on the other hand have not been identified among the analysed set of initiatives. However, some organisations do maintain agreements with recyclers. In the case of Microsoft, the partnering NGO Disha was supported in negotiating contracts with authorised recyclers so as to ensure minimum payments for certain materials. On the other hand, E-WaRDD maintains contracts to a number of IT-companies which regularly dispose of e-waste. In both cases, the contracts are beneficial to the formalised organisations as they create security of income.

Recommendations

4.1 Design of Partnerships

4.1.1 Organisational Structure

Organisational structures across the analysed set of initiatives vary considerably and range from centralised decision-making by individuals over to decentralised models with clearly defined responsibilities. On the one hand, centralised organisations can respond to changing environmental conditions much more flexibly; this is, for instance, illustrated by the case of 4R and Green E-Waste Recyclers where the management was able to make an ad hoc decision and save the business from bankruptcy by selling larger amounts of WEEE at lower prices when rental costs for the collection site became too high. On the other hand, decentralised models such as the one employed by SWaCH are more efficient in coordinating a wide spread network of collectors. Hence, they are able to maintain a steady inflow of WEEE over a fragmented pool of collectors.

Despite the heterogeneity of the analysed case studies, a number of recommendations for the conceptualisation of partnerships can be provided. First, partnerships between formal and informal actors should be designed in such a way that they pay respect the entrepreneurial spirit strong characters of individual collectors. For the most part, informal collectors are used to work independently and view themselves as individual entrepreneurs. When partnering with formal actors, informal workers become part of a greater whole and may feel that (e.g.) working under the umbrella of a cooperative compromises their personal autonomy. Neglecting this fact was one of the major pitfalls of the cooperative initiated by Sahaas Zero Waste (SZW) which eventually disintegrated due to internal frictions among workers.

In some cases, however, clearly defined responsibilities and hierarchies can become necessary to ensure efficient coordination. Once again, Saahas can be mentioned as an example as it maintains a large network of about 150 collectors which partially work on MSW and collection of e-waste. Given the large degree of heterogeneity within the e-waste sector, introducing strict hierarchies or providing leeway to individual collectors should be decided on a case-by-case basis and needs to pay and needs to pay attention to the needs and and expectations of all parties involved.

Moreover, partnerships with informal actors should be set up in close collaboration with respected individuals that are perceived as trustworthy within the target community and enjoy a well-established track record in the e-waste sector. In fact, most relationships between formal and informal actors are based on trust and have evolved over a long period of time. Such linkages can be seen as a valuable resource and should be used for making contact to informal actors. In fact, most of the above mentioned case studies (see for instance Green E-Waste Recyclers and Saahas) have highlighted the importance of trust within formal-informal relationships and demonstrated that, if individuals are perceived as reliable business partners, some rate of formalisation can be maintained even if prices paid cannot compete with those from the informal sector.

If such key individuals cannot be identified, civil society organisations can present useful interfaces for connecting to informal actors. In that, they can fulfil different functions. Since civil society organisations typically operate as non-profit or philanthropic entities, they may help to establish trust to informal actors and increase their willingness to cooperate. Moreover, they can offer additional benefits which increase the attractiveness of channelling e-waste to authorised recyclers. Such benefits can be exemplified by Chintan which operates educational centres for workers' children, promotes the rights of informal collectors through the Safai Sena secretariat and offers ID cards which enable informal actors to access larger quantities of e-waste. Lastly, civil society organisations may raise awareness for negative impacts of improper recycling techniques and hence, help to create a level playing field between formal and informal actors. The Microsoft case study serves as an example in which a civil society organisation is used as an interface which facilitates interactions with informal actors.

4.1.2 Agreements and Incentives

Oral and/or written non-binding arrangements between informal workers, formal collectors and licensed recyclers present the most common form of agreements across the analysed sample of initiatives. Often, these serve as joint declarations of intent to which all parties are tied for moral and, more importantly, financial reasons. Since those agreements do not entail sanctions and individuals cannot be held accountable in the case of misconduct, they essentially present self-commitments without legally binding provisions. Reasons for choosing such set-ups are manifold. However, given the low level of consolidation across the e-waste sector, most relationships are based on trust and do not require external assurance through legal contracts.

