

## REUSING AND RECYCLING PRACTICE OF E-WASTE IN SOME MAJOR CITIES OF BANGLADESH

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### ABSTRACT

*Reusing and recycling of electronic hardware can trigger a range of environmental, social and economic benefits. This study helps to scrutiny the existing e-waste management process in selected areas of the Dhaka, Chittagong and Mymensingh City Corporation and Munshigonj district. Outcome of this study shows i) total reusing and recycling process of e-waste's, ii) the price of the secondhand electronic products are 30-50% less than the new ones and identify reused or recycled electronics items, iv) both shopkeepers and customers are mostly unaware of their contribution to environmental benefits through this process, v) approximate yearly collection and selling amount of e-waste in these study areas with selling percentage. In Bangladesh e-waste recycling is mostly dealt by the informal sector with suboptimal procedures resulting in lower recovery rates and dangerous exposure to environment and health risks. In this paper a sustainable recycling model is proposed for recycling and reusing of e-waste.*

**Keywords:** Reuse, Recycle, Sources of e-waste, Yearly collection and selling of e-wastes, Selling rate

### 1. INTRODUCTION

In recent years, Bangladesh indicates a rapid economic growth with emerging market for consumers of electric, electronic gadgets, home appliances. Rapid population growth with rapid discarded product due to the increased access of modern technology with increased purchasing power resulted the generation of electronic waste (E-waste). Electronic waste defined as secondary computers, electronics device, mobile phones, and other entertainment items such as television, refrigerators, whether sold or discarded by their original owners. Bangladesh is a market for electronic goods in having exponential growth due to rising disposable income and increasing demand for the latest electronics products. In this country a large proportion of waste generation comprise E-waste. In general E-waste includes cell phone, television, telephone, washing machine, air conditioners, printer, light, electronic toys, etc. 'E-waste contain (Sinha et al., 2007) different toxic materials which are hazardous, and are consequently a threat to the environment and to the human health'. 'More than 1,000 hazardous and non-hazardous components (Wath et al., 2011) like ferrous material (38%), non-ferrous material (28%), plastic (19%), glass (4%) and others (including wood, rubber, ceramic) (11%) contain in the electric and electronic waste'. 'Some heavy metals like lead, mercury, cadmium, chromium (VI), halogenated constituents (e.g., CFCs), polychlorinated biphenyls, Antimony, brominated flame retardants (BFRs) can also be found as a substance in those compounds. All these may react as catalyst for the formation of dioxins (DEFRA, 2004; Wath et al., 2011) and in turn act as a harmful ingredient for both environment and human health'. Cadmium has toxic effects on the kidney, the skeletal system and the respiratory system. Cobalt has toxic effects on skin and lungs. Copper is very hazardous for eyes, skin, lungs and mucous membranes. 'Bangladesh consumes (Hossain et al., 2010) around 3.2 million tons of electronic products each year'. Of this amount, only 20 to 30 percent each recycled and the rest is released in to landfills, rivers,

ponds, drains, lakes, channels and open spaces which are very hazardous. Improper monitoring system relating to dumping does not raise the human health issue only. This paper aims to focus on the present reusing and recycling condition of e-waste considering four different areas of Bangladesh and arising awareness among the general mass about the environmental significance of it.

## **2. METHODOLOGY**

The present study is consists of selection of the study areas in the Dhaka, Chittagong, Mymensingh City Corporation and Munshigonj district. Preparation of comprehensive questioner form and door to door survey to collect selective data as described in the following sections.

### **2.1 Survey Method and Aelection of Study Areas**

The study was carried out in door to door survey method. The main object of the door to door survey process was to have the significant information of the reusing and recycling scenario of the study areas. Most prominent e-waste reusing and recycling places of four districts were selected as the study area. In total 2572 shops were identified among the four areas in which 1360, 715, 370 and 127 shops were found at Dhaka, Chittagong, Mymensingh and Munshigonj respectively. Among the 2572 shops belonging to these four areas 400 shops were surveyed. The survey was carried out in questioner method. A series of questioners were decorated in such a way which are appropriate for the study reusing and recycling process. Questioner method is the best way to collect the root based Intel's. The survey was carried out in two groups. Shopkeepers and customers were questioned considering them as the two different group. Two distinct sets of questions were prepared for the supposed two groups. The shopkeepers are questioned as they are actually the ones who reuse and recycle the e-waste. And the customers are the complimentary part of this process. Both poses equal significant role in this manner. Based on this method the collected data, discussion and findings are represented in the succeeding section and subsection.

