Digital Dump, Discarded Childhoods: Estimates, Trends, and the Digital Dump Dilemma

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Abstract: Child Labour and e-waste are two topics of utmost urgent attention and concern individually and together as well clubbed as single domain. This new category of waste is not only on rise because of the increased use of the sources like phones, computers etc., but also has adverse health and environmental effects with unknown final destination and uncertain amount found in the environment. To take the steps on an individual level that can prevent the accumulation and irresponsible disposal of e-waste is the need of hour. The accumulation of e-waste has created "digital dumps" which has created one more hazardous and vicious sector of informal employment for the people, especially young children. Their tiny hands, hearts and minds in search of gold working much more harder and dedicatedly than the grown ups. The paper aims to estimate the number of child labourers in India and understand historical trends which will include in depth study of child labour, their reasons, impacts and historical trends as recorded worldwide and in India; exploring the relation between e-waste and child labour, particularly through the "digital dump" on child labour. Finally, exploring the policy interventions and digital education programs as preventive measures and possible solutions for mitigating child labour has also been discussed. The most practical and possible solution to this major social issue is to educate the people continuously following this trap and those who are employing children. Only creating more awareness and implementing the laws with proper action can reduce the number of children involved in this sector.

Keywords: E-Waste, Digital Dumpsites or Dump, Child Labour, Trend, Policy Intervention.

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I. INTRODUCTION

In this era of quick technological development and digitalization, the rise in waste production is also on its peak. One of the waste that has been grabbing the attention of the people for more than 2 decades now is "e-waste". Also, called as "electronic waste" or "waste electrical and electronic equipment (WEEE)" or "end-of-life products". It can be defined as the electronic and electrical devices or equipment that are no longer in use or discarded ones. Such wastes can be commonly found anywhere including in almost every household and industrial area like computers, television, mobile phones, telephones, headphones, earphones, power adapters, cables, battery, remote etc. This list is ever increasing with the smallest items such as cell phones and equipment like refrigerators and washing machines. Their quantity is also rising with an alarming rate worldwide which is of great concern for every individual and the concerned authorities. This constant increase in e-waste causes serious threats to the environment and human health such as contamination of natural resources and respiratory diseases; posing danger to aquatic lives as well.

Not only has this fueled up environmental and human health but also social issues like child labour. Child labour is defined as any act of extensive labour involving young children which has negative impact on their growth and development, creating obstacle in their path of education, free childhood and physical and psychological growth; further depriving them from their potential and dignity. It leaves the kid with depression, mental and physical health issues. According to UNICEF India (2024), the most recent estimates taken from across the world present that *some 160 million children* were involved in child labour in the starting of 2020 – making about 1 in 10 children across the world. 79 million children which is approximately half of the entire number of children involved in child labour are in 'hazardous work' that directly poses threat to their safety and health [1].

According to the 2011 Census (British Safety Council, 2024), the latest one put through out in India, there are nearly

10.1 million working children from the age of 5 to 14 in the country, employed either as a 'main worker' or a 'marginal worker'. Additionally, the total number of children not in education in India surpasses 42.7 million [2].

One of the most exploiting and hazardous industry for child labour is "digital dumpsite". Digital dumpsites are defined as the places where e-waste is dumped which may be in the form of landfills or just huge piles of them. These have all sorts of electronic wastes without any sort of segregation making the surrounding toxic and harmful. Working in such dumpsites without proper equipment exposes the workers to hazardous radiations, specifically children here. As per the WHO report (2021), around 18 million children, adolescents and 12.9 million women, consisting of an unspecified number of women of childbearing age, may be at risk from negative health consequences linked to e-waste recycling [3]. It was stated in the UN News (2021), "WHO said that an estimated 12.9 million women who work in the informal waste sector are potentially exposing themselves and their unborn children to toxic residue. Additionally, more than 18 million youngsters globally - and some as young as five - are said to be "actively engaged" in the wider industrial sector, of which e-waste processing is a small part" [4].

The reasons for child labour varies from poverty to child trafficking. And, the number just keeps on increasing because of the unawareness and irresponsibility.

