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Article

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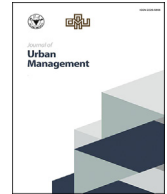
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Extended Producer Responsibility in India: Evidence from Recykal, Hyderabad

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ABSTRACT

In the past few decades in the developed world and more recently in India, Extended Producer Responsibility (EPR) has been viewed as a promising alternative to traditional waste management policy. In most cases it is impractical and infeasible for firms to manage their own EPR operations due to which they outsource it to third parties known as Producer Responsibility Organization (PRO). The article undertakes a case study of a technology driven cloud based waste management company (Recykal) operating in Hyderabad, India in order to study the operation of a PRO and its contribution to EPR in the Indian context. The study of the products and operations of Recykal reveals that its success in EPR can be attributed to 3 factors namely, market expansion, economies of scale and reduction in uncertainty. Furthermore, the study also concludes that operations of PROs like Recykal help to bring the much-needed clarity, monitoring, efficiency, formalization, coordination, choice and accountability in the waste management sector without hindering employment.

1. Introduction

Waste is a by-product of almost every economic activity. The recognition that waste needs to be dealt with in a way that it does not harm the health of humans and the environment has led to the development of the concept of waste management. From the disposal of waste away from the places inhabited to the adoption of the motto of reduce, reuse and recycle, waste management has come a long way. Across the globe a multiplicity of policies have been adopted to deal with the problem of waste management. Of these, market-based instruments like the pollution tax first proposed by economist A.C. Pigou are of prime importance particularly for their dynamic and static efficiency (Pigou, 1924). The guiding principle behind most of these policies has been the 'Polluter Pays Principle' (PPP). This states that the entity generating pollution must be liable to compensate others for the harm caused by the pollution.

In recent decades in the European Union (EU) and more recently in India, an alternative to the PPP named Extended Producer Responsibility (EPR) has been introduced in environmental legislation. EPR is defined as 'a policy principle in which the upstream actors must be made responsible for the waste generated even in the downstream activities with a focus on the take back, recycle and disposal of the product' (Lindhqvist, 2000). Compared to the PPP where the producers were only responsible for the waste generated in the production process, under the EPR, producers are responsible for waste generated by a product throughout its lifecycle.

Lindhqvist's model identifies multiple ways of interpreting EPR (Fig. 1). First, 'ownership' where the manufacturer retains the

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ownership of the product throughout its entire life cycle. Second, ‘liability’, where the manufacturer is responsible only for proven environmental damages (as defined by the legislation) that are generated by the product. Third, ‘physical responsibility’ where the manufacturer is involved in the physical management of the wastes and ensuring that they are recycled and disposed in a sustainable manner. Fourth, ‘economic responsibility’ where producer need not physically manage the waste but needs to pay for the expenses involved in the take back, recycling and disposal of the waste. Lastly, there exists ‘informative responsibility’ that requires the producers to provide information to the consumers about the environmental properties of the products. In some cases, the legislation may require the producer to mention the EPR costs as a specific visible fee so as to generate awareness among the consumers about the costs associated with disposal. This while ensuring transparency is said to provide an incentive for environmentally conscious consumers to consume products with lower environmental costs.

Depending on the way the legislation defines EPR, the activities to be undertaken by the producer will vary. In the most common case, it will include reverse logistics, take back, recycling, recovery, reuse, resale and disposal. There are various ways in which firms might organize their EPR operations. First, producers might choose to undertake all the EPR operations by themselves. They have departments and employees within the firm specifically dedicated to collection, recycling and disposal. Second, producers might contract out specific responsibilities to independent firms. For example, while they may contract out the collection to a logistics company and the recycling to a recycler, the management still lies with the producer. In both these cases the producer firm needs to have a set of employees dedicated specifically towards meeting EPR objectives. In many cases, this might not be economically feasible or practical for various firms. In such situations, producers and manufacturers can entirely outsource their EPR responsibilities to a third party known as a Producer Responsibility Organization (PRO).

At the core of the concept of EPR lies the PRO. While the exact duties of a PRO may vary, they are often responsible for organizing pick up either from the user or from registered collection points, undertake the necessary recycling or disposal and report the results to the producer and the relevant government authority. The PRO's thereby play an important role in connecting multiple stakeholders that include the waste generators (consumers), producers/manufacturers, recyclers and municipal authorities.

A large number of products have been included as part of EPR programs in a number of countries. One of the first products to be included is packaging material that was introduced in Germany in the 1990s and is now followed in a number of countries like the UK, Japan and Slovakia. Waste Electrical and Electronic Equipment (WEEE) is now a part of the EPR policy in a number of countries like The Netherlands, Japan, Switzerland, South Korea, USA, Taiwan, Colombia, China, Thailand, India and Argentina. The scope for WEEE varies across countries with some including only cell phones and small equipment while others include large equipment like air conditioners and refrigerators as well. A few other products which are included are ULAB (Used Lead Acid Batteries), PET (Polyethylene terephthalate) bottles, metal cans, used oil, oil containers, oil filters, ELV (End of Life Vehicles), End of life tyres and Glass (bottles).