## **3. SURVEY OBSERVATION AND DISCUSSION**

### **3.1 Source of E-Waste**

In the case of Dhaka, Mymensingh and Munshigonj some items of e-wastes are collected either from local customers or some are directly bought from the Chittagong port in a legal way through the tendering process or some are imported from India and China in an illegal way. These imported electronic products are called "reconditioned electronic parts". For having the port in Chittagong; generates the high quantity of e-waste due to existence of ship breaking industry and other heavy industry. The main source of e-waste in Chittagong is the ship breakage industry. Almost 90-95% of the e-waste generated in Chittagong is from this particular sector. Thus it can be commented that, without this particular ship breakage industry, Chittagong would have been less burdened with toxic e-waste problem.

### **3.2 Collection and Selling Process**

The reusing and recycling system in Dhaka, Mymensingh and Munshigonj are quite same. The e-waste reusing and recycling unit in three areas are mostly unregulated and the process of repairing and recuperating valuable materials take place in small workshops are called secondhand shops in this study. The recycling process is carried out in this sector in a simple way. This practice used in these areas are often intensify pollution by creating hazardous and additional pollution. In these secondhand shops of electronic products both the old and new products are available. According to the survey in Dhaka, Mymensingh and

Munshigonj most of the shop owner have started this business since 8-10 years from now. There are many customers or agents who bring e-products becomes useless to them. If the shopkeeper think that this e-product is purchasable; than they buy the waste product in a cheap rate and run a check to see the entire condition. If the product is functioning than they sell it to a customer who looks for secondhand parts or break it into pieces for sorting out iron, copper, lead, silver, plastic etc. and sell these to a purchaser of these individual items. They break these e-wastes without any safety measures which have a bad impact to their health and circumfluous environment. Most of these secondhand shops are using pliears, hammer, chisel, screw driver as a tool to break e-waste. Recycling as a profession is less financially paying in spite of being hazardous. Workers and shop owners don't think that these process is unsafe due to lack of discernibility of toxic materials exist in e-waste by naked eyes. Which ratify them that these are toxic free. Which indicates the lack of knowledge of the shopkeepers and workers. In Dhaka city PC, Laptops and Mobile parts are exported to China and India. After repairing these are again imported in Bangladesh. These export and import channels of electronic products in Bangladesh are done in an illegal manner. The cable wastes are directly bought from the Chittagong port legally though the process of tendering. In case of Mymensingh and Munshigonj obsolete PC, Laptops and Mobile parts were sent to Dhaka and after repairing these are again sent back to the shops in the Mymensingh and Munshigonj. The lead acid battery recycling in Dhaka, Chittagong, Mymensingh and Munshigonj City is performed in two ways are direct and indirect recycling processes are named in this study. Batteries used in ships, vehicles, generators, IPS, UPS, solar panel are recycled in these secondhand shops. Direct recycling process is a process where whole recycling process is performed in the secondhand battery shops. During this process lead is melted in an environmentally unfriendly way; which produce lead oxide (PbO) and lead dioxide (PbO<sub>2</sub>) and other toxic gases; has detrimental impact on environment. In case of indirect process collected battery waste is conveyed to the battery manufacturing industry and whole recycling process is accomplished in the industrial periphery. According to shopkeeper and workers in four study areas almost 20-30 items of e-waste are reused or recycled in a significant number. The weight of different electronic products are varies in shopkeepers to shopkeepers.

The recycling process in Chittagong most of second hand electronic products are purchase by recycling shop owner from auction which is held in the vatiary area of the Chittagong city. CDA market, Coxy market, Ice factory road, Vatiary and Kadamtali are the key areas dealing with shipyard e-waste where reusing and recycling is performed. CDA market, Coxy market, Ice factory road, Vatiary and Kadamtali consists of 60, 20, 30, 100 and 40 recycling shops respectively. Electronics products such as auto pilot, printer and ship navigation related products, fridge, air conditioner, generator hydraulic pump, panel board, and compressor, different types of light to horn, radio, television fan, washing machine, IPS etc products are deals in these areas. Recycling process is almost similar in each area. The shop owners buy the old electronics products from the auction held in shipyard. This auction accrues various items retrieved after ending the life cycle of ship as scrap. After buying and taking this delivery they clean and repair the e-products. The repaired useable products are sold to retailer, and wholesalers. The non-recoverable item are also valuable as include metal such as iron steel, bronze cables etc. Then these are sold to scrap dealers. According to the shop owner and workers almost all the purchase item are either sold by repairing or sold as scrap and residual parts are thrown away as a waste.