In fact, some interviewees mentioned that contracts can even be a hindrance to the formation of partnerships. While some initiatives do maintain contracts with generators of WEEE (e.g. Disha and E-WaRDD), agreements need to be renegotiated on a regular basis and require frequent interactions, thereby inducing transaction costs to both sides. Considering that e-waste collectors and recyclers often operate at rather small economic margins, making regular efforts to negotiate contracts simply lies beyond the capacities of many organisations.

Once collectors and recyclers reach a certain size however, signing contracts can become a necessity to ensure security of supply and provide long-term incentives to key stakeholders. Looking at the sample of partnership models, this point is particularly visible in the case of SZW. Here, employment contracts between the company and the workforce are needed; in fact, these agreements even appear to be positive to the organisation. By providing securities to its employees, SZW manages to ensure formalisation and maintain a steady inflow of e-waste over a prolonged period of time.

As illustrated by the Microsoft case, local NGOs can be mandated with collection on behalf of a producer. If successful, such partnerships can create valuable win-win-win-situations, e.g. by assisting corporations in meeting compliance targets and generating additional income for the partnering organisation and/or informal collectors. This is illustrated by the Disha case, which was able to establish an economically viable model and until today, uses Microsoft's collection license to channel WEEE towards authorised recyclers. For such win-win-situations to materialise, it is essential that agreements entail some degree of flexibility so that the approach to collection followed by the local partner can be adjusted to specific (and often variable) socio-cultural conditions.

With regards to incentives given to informal collectors, interviewees repeatedly mentioned that a lack of financial compensation was the main reason why formalised stakeholders decided to turn away and re-enter the informal economy. Vice versa however, sufficient financial returns do not present the sole reason for which formalisation occurs; in addition, strong personal bonds and mutual trust between local stakeholders help to sustain a low-yet-steady rate of formalisation. Here, the case of Green E-Waste Recyclers provides valuable insights where the long-standing track record of Mr Mohammad Sabir can be seen as a crucial factor which positively affects his ability to collect WEEE despite not being able to provide competitive prices to workers from the informal economy.

In case trust is not yet established, a number of soft measures may be applied to incentivise informal workers to join a formal initiative. Based on the analysis of the case studies, provision of personal protective equipment and introduction of decent occupational health and safety standards appears to be a common approach. Moreover, the organisation may provide additional immaterial benefits by supporting the technical education of staff members and providing social securities. Here, learnings can be drawn from both Chintan and SZW; while the former increases the attractiveness of formal-informal relationships through trainings, capacity building and advocacy of workers' rights via the Safai Sena secretariat, the latter provides security by paying fixed salaries to previously informal collectors.

4.2 Strategic Recommendations

4.2.1 Longevity of Partnerships

One key lesson from the case studies presented in this paper is that trust is a crucial precondition for the existence of sustainable partnership models. Almost all interviewees had a long-standing track record and were recognised as well respected collectors within their local communities. This, together with some external pressures through the implementation of the E-Waste Management Rules, helped to kick-start formalisation among collectors and convinced them to join authorised initiatives. Therefore, having a strong standing within the network of informal collectors is absolutely crucial for maintaining long-term partnerships and diverting larger quantities of WEEE towards formal channels.

The Indian e-waste sector is comprised of numerous different stakeholders with heterogeneous socio-cultural backgrounds which need to be considered if formal-informal partnerships are to be sustainable. From the perspective of producers, this means assessing a number of key parameters when entering partnerships across different regions in India. Looking at the challenges to formalisation across the set of analysed case studies, the lack of competitive financial remuneration to informal collectors appears to be another major bottleneck for long-term v of formal-informal relationships. Table 4 illustrates the price gaps across three exemplary product groups which were identified through a market analysis conducted by Khetriwal Sinha et al. in 2016.