Multiple factors have contributed to the success of EPR in various countries across the globe. In the case of used tyres in the Netherlands, Belgium and Italy clarity in policy in terms of definition of “waste” and clear targets have resulted in higher take back and recycling rates (Winternitz et al., 2019). In Washington state, USA existence of multiple PRO's have helped to prevent PRO's from reaping monopoly profits and have thereby kept EPR costs low (Gui et al., 2013). In the EU, EPR in the form of explicit bans have helped abolish the use of hazardous materials in electronics. On the other hand, a cost based approach (an upfront fee) has helped reduce the domestic waste generation in South Korea from 1.3 to 1.04 kg/cap/day (Hong, 1999). Similar cost based approaches like a deposit refund system have also reduced free riding by firms (regarding their EPR obligations) in the EU (Filho et al., 2019). Lastly, the usage of differential fees for collecting waste in rural and urban areas in the case of Washington state, USA has helped ensure greater regional balance in adoption of EPR (Gui et al., 2013).

EPR in India is limited to plastic waste and electronic waste (E-Waste). The guidelines for implementation of EPR in India have been encoded in the Plastic Waste Management Rules and the E-Waste Management Rules. EPR in India is defined as ‘responsibility of the producer for the environmentally sound management of the product until the end of its life’ (Ministry of Environment, Forest and Climate Change, 2020). In addition, the rules list some of the roles and duties that need to be performed by the various stakeholders. This includes the responsibility of the local government to provide necessary infrastructure support for the segregation, collection, storage, transportation, processing and disposal of plastic waste either on its own or using the producers. The waste generator must be responsible for reducing litter of plastic waste and must also segregate the waste. All the producers of plastic must register with the state

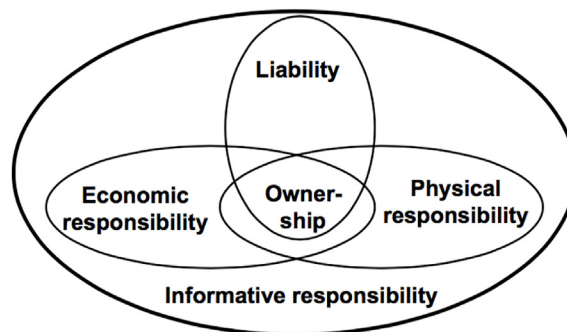


Fig. 1. Models of Extended Producer Responsibility.

Description: This diagram presents the relationship among the different ways of interpreting EPR. Source: Lindhqvist (2000).

pollution control boards that must provide a result regarding the same within ninety days. Moreover, user charges need to be explicitly levied on carry bags and the revenue collected must be used by the authority for waste management only.

In June 2020, the Ministry of Environment, Forest and Climate Change introduced a new set of EPR guidelines (Ministry of Environment, Forest and Climate Change, 2020). The draft does make improvements in terms of increasing the responsibility of the producer beyond collection and take back towards a role throughout the entire waste management value chain. Multiple forms of adopting EPR have been suggested given the vast diversity across the country which include fee based models as well as PRO models (individual targets as well as plastic credits). Central to these recommendations is the establishment of a web portal for the registration and monitoring of the various stakeholders. Such a mechanism is also likely to aid stakeholders make informed decisions. The present study is an example of a cloud-based software that provides the means to undertake such EPR.

EPR has both upstream as well as downstream improvements. The present study is aimed at understanding the downstream improvements caused by EPR. A quantitative analysis of EPR downstream improvements requires information regarding the amount of product produced and sold, waste generated and recycled, disaggregated at the firm level. Such data is not collected and published by the Government of India despite the calls for inventorization nor has the government made it compulsory for private firms to publish the said information to the general public. While some firms do not maintain constant accounts, for others such data is confidential and hence elusive for researchers.

In such a situation, most studies for EPR adopt the case study approach. While there are some works on EPR in India from the point of view of the manufacturer and the waste generator (Borthakur & Govind, 2017) there have not been any studies undertaken to study EPR in India from the point of view of a PRO. To bridge this gap, the main objective of this work is to study the implementation of EPR in India, taking Recykal, a PRO operating in Hyderabad as a case study.

This article is divided into 3 sections. Section 1 provides a brief explanation of EPR, its origin and rationale, types and implementation with a special focus on the role played by a PRO. It also provides a very brief description of the aspects of EPR policy in India and gives reasons behind the choice of a case study approach for this study. It provides a concise description of Recykal, the rationale behind choosing it as the subject of the present case study and a brief description of the methodology adopted. It gives a detailed description of the various products and services provided by Recykal. It puts forth Recykal's contributions to the waste management sector particularly in terms of market expansion, economies of scale and reduction in uncertainty along with a description of the steps adopted by Recykal to increase its client base. Section 2 gives an understanding of Recykal's role in EPR and how its overall business structure helps it to contribute towards this objective. This section also includes an exposition of the steps involved in logistics, the benefits generated from formalization as well as an analysis of the results of the case study in terms of some of the factors contributing to the success of EPR that were identified from multiple previous studies across the world. This is followed by a brief conclusion in section 3.