In Dhaka city mainly lead acid battery, AC, refrigerator, iron, washing machine, cable waste, car audio set, table fan, wall fan, telephone, electric heater etc. are available in Dholaikhal, Doyagonj, Sdarghat, Kakrail, Mirpur, Gulistan. Television, radio, LCD screen, video recorder are obtainable in Mosjid Market at Gulistan. Multiplan center at Elephant Road is selected for PC and laptop products and Motalab Plaza and Eastern Plaza at Sonargoan where mobile sets are available. In Chittagong mainly (excluding shipyard e-product) lead acid battery, AC, refrigerator, iron, washing machine, table fan, wall fan, telephone, electric heater,

Television, radio, LCD screen, video recorder, PC, laptop products and mobile etc. are available in Chowmuhani, Agrabad, Jublee Road, Newmarket, Reazuddin Bazar, Sahamanat Market, EPZ, Kathgar, City College Road. In Mymensingh mainly lead acid battery, AC, refrigerator, iron, washing machine, table fan, wall fan, telephone, electric heater, Television, radio, LCD screen, video recorder, PC, laptop products and mobile etc. are obtainable in Maharaza Bazar, Rambabur Bazar, Ganginarpar, Notun Bazar. In Munshigonj mainly lead acid battery, AC, refrigerator, iron, washing machine, table fan, wall fan, telephone, electric heater, Television, radio, LCD screen, video recorder, PC, laptop products and mobile etc. are obtainable in Mukterpur, Sipahipara, Thanarpoal (Super Market, Pouro Market, Mollah Plaza), Chowdhury Market (Kali Bari Road), Mosjid Market (Kachari), College Road (College Road Market, Stadium Market).

In total 2572 shops were identified among the four areas in which 1360, 715, 370 and 127 shops were found at Dhaka, Chittagong, Mymensingh and Munshigonj respectively. According to the Table 1 approximately 17826 tons and 11297 tons of e-wastes has been collected and sold yearly in these study areas of Dhaka city at the selling rate of 63%. In an average 23964 tons and 18007 tons of e-wastes has been collected and sold yearly in these study areas of Chittagong city at the selling rate of 75%. Roughly 11818 tons and 7313 tons of e-wastes has been collected and sold yearly in these study areas of Mymensingh city at the selling rate of 62%. Approximately 2767 tons and 1466 tons of e-wastes has been collected and sold yearly in these study areas of Munshigonj at the selling rate of 53% represented in Table 1.

Table 1: Yearly collection and selling amount of particular e-waste in tons

Items	Yearly collection				Yearly selling				Percentage of selling (%)			
	1	2	3	4	1	2	3	4	1	2	3	4
Television*	504	1234	305	95	208	802	138	71	41	65	45	75
Radio*	348	895	160	17	181	510	96	13	52	57	60	75
LCD Screen*	177	675	27	-	52	304	22	-	29	45	80	-
Video recorder/ DVD Player	539	357	234	35	206	161	141	25	38	45	60	70
Cable Waste*	40	250	-	-	32	213	-	-	80	85	-	-
Mobile	1296	870	576	40	770	566	260	24	59	65	45	60
Desktop	1350	656	450	200	900	492	261	64	67	75	58	32
Mouse	9	3	2	1	6	2	1	0.5	67	67	50	50
Keyboard	210	120	80	12	150	54	40	7	71	45	50	56
Laptop	368	234	145	34	263	162	52	8.5	71	69	36	25
(AC)*	442	1256	678	12	165	942	440	2.5	37	75	65	20
Refrigerator*	2097	3756	3256	678	1259	3004	2344	468	60	80	72	69
Washing Machine*	378	1678	890	-	167	1258	498	-	44	75	56	-
Iron	28	20	12	45	13	10	5	27	47	50	45	60
Telephone	37	24	13	25	17	8	3	7.5	45	35	25	30
Wall Fan*	114	245	102	87	74	191	68	61	64	78	67	70
Table Fan*	153	466	125	90	91	373	75	67	59	80	60	75
Electronic	168	125	45	68	119	75	36	30	70	60	80	45

Heater												
Printer*	420	880	245	36	282	704	147	9	67	80	60	25
Mobile Charger	28	20	17	3	21	16	12	1	75	80	70	33
Car Audio Set	420	-	-	-	231	-	-	-	55	-	-	-
Lead Battery*	8700	10200	4456	1289	6090	8160	2674	580	70	80	60	45
In total	17826	23964	11818	2767	11297	18007	7313	1466	63	75	62	53