➤ How Is Digital Dumping Affecting the Health of Working

The interaction with e-waste directly or indirectly has been proved to affect the human health conditions adversely, even prenatal and exposure, which include:

- Due to exposure to various harmful chemicals it can effect the immune system functioning. This includes increased vulnerability to frequent infections such as hepatitis B, ear infections, and respiratory illnesses, and due to contact with certain organic substances a diminished response to vaccinations as well. Additionally, the risk of allergies and autoimmune conditions can also increase due to the interactions with specific metals. Direct contact with heavy metals like lead and cadmium can lead to suppression of immune responses.
- Also a heightened likelihood of developing long-term chronic diseases—such as cancer and heart disease—due to such exposures. Lead often caused damage to DNA, chromium, cadmium, and nickel, further contributes to health deterioration.
- Exposure to lead and polycyclic aromatic hydrocarbons (PAHs) has been connected with cardiovascular impairments. Furthermore, exposure to organic pollutants such as polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) caused disruptions in thyroid function.
- Also having long time exposure to metals like chromium, manganese, and lead caused many respiratory problems

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such as coughing, wheezing, and asthma. During pregnancy having associated with harmful chemicals can lead to negative birth outcomes, mainly from substances such as PAHs, lead, cadmium, nickel, and chromium.

- Neurological and behavioral impairments in children have also been correlated to exposure to toxic elements like lead, mercury, and certain organic pollutants like PCBs.
- As the aftermath of COVID-19, the immunity of people has already weakened and continuous exposure to the harmful chemicals is escalating the situation even more [3].

➤ Most Common Forms of Child Labour

Agriculture, the sector where most child labour occurs for girls and boys alike. Involvement on farms or in other agronomy activities constitute around 70% of children involved in child labour worldwide; a lot of them being young children.

The total strength of child labour occurring within families is another common trend. Family farms or small family enterprises are the places where nearly 72% of child labour occurs in the family unit. A child's safety, moral or health development is likely to get harmed and frequently hazardous for the children despite the common view of families claiming to offer a safer and better work environment.

➤ Why Does Child Labour Occur?

There can be various reasons driving children into work. Financial challenges or uncertainty in families because of poverty, sudden ailment of a caretaker or job discharge of a main wage earner is the most often cause leading to child labour.

Many of the migrant and refugee children uprooted by poverty, disaster or conflict can be made to work and even traded, especially in case they are alone or with families taking aberrant or remote routes.

SUSTAINABLE DEVELOPMENT GOALS II. (SDGS) AND E-WASTE

Sustainable development goals were adopted to ensure fair development across all the nations providing equal opportunities to everyone. All the SDGs are interconnected, implying the impact of each one on the other one. For e-waste as well, there are lots of interlinked SDGs but we will be discussing SDG 1, SDG 3, SDG 4, SDG 8 and SDG 12 here.

➤ SDG 1 (No Poverty):

This SDG aims to "end poverty in all its forms everywhere" [5]. Poverty doesn't only mean earning low income but also affects public access to healthy food, clean water and other basic human needs. Everything happening around them affects them more adversely. In such a situation, when people work hard on digital dumpsites and don't get

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paid enough, this SDG is being contradicted. Maybe formalizing this stream can help achieve the sustainable goal.

> SDG 3 (Good Health and Well-Being):

SDG 3 targets to "ensure healthy lives and promote well - being for all at all ages" [5]. This is solely possible when the environment around is healthy and humans are not exposed to the harmful environment on purpose. E-waste doesn't only contain a lot of tacky harmful substances but also releases and radiates them after their life ends or when they're dismantled. Workers and children working on such sites are constantly exposed to the harmful radiations of the wastes making them prone to a lot of diseases and illnesses. Even a lot of pregnant and childbearing women work on such sites making them and their children with weak immunity to diseases.

> SDG 4 (Quality Education):

Foremost goal of this SDG is to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [5]. Without quality of education, the real progression of a nation cannot be achieved and even dreamt of. The children working on digital dumpsites are deprived of this fundamental and basic right. How can the sustainability goal be achieved if this is how the children's lives are risked in the toxic environment without any proper monitoring of it?