1.1. Rationale for choice of "Recykal"

While there are quite a few firms and technology start-ups that have been established in the last few years participating in the waste management business not many of them are PRO's that undertake EPR. Many of them are only involved in connecting waste generators to waste aggregators. The choice of Recykal is guided by the fact that it is one of the very few PRO's operating in India. It is important to note that in addition to EPR, Recykal also participates in a number of other activities in the waste management sector.

Recykal has received multiple awards for its performance that include the FICCI (Federation of Indian Chamber of Commerce and Industry) Indian Circular Economy Award, ASSOCHAM (Associated Chambers of Commerce and Industry of India) Best Digital Technology Solution for Waste Management and NASSCOM (National Association of Software and Service Companies) Emerge 50 award 2019. The receipt of multiple awards gives the indication that Recykal is one of the best in the business and the operations of Recykal would provide a useful guide regarding the operations of PRO's in India.

Launched in 2017 in Hyderabad, India, Recykal is a digital technology company that is aimed at providing cloud-based solutions and services for the waste management and recycling industry. Its services help to create a cross value chain alliance and connect multiple stakeholders that include waste generators (business and household consumers), waste aggregators and recyclers thereby ensuring transactions among the above take place with greater transparency and traceability. It now has operations also in Pune, Delhi, Chennai and Bangalore and has worked with more than 500 businesses across India. Since its launch, Recykal has grown considerably. The amount of waste collected per day has increased from 20 to 30 kg in its initial months to about 10,000 to 15,000 kg per day at present. The growth has been higher in the past 8–10 months. At present it has workforce of about 140–150 employees.

Recykal states that it aims at helping FMCG (Fast Moving Consumer Goods) as well as electronics brands in achieving their consumer awareness, take back programs as well as EPR in accordance with the rules put forth by the Government of India. It believes that innovative, reliable and scalable technologies can help convert the informal, offline, disconnected waste management sector into one where there is increased information, communication, increased recycling and lesser waste reaching landfills. It believes by doing so it will be able to bridge the digital divide and thereby ensure a movement towards achieving a circular economy.

Recykal is owned by the parent company Rapidue Technologies that has its office located in Gachibowli, Hyderabad. The office of Recykal is also present at the same location. The case study was undertaken using the interview method. These interviews were of semi-structured nature. Some of them were conducted at the Gachibowli office of Recykal while a few others were conducted over the telephone. While a basic set of questions was decided before undertaking the interview, there was sufficient flexibility to omit, add and modify questions as per the responses throughout the interview.

The interviews were conducted with the employees, management and the clients of Recykal to get an overview of the entire value chain of operations. An initial set of interviews was conducted in February 2020 followed by further interactions in May 2020. In the

meantime, correspondence was undertaken using email. The questions were designed in a manner to get information both about the present operations specifically relating to EPR as well as information regarding the future operations. The respondents of the interview include the business head of operations, the project coordinator for training, the general manager of new initiatives at Recykal as well as a member of the management team for Brandstores that undertakes the logistics operations for Recykal.

At this point, a brief description of the origins of Recykal might be useful. Having learnt about the large quantities of waste that lie in people's homes from personal experience, the founders of "Recykal" decided to develop a mobile application named "Uzed" that would enable people to buy and sell used items. The success of Uzed helped the founders to recognize the massive quantities of waste that was being generated across the country.

Realizing that reuse was not the only way in which used products or waste could be utilized, they shifted their focus to recycling. In addition to reducing the burden on landfills, this would reduce the need for extracting virgin material thereby generating economic, environmental and social benefits. It was recognized that in addition to the households, large quantities of waste are also generated in corporate offices. Recykal was developed to address this sector and much more. Recykal connects all the stakeholders of the waste management sector through its digital platform. The exact way in which Recykal does that is explained below through its various products.

1.2. Products of Recykal

The cross value chain alliance that Recykal aims to create in the waste management sector through its technological solutions is made possible using a number of specific products.

- **Uzed App:** This is a mobile application that has also been developed by Rapidue Technologies and operates along the same lines as Recykal. While Recykal focuses on waste management for industry and government clients, Uzed operates for individual household consumers. Uzed allows consumers the means to properly dispose their recyclable waste through home pickup of waste scheduled as well as on demand. Though mainly aimed at households, Uzed also operates take back from institutions like schools and colleges. In addition to ensuring the waste is recycled rather than disposed in a landfill, the Uzed app also provides financial incentives on the basis of the amount of waste that has been recycled. This involves receiving points based on the amount of waste that has been recycled through the application that can be redeemed to purchase various goods through the application.