Here in Table 1, 1=Dhaka, 2=Chittagong, 3=Mymensingh, 4=Munshigonj and (\*) means particular products are both local shipyard in Chittagong

The questioner survey was performed on 125 customers. Normally the male customers appear in the secondary electronic market and female customers are not seen usually. Customers comes to the secondary shops not only for buying the secondary electronic products but also for selling their electronic product which are wastage to them. Their age vary in a tremendous range from 15-50 years. The reused or recycled electronic products have a huge demand to the customer due to its cheaper price. Customers from all phases of occupations are gather here. In an average 5-25 retail customer visit shops and 15-20 electronic parts are sold in retail every day. Though customers appreciate this reusing and recycling items selling process they are not aware at all about the environmental significance and rather emphasis on the good quality and cheap value of the e-product.

### 3.3 Data Analysis

From the above discussion it appears that e-waste reusing and recycling is a popular practice in these study areas. Approximately 17826 tons and 11297 tons of e-wastes are collected and sold respectively in these study areas. The selling percentage is 63% which also indicates the reusing percentage. The reusing and recycling process of e-waste is done in informal sector. Surveying the study areas of Dhaka City Corporation a qualitative flow diagram is proposed in Figure 1.

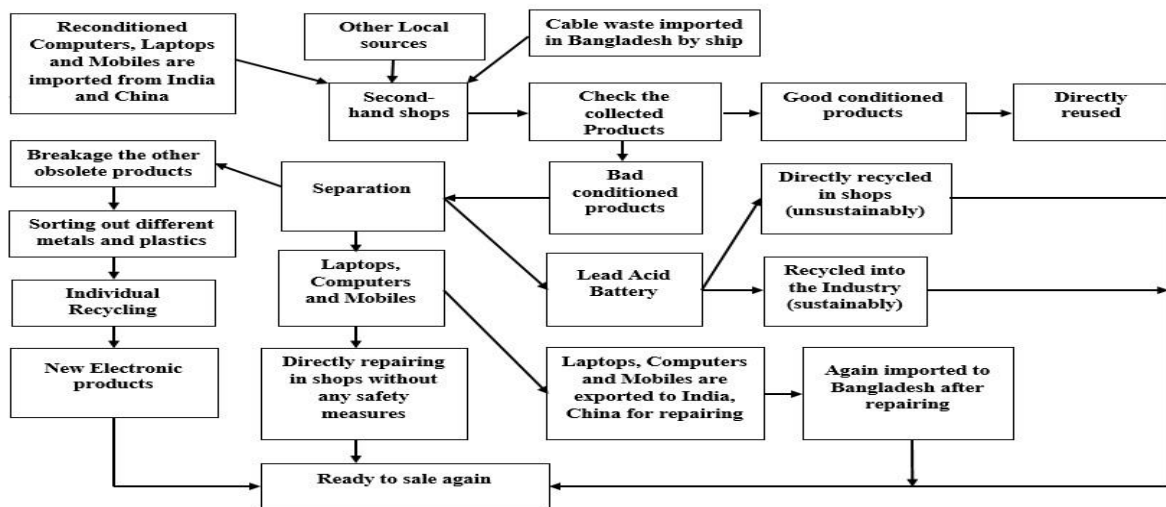


Figure 1: Qualitative flow diagram of reusing and recycling of e-waste in Dhaka City

Reusing and recycling process in Mymensingh and Munshigonj are quite similar to Dhaka. Roughly 11818 tons and 7313 tons of e-wastes has been collected and sold yearly in these study areas of Mymensingh city, at the selling rate of 62%. Approximately 2767 tons and 1466 tons of e-wastes has been collected and sold yearly in these study areas of

Munshigonj at the selling rate of 53%. Surveying these two study areas a qualitative flow diagram is proposed in the Figure 2.