> SDG 8 (Decent Work and Economic Growth):

This SDG aims to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all" [5]. Providing everyone with a decent work environment and fair pay is what is implied in the SDG. But do the workers operating in the informal sector of e-waste are provided with this basic pay ensuring economic growth? No, the answer is a big no and seeing the dumps and so safety equipment, a not decent at all work is obvious. Even the workers not directly working in this are affected by it as the the materials seep into the ground and a lot of times they are directly released in the water bodies.

> SDG 12 (Responsible Production and Consumption):

The goal of this SDG is to "ensure sustainable production and consumption patterns" [5]. Sustainable production refers to the production of goods and products using sustainable methods and materials to the possible extent and responsible consumption refers to the sustainable and planned consumption where the resources are shared and not just used without thinking about the negative consequences.

The important targets to achieve this goal are - the way in which the hazardous waste and pollutants are discarded. It is equally important to sustain developing nations to move ahead for more sustainable utilization patterns by 2030 and encourage consumers, businesses and industries to reduce and recycle waste [6].

III. OBJECTIVES

The study will proceed in order to achieve the following objectives-

- > To estimate the number of child labourers in India and understand historical trends.
- ➤ To examine the impact of digitalization, particularly through the "digital dump" on child labour.
- ➤ To explore policy interventions and digital education programs as preventive measures and possible solutions for mitigating child labour.

IV. LITERATURE REVIEW

According to the author, the role of India in e-waste handling is completely in contrast with the role of India in e-waste production. The laws are not properly reviewed and the formal infrastructure is not sufficient. Informal sector plays a important role in the collection and dismantling of e-waste. Public - private partnership can streamline the collection mechanism (Deshwal, 2025).

The author emphasizes on the fact that the country lacks proper management of e-waste whereas throwing light on the point that corruption leads to improper installation of e-waste collection mechanism while suggesting a few ways as well to manage the waste like referring to the plans of other countries, etc. (Garg & Adhana, 2020).

The number of children working on e-waste sites is high in India and China which is estimated to rise even more. Working on such sites have adverse effects on the health of people with them having higher chances of respiratory diseases and thyroid. The author has discussed the effects of different chemicals and ways to manage the e-waste (Mondal, 2021).

The author says that e-waste is increasing very fast due to the obsolescence of electronic and electrical equipment. It emphasized on the emergent need of having proper information systems through standardized mechanisms, implementation of rules and knowledge among the people for the proper management of e-waste. (Sharif & Kaushal, 2018).

E-waste in India is increasing by 10% with cities such as Mumbai, Delhi, Bangalore etc. as leading producers of e-waste. Further, most of the e-waste in India is recycled in the unorganized sector. A holistic approach and suitable mechanism is obligatory to overcome the hurdles of e-waste which involves unifying the unorganized and organized sector (Chatteriee, 2011).

V. RESEARCH METHODOLOGY

Research Methodology refers to the method or process that has been followed to carry out the research and our findings. Here, in this paper, the secondary data has been used and their in depth study for carrying out the research and

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reaching to the conclusion of our objectives. This paper is based solely on the detailed study of various existing papers and information related to the topic.

Variety of survey data over the last 2 decades and before that have been studied and interpreted to represent the statistical data for the historical trend worldwide and in India.

Different articles have been examined to study the impact of digital dumps on the life of people directly or

indirectly. With specific attention to the children involved in it

Various websites of government ministries, organizations and research papers have been referred to study the existing formulated government policies to stop this. But the gap between these policies and their implementation is also going to be examined based on the study. Also, how digital literacy can prove to be a useful step towards mitigating child labour.

VI. ANALYSIS OF DATA

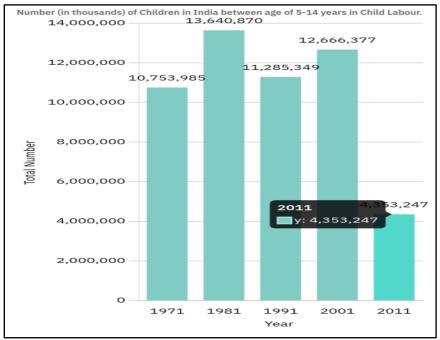


Fig 1 Trend of Child Labour in India from 1971 to 2011 (Data Taken from Ref. [12]).