In addition to general recycling, the Uzed app also organizes special take back programs of brands. Often, if one participates in these specific take back programs the users receive additional incentives. The Uzed app also helps to materialize the benefits in terms of customers' contribution to the environment by calculating the contribution of waste recycled by a user in terms of energy, water and trees that have been saved.

- **Recykal DRS solution:** A DRS (Deposit Refund Scheme/Deposit Return Scheme) is a scheme adopted by brands to ensure necessary participation of the waste generator in the management of waste. It requires the consumer to pay a deposit amount once they purchase the good (either as a visible fee or included in the price of the product itself) that is returned to the consumer once the required waste (after use of the product) is disposed at the authorized collection point. In case consumers do not return the product, the deposit will not be returned. This is essentially the penalty the user faces for not undertaking recycling.

Recykal in the process of helping firms undertake their EPR objectives help firms to organize their DRS. They provide a mobile app based collection system that helps to connect firms and their consumers. The application provides information to the consumers about what they must do, (information for example regarding what part of the waste must be returned) information about the nearest collection centre based on the location of the consumer as well as enables the use of online payment methods such as Unified Payment Interface (UPI) to ensure quick and safe financial transactions. Adopting a cloud based computing software also allows the firms to collect and manage data regarding the operation of their DRS.

- **Recykal Smart Centre Solution:** This is an online tool provided by Recykal specifically aimed at the waste aggregator and the Material Recovery Facilities (MRF). The waste aggregator collects the waste from the waste generator, segregates it (if not done earlier), grades it according to quality and then sells the various wastes to the recyclers. This online tool provided by Recykal helps the waste aggregator to manage their operations in a way that results in optimization.

It helps in inventory management to keep a track of the amount of waste that is coming in and out and ensure that while they are not operating below capacity that they are not overburdened as well. It manages the scheduling of logistics both organized by the waste aggregator itself as well as third party relating to collection of waste from the generator as well as drop off of waste to the recycler.

The tool registers the various clients on both sides and also manages the orders, which includes the documentation regarding sale and purchase. Information provided regarding the market trends such as the demand and supply of waste also helps the firms to set prices on both sides of its operations. Lastly by making the entire process online it avoids paperwork and cash transactions while maintaining all records online for it as well as regulatory authorities.

- **Recykal Marketplace:** This is an online marketplace set up by Recykal for waste including but not limited to plastics, paper, and electronics. It provides an online platform for connecting bulk waste generators, waste aggregators and recyclers.

Recyclers can put forth their demand onto the system regarding the amount of waste, the type of waste as well as the location where they want to receive the waste. The intelligent search engine of Recykal helps to connect that recycler to a waste generator or aggregator that best meets these requirements. With thousands of waste aggregators and bulk generators in its network, the marketplace helps recyclers to expand their market since they are no longer forced to purchase the waste from the few waste aggregators in their network. Access to information about demand and supply of waste of various types also helps recyclers to time their purchases in a way that ensures increased profitability.

Similar benefits accrue to the waste aggregators and bulk generators as well. They get better prices by being connected to many more recyclers and are able to receive on demand pickup in case they do not have their own logistics services. Lastly, an online mechanism helps to ensure transactions and documentation do not require paperwork that ensures greater speed as well as compliance.

- **Recykal EPR Platform:** Recykal provides an online platform for firms to manage their EPR operations. As understood from the previous discussion, EPR can be understood in various ways. Taking into account only the methods that involve managing the waste physically, Recykal helps firms meet their EPR through two ways.

One involves Recykal helping firms to carry out their existing EPR programs by aiding them in the take back program or helping them in managing their DRS. In this case, firms already have their EPR programs in place and Recykal improves the management of these operations through their online system of connecting firms with customers, waste aggregators and recyclers. The second method that is more relevant to the study at hand is when firms make use of Recykal to set up their EPR program. Firms can use the EPR platform to set their targets regarding the amount of waste they want to recycle. This amount can be subdivided into various categories based on type of waste.

Recykal through its waste collection efforts from households as well as bulk generators have a significant amount of waste available with them in the MRF. Once a demand from a firm arises to recycle a particular amount of waste, Recykal recycles accordingly from the waste that has been collected, in the name of the firm (client). In this way, the firm is able to outsource its EPR obligations to Recykal. Recykal performing EPR for a number of firms is able to make use of its internal economies of scale. This is much cheaper as compared to each firm having to individually collect a particular amount of waste material on their own. In the process, Recykal also takes care of all the documentation to be provided by the firm to the Central Pollution Control Board (CPCB) regarding fulfillment of EPR that includes EPR reports as well as destruction and disposal certificates.

Furthermore, Recykal also provides real time tracking of the waste to ensure greater transparency. This helps firms get real time data regarding what portion of their EPR targets have already been met, the amount that is left and also information regarding the geographic location of waste management.