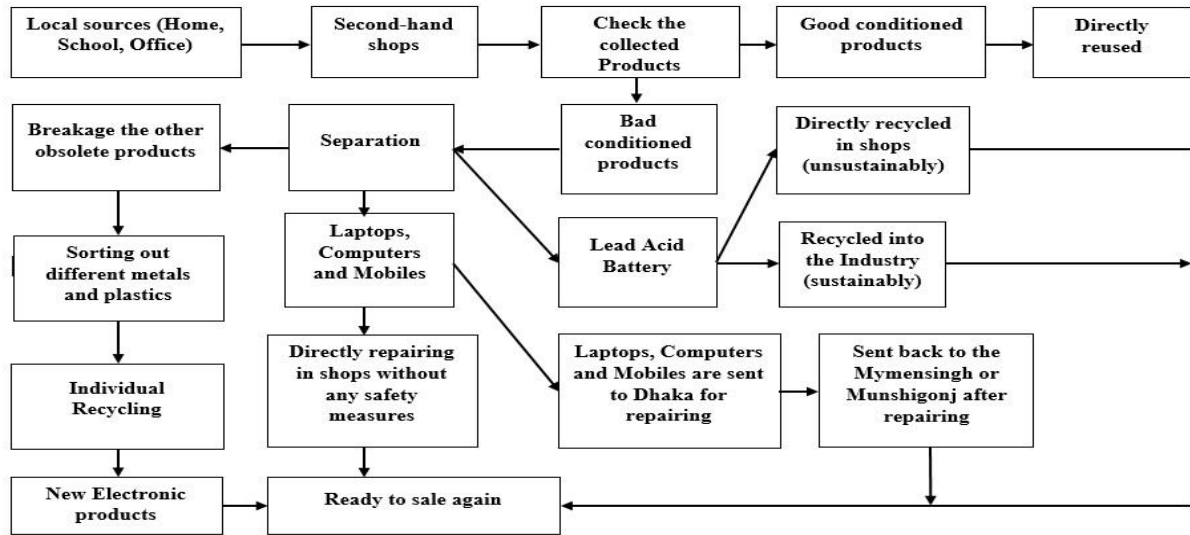


Figure 2: Qualitative flow diagram of reusing and recycling of e-waste in Mymensingh and Munshigonj

Recycling pattern of Chittagong is quite different from other three study areas represented in Figure 3. In an average 23964 tons and 18007 tons of e-wastes has been collected and sold yearly in these study areas of Chittagong city at the selling rate of 75%.

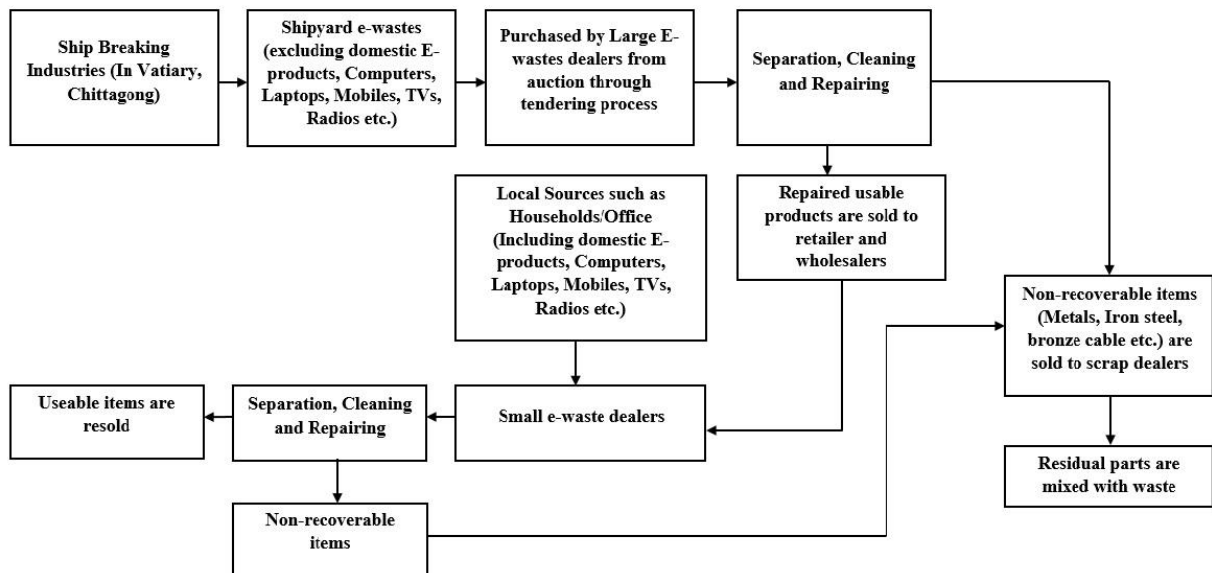


Figure 3: Qualitative flow diagram of reusing and recycling of e-waste in Chittagong