As stated in the Census conducted by the Ministry of Labour & Employment in the various years, the above shown trend has been observed from 1971 to 2011. The trend is alternating between increase and decrease in number with the

highest recorded in 1981 and lowest in 2011. It saw a huge decrease from 2001 to 2011. Whereas, the increase recorded from 1971 to 1981 was highest among all the recorded census.

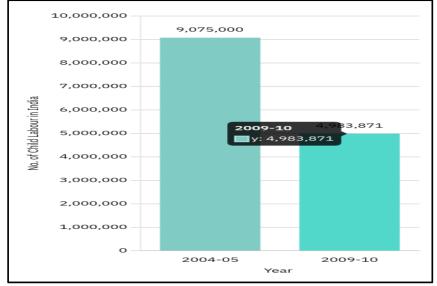


Fig 2 Trend of Child Labour in India in 2004 - 05 to 2009 - 10 (Data Recorded from ref. [13]).

According to the data recorded by NSSO, the number of children working in 2004-05 is 90,75,000 and 2009-10 is 49,83,871 which shows a huge downfall in the total number

from 2004 - 05 to 2009 - 10. This also indicates more awareness among people regarding this social issue. This number further decreased in 2011.

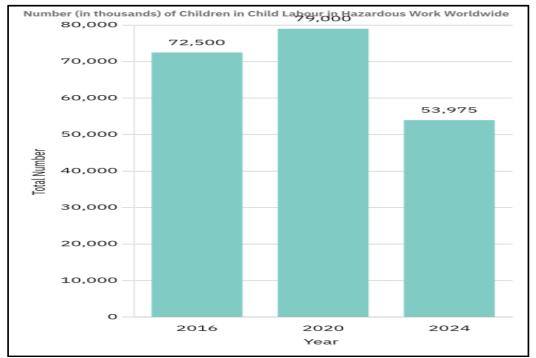


Fig 3 Trend of Child Labour in Hazardous Work Worldwide from 2016 to 2024 ref. [14]).

According to the data recorded by the ILO, 2020 saw the highest number of children involved in hazardous work worldwide. This number increased from what was recorded in 2016 and decreased further in 2024 showing lesser involvement of children in hazardous work.

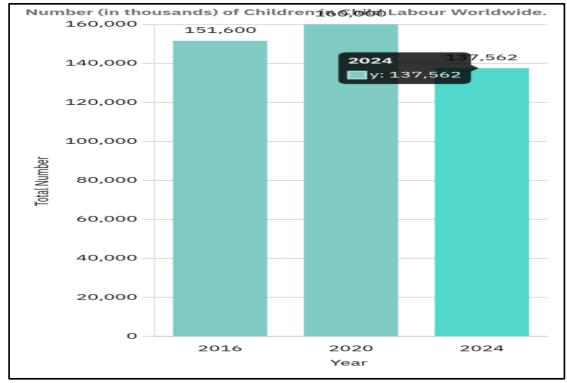


Fig 4 Trend of Child Labour Worldwide from 2016 to 2024 (Date Taken from ref. [14]).

This graph shows the trend of child labour world wide as recorded by the ILO from 2016 to 2024. Highest number

was recorded in 2020 and lowest was in 2024. It shows overall awareness regarding child labour.

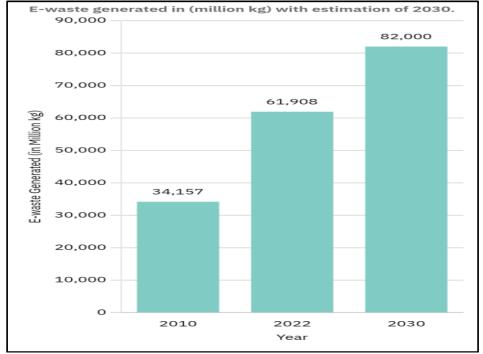


Fig5 Trends of Global E-Waste Production with Estimates up to 2030 (Data Taken from ref. [15]).

This graph shows the total e-waste generation worldwide across the globe as recorded in 2020 and 2022 with an estimate upto 2030. The linear increase can be

observed with this trend continuing till 2030 as per the estimation. About 22.3% waste was formally recycled in the formal sector, according to the UNITAR (2024) [15].