PRODUCT CATEGORY	INFORMAL PURCHASING PRICE	FORMAL PURCHASING PRICE
Printers and copiers	25 to 45 INR/kg	20 to 25 INR/kg
Microwave oven	36 to 44 INR/kg	25 INR/kg
Refrigerator	1,500 to 2,000 INR/piece	200 to 300 INR/piece

Table 4: Comparison of purchasing prices for different WEEE fractions across the formal and informal recycling sector [no location specified] (Khetriwal Sinha et al. 2016: 4)

Due to significant price volatility in the e-waste sector, regular assessments on the magnitude of such price gaps need to be conducted. Another key parameter to be assessed pertains to the needs and expectations of stakeholders in the e-waste value chain. In fact, findings from the case studies presented in this paper suggest that long-term formalisation can only be achieved if, from the perspective of informal collectors, interacting with formal actors becomes at least equally attractive as channelling materials towards informal recyclers. It appears that financial mechanisms play a crucial role for achieving this, however, other benefits may be provided as well. These typically correlate to specific socio-cultural conditions within the target regions and may include, amongst others, the level of education as well as the position and negotiating power of informal actors within the local community.

From the perspective of interface agencies, the analysis has shown that margins are often too small to create economically viable partnerships. In this case, agencies may consider taking up additional activities along the value chain to increase profitability, i.e. dismantling and/or refurbishment as well as PRO/consulting services. Here, SZW presents an interesting case study as it actively engages with producers to support them in meeting EPR targets. These activities have so far shown limited success.

Another option is to enter the dismantling or recycling business. However, this induces significant capital costs and – due to legal stipulations on treatments of hazardous wastes – may only be conducted in designated areas. The case of E-WaRDD has shown that recyclers can successfully enter the collection and dismantling business in order to obtain WEEE directly from bulk consumers or via informal collectors. In doing so, other intermediaries (i.e. collection agencies) are bypassed and and do not need to be paid for their services; this may further increase the competitiveness of business operations. In order to support such processes and create viable partnership models, assistance from producers and policy makers is needed. This could materialise in form of technical trainings or financial aid for relocation in case these activities cannot be carried out in the current location.

In case diversification of activities is prohibitive and profitability of collection cannot be increased by other means, producers need to step up to their financial responsibilities when collaborating with collection agencies and provide adequate monetary support to bridge the price gap between formal and informal transactions. Alternatively, the role of interface agencies would need to be taken up by other stakeholders, e.g. by a designated PRO or recyclers which directly partner with informal actors. Again, these need to receive adequate support from producers to fulfil their mandate for e-waste collection.

Furthermore, the case studies suggest that policy makers need to ensure that resources are in place to enable sound enforcement of E-waste Management Rules. Without due enforcement from policy makers formal recyclers and other intermediary organisations will be faced with intense competition from the informal sector. The creation of a level playing field is of utmost importance if long-lasting formal-informal relationships are to be maintained. This requires effective monitoring of producers' EPR plans and, in case of non-compliance, legal prosecution of individual organisations. In order to avoid such cases and create favourable conditions for meeting EPR targets, policy makers should consider incentivising producers to partner with informal actors, e.g. by providing tax breaks or subsidies.

4.2.2 Scale-Up and Replication
In order to replicate proven approaches and achieve large-scale formalisation across different geographical contexts in India, a number of aspects should be borne in mind. First and foremost, producers should offer long-term support and technical assistance to partnering institutions. In that, the partnerships can benefit from lessons learnt and stimulate incremental formalisation of informal actors. Drawing inferences from the Microsoft case, assistance provided to partnering organisations was limited to merely two years; however, given the current conditions of e-waste management in India, this is a comparatively short time frame and insufficient to assess the diverse and heterogeneous needs of stakeholders in different parts of the value chain.

Throughout the interviews it was mentioned that formalisation within the e-waste sector cannot be created in an ad hoc fashion but needs to be fostered incrementally over a longer period of time. In order to achieve such change, frequent interactions are needed to establish a fruitful relationship between partners. Close monitoring by producers or PROs is mandatory to assess quality of materials, recommend changes in organisational set-ups and prevent leakages of collected e-waste towards informal channels.