- **Recykal Informal Sector App:** Recykal not only conducts its own collection and waste aggregation efforts but also helps to bring the benefits of formalization to the informal sector through this application. Waste pickers, *kabadiwallas* and other informal waste aggregators can make use of this mobile application to get information regarding buyers to ensure better prices. It also helps in optimizing their operations by providing information about nearby waste generators from whom they can collect and also waste aggregators and recyclers that are willing to purchase the waste. All payments are done online and Recykal also helps these individuals get access to banking, insurance and health care schemes to safeguard the life and livelihood of the informal sector workers.
- **Sustainability Consulting:** Recykal also provides consulting regarding waste management and sustainable operations for corporates that help reduce their environmental impact, increase efficiency and ensure compliance with governmental regulations. Recykal also provides consulting services to governments that are aiming to bring a change in their waste management operations.

1.3. What does Recykal add to the waste management sector?

The waste management sector has existed in India prior to Recykal and continues to exist now as well. This begs the question as to what is Recykal's contribution or impact on the waste management sector? It is important to realize that Recykal does not aim to displace or replace the existing actors in the waste management sector but it instead aims at optimizing their performance. Recykal does this by the following means:

- **Expansion of Market:** Recykal is able to harness its online digital platform to connect a large number of waste generators, aggregators and recyclers. In the absence of Recykal, most entities had to transact with only entities that were known to them. This in most cases resulted in transacting with only those entities that existed in proximity. This created a form of geographical monopoly that resulted in incorrect pricing and inefficiency.

Recykal allows waste generators, aggregators and recyclers to connect with thousands of entities through its online marketplace. This ensures that they are no longer bound to transact with the few actors that exist in their proximity. With a large number of buyers and sellers the market becomes more competitive and transparent and hence is likely to generate more efficient prices. The prices are fixed at a point of time and so does not vary based on the identity of the buyer or seller. However, it is dynamic and changes as per changes in overall demand and supply.

In addition, access to information regarding market trends also helps one make decisions regarding the type of waste that a particular entity must participate and deal in as well as what particular time period would give the best possible return.

- **Economies of Scale:** Increasing the competitiveness and transparency is one way in which Recykal improves pricing in the waste management sector. Another way is through its effects on the economies of scale. About 75 % of the cost of recycling is related to logistics (Banerjee et al., 2014) which includes collection and transportation of the waste from the generator to the aggregator and finally to the recycler.

Recykal with the help of Brandstores undertakes the collection, segregation and storage of waste. Collecting and transporting such large quantities of waste results in reducing the cost of handling waste per unit and thereby results in reducing the cost of recycling. The benefits of this reduction in cost are realized throughout the value chain of waste management. It allows Recykal to pay higher prices to the waste generators while also selling higher quality waste at lower prices to the recyclers.

- **Uncertainty:** The third factor that affects pricing and efficiency negatively in the waste management sector is the high levels of uncertainty faced by the recycler (Borthakur & Govind, 2017; Filho et al., 2019; Gupta & Sahay, 2015). It is of two types.

First, uncertainty regarding the quality of waste. This brings one to the common problem of the 'market for lemons' where there exists information asymmetry regarding product quality in a market for used products that are not backed by warranties and guarantees. The seller of the waste usually has much greater information regarding the waste as compared to the buyer (recycler) at least at the time of purchasing. At the same time, essential to recycling, especially of plastic is segregation. Mixing of plastic waste of multiple varieties often makes the entire set unfit for recycling. Hence, information regarding the type of waste is of utmost importance for the recycler. In the absence of such information, the market is likely to be thin and efficiency is unlikely to arise. Recykal undertakes the segregation of waste and provides complete, accurate information regarding the nature of waste to the recycler. This reduces uncertainty and ensures greater efficiency.

Second, uncertainty regarding the continuous supply of waste to the recycler. The large presence and high accessibility of the informal waste management sector results in it absorbing majority of the waste. This results in formal Authorized Treatment Facilities (ATF) to operate below full capacity that increases their operating costs. The uncertainty of supply of waste acts as a disincentive to invest in increasing capacity and improving technology. Recykal engages only with formal recyclers. Since Recykal is able to collect large amounts of waste they are able to provide continuous supply of waste to the ATF to operate at full capacity.

- **Steps Undertaken by Recykal to Expand Market and Increase Participation:** One of Recykal's major strengths is its large network of waste generators, aggregators and recyclers. Recykal's connection with various entities runs both ways. On the one hand, a large number of clients reach out to Recykal. This is a result of the news spread about Recykal through the media for winning multiple awards as well as the novelty of the concept of a cloud based waste management company. On the other hand, Recykal has its own customer outreach programs.