Recycling process in these four areas are less efficient because of the only use of the poor qualities breaking tools. The process of recycling in four study areas has the potential to be hazardous to recycler's health and environment. Due to the knowledge gap of shopkeepers and workers, recovery of precious metals are very insignificant. Thus this process is unable to occupy the economic support of Bangladesh. According to the shopkeeper the price of the second hand electronic products are 30-50% less than the new ones. The less price of products attract people much and is high demanded among the all classes of people. The

reusing and recycling process of e-waste have combined positive and negative impacts on environment. If the obsolete electronic products are dumped or incinerated it gives bad impact on environment. On the other hand if these process is performed environmentally unfriendly manner can also have bad impact on health and environment. Only sustainable reusing and recycling process is eco-friendly. The present reusing and recycling system in these four areas which are not performed in sustainable way. A proposal of sustainable and legal reusing and recycling model of e-waste for these study areas are given in Figure 4. This model can also be applicable for any other division or districts of Bangladesh. The reusing percentage can be increased if it is done by formal sector with proper infrastructure of it.

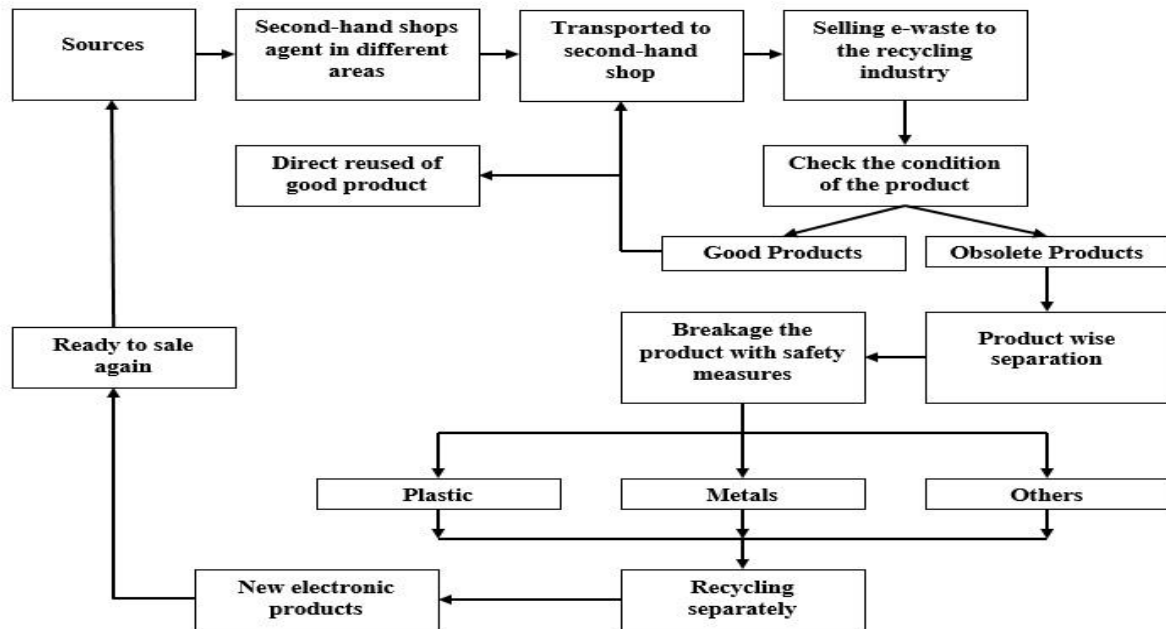


Figure 4: Proposed model for sustainable reusing and recycling of e-wastes

#### 4. CONCLUSIONS

The study was undertaken considering root level recycling and reusing of e-waste. Currently no proper guidelines are follow regarding the e-waste management of these study areas. The demand of second hand electronic products among the people of all stages is significantly high due to its 30-50% lesser price than new ones. The selling or reusing rate of e-wastes in Dhaka, Chittagong, Mymensingh and Munshigonj are 63%, 75%, 62% and 53% respectively. This paper has included four qualitative flow diagram and some quantitative information of existing situation in the field of e-waste reusing and recycling segment of these study areas. The study tried only to develop a survey based and theoretical model for better e-waste recycling process in these study areas. Workshop on proper and sustainable repairing and training on the health issue is mandatory for the workers in reusing and recycling system. Government with different NGOs can work together in this matter and encourage people for selling their e-waste. Again, inspire people for donating their electronic products which are wastage to them. To investigate the possibility of this model a complete empirical study is necessary.

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