Furthermore, implementation of a viable financing mechanism should be complemented with large-scale capacity building measures. While all of the presented case studies manage to formalise informal workers to some extent, organisations which harness entrepreneurial thinking seem to be most successful in maintaining a link to the informal economy. Having this in mind, capacity building measures could convey entrepreneurial skills (e.g. calculations of profit and loss, marketing of products and services), introduce innovative approaches to problem management and/or provide simple analytical tools for efficient allocation of organisational resources. The importance of entrepreneurial and innovative thinking became particularly apparent from various case studies, such as Saahas Zero Waste, Microsoft and E-WaRDD.

In addition, capacity building approaches could also convey a basic understanding regarding organisational management and internal allocation of resources. Based on the set of case studies examined in this study, establishing an efficient structure and having clearly defined responsibilities emerged as a key condition to successful organisational development and hence, lies at the heart of successful replication. The importance of such issues could, for instance, be substantiated by transaction cost theory to highlight the scale of tacit (i.e. non-financial) resource flows and illustrate the consequences of excessive information asymmetries. By integrating such components into capacity building measures, actors along the e-waste value chain would be enabled to replicate proven approaches across other areas in India.

The project team further means to highlight the role of the government and producers in scaling up formal-informal partnerships for collection of e-waste. In order to create a viable business case, regulators and producers need to recognise collection of e-waste as a significant market opportunity. According to United Nations University (2014b), the global intrinsic material value of e-waste is estimated at about EUR 48 billion but as of today remains largely underexploited due to a lack of concerted public-private efforts. Exploiting these values can be achieved by scaling up formal-informal partnership models, provided that they receive sufficient support to increase their outreach and enhance their capacities. Last but not least, it should be emphasised that there is no one-size-fits-all approach to replication and scale-up; instead, measures need to be contextualised to the local conditions within the target regions. This aspect was repeatedly mentioned by various interviewees and pertains to both technical (e.g. agreements) and financial aspects (e.g. payments). It became particularly evident in the case of Microsoft where two of overall three initiatives turned out to be unsustainable because they did not adapt to the changing organisational environment. Considering the wide variations in market prices for e-waste goods across different areas in India, there is a need for regionally specific actions which pay attention to the needs and expectations of stakeholders from both formal and informal backgrounds.

Formal dismantling of old computers. © GIZ / Ostermeier.

Conclusion

5.1 Summary of Recommendations

The Indian e-waste sector is characterised by highly dynamic market environment and high degree of fragmentation. At times, the research team was confronted with contradictory information and needed to cross-check various sources in order to verify findings and produce warranted results. As such, the researchers gained the impression that conditions across the Indian e-waste sector are rather unstable and can change drastically within a comparatively short period of time. Given the low level of consolidation along the value chain, there is no central authority which is able to provide statistically representative information. Therefore, the findings presented in this paper should be interpreted carefully. One-to-one extrapolation to different geographical contexts may not be applicable and in fact lies beyond the scope of this research endeavour.

Despite these limitations, this paper offers valuable insights into the underlying mechanisms to formalisation of informal structures. The key recommendations presented in this paper should be taken into account for achieving collection targets of 30% within the first two years of implementation of the new E-Waste Management Rules, 2016. They can be summarised as follows.

The organisational structure of partnerships should be designed in such a way that they respect the entrepreneurial character of informal collectors.

For the most part, informal collectors are used to work individually and see themselves as entrepreneurs. If partnerships follow strict hierarchies, conflicts may arise and create frictions among parties involved. This was an important lesson from the failure of the collective which Saahas helped to initiate; eventually the collective disintegrated due to strong personal ambitions of individuals which felt that being part of a larger organisation would compromise their autonomy. Similarly, SWaCH can be mentioned as an example as it successfully cooperates with a wide range of collectors under the umbrella of a rag-picker union (KKPKP). For some organisations, however, clearly defined responsibilities and hierarchies can become necessary to ensure efficient coordination of collection activities; again, Saahas can be mentioned as an example as it maintains a large network of about 150 collectors which partially work on MSW and collection of e-waste.

To increase the success of formal-informal partnerships, key individuals within a particular community should be identified, approached and included.

The analysis suggests that a central building block of formal-informal relationships is trust and may, in fact, be seen as a necessary precondition to the successful formalisation of informal collectors. Hence, integrating key stakeholders which are perceived as reputable and reliable business partners within the target community is necessary to render the partnership trustworthy and can bring additional informal sector workers on board. In case such key individuals cannot be identified, local civil society organisations can be approached and used as vehicles for roll-out of activities.

