3.3 Close look at the hotspots

Nimtali

Nimtali, in chankhar pool, is the largest computer vangari spot in Dhaka. There are 100-150 computer vangari in this area including temporary and permanent vangari shop. Here, permanent vangari shops are those which mainly deal with pc related wastes on full time basis. Temporary vangari shops deal pc wastes on a part time basis. These temporary shops are related to other vangari products such as refrigerators and air conditioners. Vangari shops buy pc parts from various organizations through auction (see Table 2). They also buy from hawkers, personal users, retail shops (old parts) and internal buying among the vangari shops. Average monthly total purchase amount was reported to be BDT.100, 000 and selling amount to be BDT 120,000 to 140,000. According to the interviewers they were reluctant to mention purchase and sales item by item. The shop owner claimed that they can reuse 100% of the electronic products purchased. The rest of the recovered items such as copper, iron, plastic and cable wires are sold as scrap (see Table 3). On an average in the shops located in this area there are 2/3 employees working on an average for 8 hours daily earning yearly salary of BDT 18000-24000 with other benefits (see Table 4). The employees on this spot are paid on a yearly basis which is a very unique feature of this spot. Some of the workers are residing in the shops which imply that they are exposed to the hazards of e-waste almost for 24 hours a day. The owners of these shops are in business for around 4 to 5 years. They think that their current informal recycling process is safe and do not agree that these electronic products contain toxic material which can be hazardous for human health.

Table 2 Description of the Products Handled

E-products	Avg. Weight (K.G)	Purchase Price (BDT)	Qty Purchased (Per Month)	Selling Price
Mother Board	300-400 gms	100,000	25	120,000-140,000
Power Supply	400 gms		60	
CD ROM	1		70	
CRT Monitor	10-15 kg		20	
Hard Disk	1-1.5 kg		25	
Casing	1-2 kg		45	
Cables				

Table 3 Quantity of dismantled materials

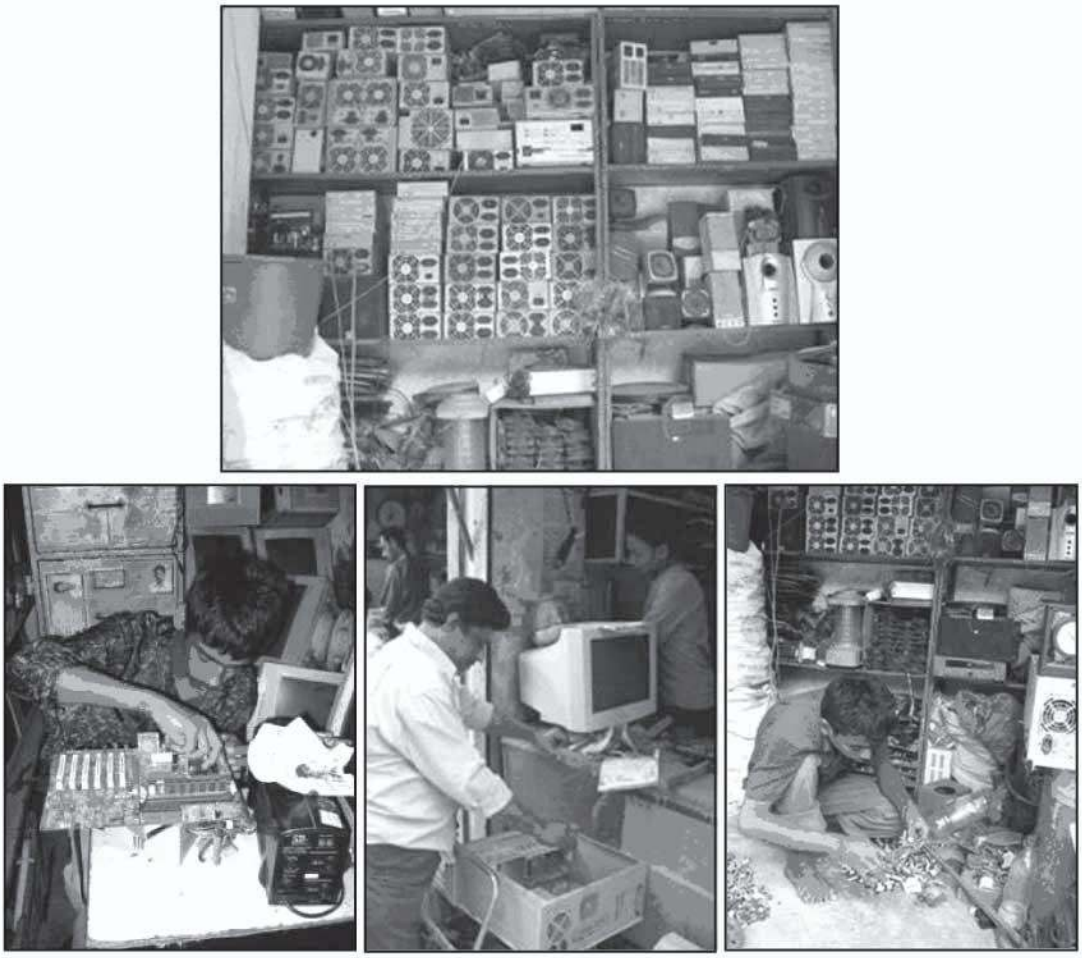
Materials	Copper	Iron	Plastic	Cable wire
Qty Discarded (Per Month in K.G.)	10-15	10-12	30-40	70-80