Crucial to the success of a waste management system is consumer participation and awareness. In accordance with this, Recykal has its consumer awareness and training programs. There are two types of training programs. The first is the programs and workshops that are organized at the corporations and large firms. These generate significant quantities of waste and ensuring their participation is crucial to maintain a successful waste management program. The training comprises of two aspects. The first aspect includes creating consumer willingness and motivation. This involves explaining to the management and the employees of the corporates about the need for waste management. It involves explaining the benefits of adopting sustainable waste management and the meaning as well as gains from a circular business model. The second aspect of the training involves teaching the employees about how they may contribute to the same. It involves explaining the various steps that employees may take such as explaining the segregation of waste to avoid contamination and mix of material.

The second form of consumer awareness programs take place at educational institutes and schools. While in the former case, Recykal aims at forming long-term contracts and relationships with the corporates, in this case the focus is not necessarily on establishing a waste management contract with the education institutes. Instead the focus is more on inculcating a habit of waste segregation and recycling among the members of the institute (student, faculty) so as to reach out to their larger families. While these programs do involve collection of waste from the school, the focus is on ensuring that more people can start recycling at their home through the Uzed mobile application.

There is a significant share of the population that feel very strongly about the environment and Recykal provides them a mechanism to contribute towards it. However, in many cases having alternative financial incentives over and above the social and environmental gains help to attract and motivate more people to join such initiatives. As a result, there are financial incentives that are provided by Recykal. As mentioned previously, there are points one can earn on the Uzed application that can be used to purchase goods on the same application. In the school programs, children are often given goodies as means of appreciation. At present, there are no direct cash incentives provided to the waste generating households.

2. EPR and Recykal

Recykal helps firms undertake their EPR objectives. Under EPR, firms aim to recycle and sustainably dispose a particular amount of waste relating to the product that they have produced and sold. While the segregation is not firm specific, it is type specific. For example, if there is a firm A that produces biscuits that uses plastics as packaging material. To fulfill its EPR objectives, it will have to recycle a particular quantity of plastic depending on the amount of plastic it has produced and used in its products. While it has to recycle plastic

(as opposed to other material like paper, cloth etc.) it is not necessary for the firm to only recycle plastic that it has produced. It can recycle any plastic of the required quantity. This is where Recykal steps in.

Firms have contracts usually lasting up to a year where they pay Recykal for undertaking the collection, segregation and recycling of waste. Recykal uses its access to a large number of waste generators, aggregators and recyclers to get the required amount of waste recycled as per the requirements of the producing firm. Recykal collects the waste either through its own operations such as the Uzed application or source the waste material with the help of waste aggregators in their network and the Urban Local Bodies (ULB). Once it gets the waste recycled from an ATF it gets a certification that is provided to the firm.

While EPR is required for every firm producing plastic or electronics, as of now, it is mostly the top brands in the respective sectors that have started adopting it with some being more proactive. While there are targets set for electronic waste, that is not the case for plastics. The Smart centre solution explained previously also helps firms get information regarding what aspect of their EPR objectives have already been met and what is left. The platform explains the amount and the quantity of waste that has been collected and how it is exactly being recycled.

- **Waste management Logistics:** Brandstores is a firm that has tied up with Recykal to undertake collection, segregation and storage of waste. Brandstores mostly collects the waste from the corporates. At present, they receive about 15–20 pick up orders each day. The total amount of waste that is collected by Brandstores is about 3 tonnes per day. While in the past there were multiple small storage facilities at Moosapet and Hyath Nagar, they were given up and presently Brandstores operates at one large MRF located at Kompally, Hyderabad that has a capacity of 8200 tonnes. While Recykal deals with a large variety of waste, Brandstores' facility deals with mostly plastic and electronic waste.

Earlier, Brandstores used to work with a number of clients. However, in recent times the amount of waste that they receive solely from Recykal's clients is so high that now they collect waste only for Recykal. Moreover, the waste received from the clients of the Recykal has been of high quality. This notion is also supported by the fact that Brandstores has worked up a plan to expand its MRF to 6 facilities based on dividing Hyderabad into 6 zones. Brandstores has about 40 employees on its payroll with a possibility for expansion in the near future.

- **Steps involved in the logistics process:** Recykal has created a portal that Brandstores has to log into. This portal provides information to Brandstores about the demands for pickups that Recykal has received. Once this information is received, the management of Brandstores decides about the schedule of pickups. For this, multiple factors are taken into account. These include the location of the pickups (are these scattered or close), the amount of waste (which determines the number of pick up executives and size of vehicles that need to be sent for the pick up). Once a plan is made regarding the pickups, the information is sent to the pick up executives through a separate mobile application.

The morning of the pick up, the pick up executives arrive at the warehouse. The timings as well as the empty weight are noted down. They are also provided the weighing scale and the personal protective equipment (PPE). This ensures that once the waste is brought back one can accurately measure its weight. The final decision is taken regarding the schedule of pickups and the pick up executives leave for collection.