Civil society organisations can be a useful interface for connecting to informal actors and should be included in partnerships.

Due to the strong standing and often philanthropic involvement across local communities, these organisations can foster relationships to informal actors. As such, they may fulfil different functions and may help to establish trust, offer additional benefits (e.g. in form of trainings, educational activities or advocacy of workers' rights) and raise awareness for proper handling of e-waste among the informal sector. The ability of civil society organisations to interact with informal workers on the ground can be seen as a valuable resource and should be exploited accordingly by producers and PROs who seek to fulfil their mandate within the current EPR regime.

Agreements between formal and informal actors need to provide some degree of flexibility in order to avoid transaction costs and adapt to changing local conditions.

One key lesson from the case studies presented above is that there is no one-size-fits-all-approach to making arrangements between formal and informal actors. The e-waste sector consists of a wide range of stakeholders with diverse socio-cultural backgrounds and most interactions are based on trust; this needs to be reflected by the structure of agreements between formal and informal stakeholders. Having this in mind, specific agreements which entail legally binding provisions may fail to formalise stakeholders on a broader scale because they can cause transaction costs when contractual provisions are not upheld; hence, they can pose significant barriers to formalisation of informal structures and can negatively affect collection of WEEE. Consequently, specific stipulations (e.g. on prices paid or the amount of WEEE collected) should only be included if the economic situation of all contracting parties permits negotiation of details.

Producers should offer long-term support and technical assistance to partnering institutions.

In the light of current conditions across the Indian e-waste sector, sudden formalisation is unlikely to occur. Instead, it needs to be fostered in an incremental fashion, e.g. by providing support to organisations which enjoy a good reputation within local communities and have the potential of reaching a large number of informal actors. Drawing learnings from the Microsoft case, producers need to provide constant, long-term support to partnering institutions in order to create viable partnerships. Frequent interactions are needed to establish a fruitful relationship between partners. Moreover, close monitoring by producers or PROs is mandatory to assess the quality of materials, recommend changes in organisational set-ups and prevent leakages of collected e-waste towards informal channels.

In part, the price gap between formal and informal transactions can be offset by providing additional benefits and establishing trust to informal actors.

Despite being unable to provide competitive prices to informal collectors, some initiatives have managed to create lasting formal-informal bonds by offering a range of benefits which increase the attractiveness of channelling wastes towards formal actors. For instance, such benefits can materialise in the form of trainings for proper handling and/or dismantling of WEEE or by offering social securities and paying fixed salaries to employees. Here, SZW presents a valuable case study. On the other hand, Delhi-based Chintan provides benefits by establishing educational centres for children and advocating the rights and interests of informal workers. As for Green E-Waste Recyclers and most other cases, linkages to informal collectors are built on trust. This can be understood as a necessary precondition for maintaining a low-but-steady rate of formalisation despite the inability to provide competitive prices. Yet, the limited success of the analysed partnerships suggests that offering additional benefits alone is insufficient for securing formal-informal relationships. Instead, financial resources to informal collectors need to be provided by producers or PROs.

Producers and PROs need to assess local conditions when entering partnerships across different regions in India.

Based on the research conducted, it appears that there is no general approach to the formation of successful partnership models. Given the high degree of heterogeneity and fragmentation across the Indian e-waste sector, implementing standardised models is ill-suited and will likely fail to achieve long-term formalisation. This aspect was frequently mentioned by various interviewees and applies to both technical (e.g. agreements) and financial aspects (e.g. payments). Crucial parameters to be considered include the price structure of e-waste fractions, the needs of key stakeholders to be involved, the outreach and capacity of partnering institutions and the socio-cultural context of the respective target region. A key aspect is to determine the magnitude of financial flows from producers or PROs to collectors/dismantlers/recyclers.

Diversifying activities of interface agencies beyond mere collection can increase the financial viability of formal-informal partnerships.