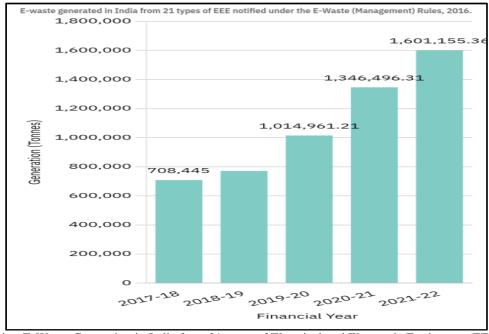


Fig 6 Trend Showing E-Waste Generation in India from 21 types of Electrical and Electronic Equipment (EEE) Notified Under the E-Waste (Management) Rules, 2016 Since Financial Year 2017-18 to Financial Year 2021 - 22 (Data Taken from ref. [16]).

This graph shows the e-waste generated in India from 21 types of EEE notified under the E-Waste (Management) Rules, 2016 as per the data available with the Ministry of Environment, Forest and Climate Change (MoEFCC) and estimated by the Central Pollution Control Board (CPCB).

There has only been increase in the total e-waste generated from 2017 onwards.

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➤ Analysis of Objective 2

The increasing use of digital devices and rising trend of digitalization has led to the creation of "digital dumps". This does not only prove to be not good for the environment in any way but also has impacts on human lives. People working on such sites suffer from various illnesses.

As per the story from factly 2021, "according to the most recent estimates of United Nations University (2021), only 17.4% (9.3 MT) e-waste reached formal recycling facilities or management in 2019 out of the total generated 53.6 MT of e-waste. The rest of 82.6% (44.3 MT) was illegally dumped, overwhelmingly in low- or middle-income countries like areas of Asia, Africa and Latin America" [17]. As majority of the waste is dumped informally, so the irregular sector employs more workers for dismantling, recycling etc. This means more people working without proper safety setup and handling knowledge making them vulnerable to a lot of health problems. As per the review by World Bank (2021), there are about 15 million informal waste workers and an International Labour Organization (ILO, 2021) analysis approximates about 15 - 20 million informal waste workers globally. As for participation of women, was evaluated 23% of informal or non - organized workers in the industrial sector consisting of e-waste. According to WHO (2021), on the basis of involvement of women in the industrial sector, it may be approximated that some 2.9-12.9 million women engage in the informal waste sector for employment. Talking about children, around 152 million children between the age of 5-17 years are involved in child labour, which include more than 18 million children (11.9%) involved in the industrial sector constituting waste handling as a component sector. Around 73 million children across the world are involved in hazardous labour, with still uncertain strength in hazardous roles in the informal or unorganized recycling sector of waste [3]. From the 18 million children unlawfully employed in different types of industry, e-waste and its handling is a quickly expanding branch. Uncertain strength of those children are hence at risk of getting exposed to toxic and harmful e-waste through their involvement in the informal waste sector as per the report by WHO (2021) [3].

In Delhi itself, an approximated 25,000 workers consisting children are engaged in unrefined e-waste deconstructing units, on an annual basis these units deconstruct 10,000–20,000 tons of e-waste with unprotected hands without any safety equipment. It is approximated that across India, 400,000–500,000 child workers from the age of 10 to 15 are engaged in activities of e-waste reprocessing [18].

The irresponsible consumption has not just increased the amount of e-waste but has also put the right to healthy life of the workers at great stake.

➤ Analysis of Objective 3:

In India, the e-waste management is currently governed under E-Waste (Management) Rules, 2022 under the Environment Protection Act, 1986. The overall goal of E-Waste (Management) Rules, 2022 is to take every step needed to make sure that e-waste is handled in a manner

which shall protect environment and health from any negative effects, which may result from such waste [19]. This does not include wastes such as waste batteries, packaging plastics, micro enterprise and radio-active wastes as they're regulated under their own respective laws [19].

This law focuses on the EPR (Extended Producer Responsibility) which can be defined as duty of any producer of electrical or electronic equipment for meeting recycling objectives as specified by the law, only through registered recyclers of electronic waste to make sure environmentally responsible management of e-waste [19].

A lot of amendments have been made modifying the law from the time it first came into effect.