Once the pick up executives leave the MRF, the customer (waste generator) is informed through the mobile application (Recykal app) that the Recykal team has started moving towards their location and a tentative time is provided. At present, real time data regarding the position of the pick up executive is not provided. However, this is in the works and Recykal hopes to provide this service on their

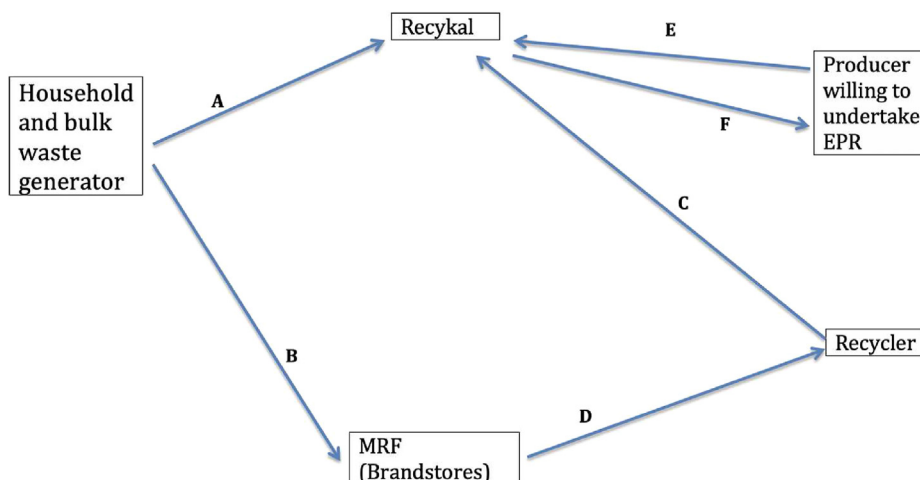


Fig. 2. Overview of Operations of RecykalSource

application soon. Once the pick up executives reach the location and have established contact with the customer that has been confirmed by the customer on the application, the pick up executives coordinate the collection of waste.

The waste is first weighed by the pick up executives and the weight noted down in front of the customer. Once the customer is satisfied, the waste is then stacked and put in the vehicle. If the waste is loose in nature it may need to be stored in bags that are provided by Brandstores. The pick up executives who collect and stack the waste are accompanied by pick up managers who inspect the material at the point of collection.

Once the waste is collected from the various orders for the day, the waste is brought back to the MRF at Kompally. At the MRF, the waste is weighed again to ensure the waste is as per the specifications claimed by the customer. The waste is then manually segregated according to type. The waste is then added to the Recykal stock. Once the waste of the Recykal stock reaches a minimum of 3 tonnes Recykal is informed. Accordingly, Recykal informs its recyclers about the waste and once the recyclers purchase the waste, Recykal collects the waste from the MRF and sends it to the recycler.

The amount of waste collected is quite high due to which this minimum requirement is achieved almost every two days. Furthermore, the demand from the recyclers to Recykal is quite high due to which the time period for the waste to be stored at the MRF is also quite low. A simple diagram indicating the overall structure of the operations is presented below (Fig. 2).

Author's Own (2020). Description: A simple schematic presenting the operations of Recykal Key: A- Pick up waste demand from household through Uzed App and from bulk generators (Firms) through Recykal App and inform Brandstores. B- Waste collected by Brandstores and sent to MRF. C- Recycler puts demand for waste on Recykal marketplace. D- Brandstores delivers waste to Recycler. E- Objectives of EPR to be undertaken sent to Recykal by producers. F- Recykal send documentation to Firm informing EPR objectives have been met after getting disposal certificate from recycler.

- **Benefits of Formalization:** The benefits of formalization of waste management can be noticed from multiple instances in the operations of Recykal and Brandstores.

First, the waste is properly and accurately weighed using official weighing scales. Second, to ensure the safety and health of the pick up executives they are provided with PPE. Third, as employees on the payroll of a company the workers are able to enjoy greater financial security. Fourth, the waste is recycled only by ATF ensuring environmental safety. Fifth, the workers at Brandstores have to undergo a training program that ensures that the job can be done with greater skill and efficiency.

Once an individual shows an interest to join Brandstores, for an entire day they observe the work being done at the MRF. At the end of the day, they are asked questions regarding the process. If they are able to answer satisfactorily, they are allowed to undertake hands on training for a week at the MRF. During this period, they are also given multiple lessons and shown videos regarding the process of identifying and segregating the waste. For those workers who will become pick up executives, they are also given lessons about customer interaction. After this training, the individual becomes a part of the workforce of Brandstores.

2.1. What does Recykal's operations suggest regarding the performance of EPR in India?

Multiple studies of EPR from across the globe have helped to identify a number of factors that contribute to the success of EPR policies. These factors are used as criteria to analyze and assess the operation of EPR in India (Manomaivibool, 2009; Manomaivibool et al., 2007) on the basis of the information gathered from the study of the PRO, Recykal.