Many of the examined case studies are interface agencies which purchase materials from informal collectors in order to channel them towards authorised recyclers. While this model is generally regarded as highly important for linking informal collectors to formal EPR systems (see for instance Williams et al. 2013; Lines et al. 2016; Niyati 2014; Khetriwal Sinha et al. 2016), implementation in its current form has not been successfully scaled up to a larger context. Partially, this can be attributed to the role of interface organisations as such. Essentially, such agencies act as intermediaries for collection and channelisation of WEEE. However, the largest revenue potential lies within other parts of the e-waste value chain (e.g. material extraction and recovery of precious resources). In order to create additional value, diversifying the range of activities beyond collection of WEEE may be considered. Here, refurbishment of broken electronic goods can provide additional income which positively affects the sustainability of formal-informal partnerships. If diversification is ineligible, producers need to provide financial resources to interface agencies to ensure sufficient collection of WEEE. Alternatively, other actors such as PROs or recyclers would need to fulfil the interface function by partnering with informal collectors.

Policy makers should ensure that (financial) resources are in place to enable sound enforcement of E-Waste Management Rules, 2016.

A major bottleneck to the proliferation of partnerships remains the price gap between formal and informal transactions. In order to close this gap, policy makers should ensure resources are in place to enable sound enforcement of E-Waste Management Rules, 2016. To date, a level playing field between formal and informal actors does not exist. This subjects formal partners to intense and unfair competition, thereby inhibiting the formation of durable partnerships. A key requirement for sound enforcement of the rules is effective monitoring for producers' compliance with EPR plans. These plans need to be reviewed on a regular basis and their credibility needs to be assessed prior to granting authorisation under the E-waste Management Rules, 2016. In case non-compliance is observed, producers need to be held accountable on the basis of legal prosecution. In order to avoid such scenarios, policy makers should provide incentives to producers for partnering with informal actors. Such incentives could materialise, for instance, in form of tax breaks or subsidies.

Producers and policy makers should offer entrepreneurial and organisational-development training and capacity building to formal organisations.

Interviewees frequently mentioned that entrepreneurial thinking could be seen as a key success factor for long-term existence of partnerships. The underlying reason for this was seen in the ability to innovate and adapt to sometimes rapidly changing conditions. This is reflected by Disha Foundation which collects WEEE on behalf of Microsoft and decided to stop collection from repair shops and focus on relations to informal actors instead. Moreover, following a business mentality often coincides with better control of internal resources. Trainings could, for instance, convey know-how for realistic estimates for material value of e-waste and management skills, such as profit and loss calculations, marketing of business activities, coordination and communication. Such abilities directly translate into competitive advantages and enable partnering institutions to maintain long-lasting relationships with actors from the informal economy.

5.2 Outlook

The case studies presented in Chapter 2 demonstrate the so far limited scalability of formal-informal partnerships. While literature emphasises the need for such partnerships to divert larger streams of WEEE towards formal channels, their limited impact highlights the need for further actions on the ground.

Bearing in mind the recommendations provided above, formalisation of informal structures requires involvement from various stakeholders: producers need to step up to their responsibility and make genuine efforts to fulfil their EPR plans; policy makers need to ensure sound enforcement of the E-waste Rules to create a level playing field between formal and informal actors; and lastly, civil society organisations need to promote sustainable handling of e-waste across the informal economy. By means of collaboration, they can find suitable mechanisms for bridging the formal-informal price gap and divert larger quantities of WEEE towards authorised recyclers. It should be noted, however, that it is crucial for both private and public representatives to engage with the informal actors so as to understand their needs and expectations towards a continued process of formalisation.

While interactions in multi-stakeholder settings are often viewed as tedious and resource-intensive, there is much to win for all parties involved. Through proactive involvement, producers can position themselves as market leaders and exploit new economic opportunities from circular business practices, e.g. by tapping into previously underutilised value streams from recycled materials. Indian policy makers can gain international recognition by presenting India as the first among developing countries which actively utilises informal workers as a vehicle for large scale collection of e-waste. For civil society and informal workers, the benefits arise from lower environmental pollution, higher physical well-being and steady incomes to support their livelihoods. In making joint efforts to increase formalisation, these above mentioned actors can create sustainable prosperity on a pan-Indian scale.