According to the Press Information Bureau (MoEFCC, 2023), "the new rules intend to manage e-waste in an environmentally sound manner and put in place an improved Extended Producer Responsibility (EPR) regime for e-waste recycling where all the manufacturer, producer, refurbisher and recycler are required to register on portal developed by CPCB. The new provisions would facilitate and channelize the informal sector to the formal sector for doing business and ensure recycling of e-waste in an environmentally sound manner. Provisions for environmental compensation and verification & audit have also been introduced. These rules also promote Circular Economy through EPR regime and scientific recycling/disposal of the e-waste" [16].

Only if these laws are enforced with full effectiveness and checked, then only the quantity of recycled e-waste will increase in the formal or organized sector.

Other than this, digital campaigns and awareness programs regarding the laws can make people aware of the harm that they are doing to the environment and themselves through the informal dismantling of e-waste.

VII. SUGGESTIONS

In this paper, an approach was made towards understanding the pattern of e-waste and child labour. Before proceeding with the final conclusion, the paper would try to focus on few easy - to - do but effective suggestions-

• Buying what is Needed:

Instead of instinctive and following the trend purchasing, if everyone follows their duty towards the sustainable earth, the problem would get much more support.

• Taking Care of how and Where the Waste is Being Dumped:

Doing a little research before throwing out anything that is no longer needed can help towards the cause to a great extent. So, at least the waste will go to its right place.

• Encouraging and Awaring Others:

If the 1st step has been taken, then encouraging and awaring others about the same will add an extra effort to it.

• Getting College and School Students Involved:

If the youth is aware and responsible, then half of the problem is solved. College students can be made aware about the proper disposal methods and their types and can be asked to spread awareness about the same by interacting with the slum people as a part of their college programs or NGOs.

• Formalizing Informal Sector:

As the major amount of waste goes to the informal sector, formalizing the work in such a case will benefit the workers and the nation both. Increasing public- private partnership will increase the employment opportunities and incentives for the waste. As e-waste is known to contain more metal than the ores themselves, extracting them using proper techniques will not only reduce health issues but also will contribute to the circular economy.

• Encouraging NGOs or Non - Profit Organization's to Work for the Cause:

Collaborative effort between the government and other organisations can help target a greater number of audiences everywhere of all sorts as such organisations are known for flexible and people & environment friendly style of work.

VIII. CONCLUSION

The soaring demand of electronic devices has not only increased their production but has also given rise to their consumption and the total unused products. But unfortunately where technology is bridging the gap between a lot of things like cities and villages, it is on the other hand increasing the gap between clean environment and good health. India being the 3rd largest generator of e-waste in the world does not even recycle 20% of its waste. Around 95% or more waste is collected and dismantled in the informal sector which pose a threat to the health of people and nature. Even the children who aren't even born yet face danger because of this as a large workforce consists of childbearing and pregnant women. It is such a dilemma for a developing country like India with one of the highest GDPs to not be able to offer a healthy and clean life and environment to its people, especially young children who are supposed to be playing and dreaming. The only way to reduce this is to enforce the plans and policies in a sincere and effective way. Private - public partnership is the best way to convert the unsafe recycling space to the safe one. Digital campaigns, awareness programs, door - to - door awareness campaigns and easy to access collection centers are the most vital part of the next step towards the 100% recycling of the e-waste.

It is unfortunate to see such a powerful nation like India unable to line up with the SDGs and meet the goals by the deadline. Meeting goals would reduce these social and environmental issues to a great extent as all the goals are interconnected. For instance, if the total ratio of e-waste recycling increases in the formal or organised sector, it will automatically decrease the threat to life of flora and fauna below water (SDG 14) and on land (SDG 15). Including good health and well - being of the workers (SDG 3) and providing a chance to education to the child labourers (SDG 4).

Clean and healthy environment is the need of the hour and the negligence towards this is clear from the insufficient data available for the e-waste before 2014 in India and exact workforce involved in this even to the current date. Not only our country, even the data for the world is also not available before the late 2000s. This is the kind of unhealthy consumption that the whole world is following. Only each individual effort can now collectively change the estimated statistics for the later years. EPR should be taken by each of the individuals as the Extended Individual Responsibility (EIR) to not just dispose of the e-waste without proper information and knowledge.

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