- **Clarity and Harmonization of Policy:** The legislation regarding EPR in India does lack clarity in terms of definition of waste, identification of the producer and the nature of recycling or disposal to be undertaken to meet the given responsibility. However, this has not stopped firms from taking up responsibility. Recykal has started undertaking EPR for a number of corporates both with respect to plastics as well as electronic waste. However, the presence of ambiguity in the legislation has resulted in firms having to decide their own limits.

With policy being rather flexible, the problem of harmonization of policy does not arise. Rather than this becoming a problem, one may argue that having fixed limits in a country where such data is difficult to produce and corroborate may turn out to be counter-productive. In such a context, tools like the Smart Centre Solution provided by firms like Recykal that are used to track the EPR progress of firms may turn out to be quite useful. In this regard, Recykal has actually started to team up with ULB to measure the progress of EPR policies of firms. Once measurement and monitoring is done with a satisfactory level of accuracy, fixing targets will be useful towards achieving successful EPR implementation (Winternitz et al., 2019; Mayers, 2007; Filho et al., 2019).

- **Competition, Choice and Coordination:** As per the EPR legislation in India, firms are not bound to register with a PRO. This allows firms the choice to set up their own EPR operations thereby preventing PRO's from earning monopoly profits. An analysis of the impact of competition (as more PRO's enter the EPR market) on the cost of EPR services could not be assessed due to the unavailability of information. Earlier Brandstores, that manages the collection and MRF for Recykal had tied up with multiple companies but now operates only with Recykal due to the quantity and quality of waste that they receive from clients of Recykal. As a result, difficulties arising from the need to coordinate with multiple entities are not likely to be a major problem (Mayers, 2007; Gui et al., 2013).
- **Efficiency and Employment:** Recykal is not introducing a new set of actors into the waste management sector but is rather a facilitator that through its online services is able to optimize the operations of the existing stakeholders. As a result, in the way it is

operating in the present, Recykal is able to bring about greater efficiency without displacing workers and reducing employment. It is important to realize that Recykal mostly acts as a facilitator connecting the multiple stakeholders rather than actually undertaking the recycling of the product. As more firms undertake EPR with greater vigor, the impact that this will have on the employment situation in the recycling industry is difficult to predict at the moment (Gui et al., 2013).

- **Producer Responsibility Individual:** Barring very few cases, for example the ban on single use plastic below 40 µm in weight, the legislation in India has mainly focused on costs rather than standards to implement design for environment. With respect to EPR, as discussed previously, the responsibility is individual rather than collective. The responsibility is based on type of product but not limited to a particular brand. The existing responsibility that firms are undertaking are based only on weight of waste and do not take into account other factors such as toxicity and recyclability.

However, EPR is undertaken only when the disposal certificate is received from the recycler and not once the waste is collected. The recycler always prefers to accept and purchase the waste that is more “recyclable”. Therefore, the more recyclable the waste collected, the faster the firm is able to meet its EPR goals. In this way, while not on the particular firm in hand, in a more collective sense there is an incentive towards the production of goods that generate more recyclable waste.

Moreover, as mentioned previously, since most firms are taking up EPR on their own not necessarily bound by the government; in some way it is a cost that they could always avoid. As a result, cost of undertaking EPR is not likely to be a very strong incentive resulting in design improvements (Dempsey et al., 2010).

- **Circular Business Model:** When firms form contracts with Recykal to meet EPR objectives, Recykal collects and sells a particular quantity of waste to the recycler in the name of the firm. It is not necessary for the firm that is undertaking EPR to actually use the recycled material as input. However, the recycler purchases the waste and gets it recycled only because there is some firm that will purchase the output. As a result, while the circular business model is not being necessarily adopted at the firm level, at a higher level of aggregation there is a move towards circular economy (Filho et al., 2019).

3. Conclusion

While fairly recent in India, EPR has been undertaken for at least a couple of decades in various countries across the world as a means to deal with the massive levels of non biodegradable yet recyclable waste. Multiple studies previously have provided a number of criteria that determine the success of EPR policies in general as well as obstacles and opportunities specific to the case of India. The case study of Recykal in the present article provides an example of the efforts of a firm that has been able to bring about formalization and increased organization in a sector that has hitherto been rather informal and disorganized. Despite the ambiguities in the legislation, it has been able to bring about a sense of structure in the adoption of EPR.

This it has done not by undertaking the entire process of waste management through vertical integration but instead through increasing access to information that has connected the various disconnected stakeholders throughout the entire value chain. Doing so has resulted in reducing the costs of recycling. This combined with increased clarity in legislation and increased monitoring and enforcement with the help of improved technology like the Smart Centre solution will logically provide increased incentive for the adoption of EPR in India. As the adoption of EPR results in the growth in size and profitability of the waste management sector, it is likely to attract greater investment leading to the realization of a circular economy.

Declaration of interest

None.

Declaration of competing interest

We have no conflicts of interest to disclose.

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