In order to make progress towards a sustainable e-waste management in India, multi-stakeholder discussions need to be held at the national, city and industry level. Focal points should revolve around the specific underlying mechanisms of formal-informal partnerships and how these could assist the implementation of the current E-waste Management Rules and the fulfilment of producers' EPR plans. This process is urgently needed and remains yet to be shaped.

Discussing the way forward. © GIZ develoPPP / Vostry.

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Annex I. Interview Guide

TOPIC AREA 1: BRIEF DESCRIPTION
» When was the initiative established?
» How long have the partnerships between actors existed, are they still in place?
» Where does it operate geographically?
» How does the initiative work?
» Why does the initiative exist?
» How was it established?
» In which regulatory framework does it operate?

TOPIC AREA 2: KEY INCENTIVES
» **Core question:** Who are the key stakeholders involved in this initiative (both formal and informal) and what are their motives for partnering with you?
» What incentives do you give to the partnering actors?
» Why do your partners trust you? Why do you trust them?
» Do you offer any securities to your partners? If so, can you specify what type of securities?

TOPIC AREA 3: AGREEMENTS
» **Core question:** What are the specific agreements between you and your partners?
» What do these agreements entail specifically?
» How much time/resources have been necessary to make the partnership work?
» What are the most important agreements which make the initiative work?
» Which financial or other support mechanisms to e.g. collectors have been agreed?
» How are responsibilities distributed? Who is responsible for what?
» How tight or loose are actors coupled to one another?
» How do you communicate with your partners and how do they communicate with each other?
» What is necessary to ensure agreements persist in the long-term?

TOPIC AREA 4: CHALLENGES
» **Core question:** What are to the main barriers to the success of your initiative?
» More specifically, what are the main barriers to
  - linking the formal and informal sector?
  - effective coordination among key stakeholders?
  - efficient communication between all parties involved?
  - making contractual agreements (if applicable)?
» How does the current legal context affect your initiative?
» What are the external drivers that support/hinder the mechanism? How significant is their contribution towards the success or failure of the initiative?
» Were there any challenges in terms of making payments to actors from the (in)formal sector? If yes, could you specify?

TOPIC AREA 5: SOLUTIONS
» **Core question:** What solutions did you apply to overcome the challenges mentioned before?
» Did you establish any binding agreements?
» How did you build trust among all parties involved and how did it help to overcome the challenges?
» How were payment mechanisms designed (if applicable)? How was this tailor-made to the needs of the informal sector?
» What are the barriers that can be overcome by involving additional stakeholders from government, private sector and/or civil society?

TOPIC AREA 6: IMPACTS

» **Core question:** What are the impacts of the initiative?

» How much e-waste do/did you collect annually/monthly/daily (both in terms of absolute number and per capita)?

» How did collection rates change after implementing the solutions outlined before?

» How did the solutions impact the initiative's financial situation? How did this affect the initiative?

» Which elements of the regulatory framework or which other conditions need to change in order to create impact on a larger scale?

» How does the initiative affect the supply chain?

» How does the initiative benefit the environment?

» How does the partnership affect the livelihood of the community?

» How does your initiative affect the employment in the informal sector?

» How do you verify and quantify your impact?

» What resources are needed in order to increase the initiative's impact (e.g. finance, knowledge, people etc.)? In case of finance, can you quantify the needed amount and specify its purpose?

» To what extent can this model be scaled up to the pan-Indian context? What would be necessary for this?

» What are the key aspects which could be replicated in other contexts and implemented on a larger scale?

TOPIC AREA 7: LESSONS LEARNT

» **Core question:** What are your key lessons learnt from working in this initiative when thinking about engaging the informal sector?

Annex II. Interview Participants

NAME OF PARTICIPANT	INSTITUTION
Mohammad Sabir	4R; Green E-Waste Recyclers
Malati Gadgil	SWaCH
Maitreyi Shankar	SWaCH
Wilma Rodrigues	Saahas Zero Waste
Pranshu Singhal	Microsoft
Bharati Chaturvedi	Chintan
Asif Pasha	E-WaRDD

Table 5: Interview Participants

On behalf of

Federal Ministry
for Economic Cooperation
and Development