Table 4 Detail of employees

Number of Employees	Average Age	Payment Basis	Average Salary	Avg Working Hours	Other Benefits	Educational Background	Health Status
2/3	20-25	Yearly	18000-24000	8	Food, lodging and other basic needs	Primary	Average

Table 5 Shop owner details

Gender	Age	Level of Education	No. of years in the business
Male	45	Secondary	4 years



Dolai Khal, Dhaka

Dolai Khal has got 4-5 vangari mainly concentrating UPS. There are 2-3 temporary very small scale pc vangari shops. They buy the products from official auction or retailers as shown in Table 6, they mainly handles UPS. After buying these products they separate the battery and other material from UPS. The rest of the dismantled items such as copper, iron, lead and plastic are sold as scrap (see Table 7). On an average in the shops located in this area there are 2 employees working for on an average 8 hours daily earning BDT 700 per week (see Table 8). The owners of these shops are in business for ¾ years with secondary level educational background. They think that their current informal recycling process is safe and do not agree that these electronic products contain toxic material which can be hazardous for human health.

Table 6 Description of the Products Handled

E-products	Avg. Weight (K.G)	Purchase Price (BDT)	Qty Purchased (Per Month)	Selling Price
UPS	8 kg	25000	50	45000

Table 7 Quantity of dismantled materials

Materials	Copper	Iron
Qty Discarded (Per Month in K.G.)	10-15	50-60

Table 8 Detail of employees

Number of Employees	Average Age	Payment Basis	Average Salary	Avg Working Hours	Other Benefits	Educational Background	Health Status
2	20	Weekly	700	8	Bonus	Primary	Average

Table 9 Shop owner details

Gender	Age	Level of Education	Capital Invested	No. of years in the business
Male	28	Secondary	Tk._____	3 years

Elephant Road, Dhaka

In elephant road there are only 3-4 vangari shops. Elephant road mostly consists of 2nd hand pc market (see Table 10). They sell to 2nd hand buyers or to the vangari shops. They buy pc parts such as mother boards, monitors, cables, CD ROM etc. from various organizations through auction and also from hawkers, personal users, retail shops etc. From the survey it was revealed that, the shops can salvage 50% of the purchased products and sell these to the buyers at home and abroad (China). The rest of the non-recoverable items such as steel, iron, bronze and cable wires are sold as scrap (see Table 10). On an average in the shops located in this area there are 2 employees working for on an average 10 hours daily earning BDT 3,000 monthly (see Table 11). The owners of these shops are in business for 3 to 4 year. They think that their current informal recycling process is safe and do not contain any toxic material.

Table 10 Description of the Products Handled

E-products	Avg. Weight (K.G)	Purchase Price (BDT)	Qty Purchased (Per Month)	Selling Price
Mother Board	300-400 gms	150,000	20	200000-220,000
Power Supply	400 gms		60	
CD ROM	1		50	
CRT Monitor	10-15 kg		40	
Cables				

Table 11 Detail of employees

Number of Employees	Average Age	Payment Basis	Average Salary	Avg Working Hours	Other Benefits	Educational Background	Health Status
2	30-35	Monthly	3000	10	Bonus	Primary	Average

Table 12 Shop owner details

Gender	Age	Level of Education	Capital Invested	No. of years in the business
Male	35	Secondary	Tk._____	3-4 years

3.4 Hotspot Characteristics

Main source

Most of the shops in different recycling markets of Dhaka opened during the last 3-4 years and they are handling mainly PC and related materials. The exponential growth and use of PC and their rapid obsolesce has led to the growth of these recycle shops. Thus PC is the main source of e-waste in Dhaka.

Low wages

Workers in the recycle shops are receiving monthly wages of approximately BDT 3000 working for 8-12 hours daily. This is lower than the wages earned by day laborers. Thus the recycle workers are getting less payment for hazardous job.

Inefficient recycling process

Most of these shops are using pliers, hammer, chisel, screwdriver as a tool to break those things. From most of the items they could not recover important parts which they could have if used modern technology. This inefficiency is resulting into higher quantity of wastage and scraps.

Ignorance regarding hazards of e-waste

Workers and the owners don't think that recycling electronic products are hazardous. The lack of visibility of toxic material contained in e-waste by naked eyes making them believe that these are toxic free. There is huge knowledge gap among the shop owners and workers.

Re-import of e-products

In our survey we have found that PC parts like mother boards are exported to china and India. After repairing these are again imported in Bangladesh. There are illegal import and export channels of e-products in Bangladesh.

New Business

During the survey most of the shop owners reported that they are in the business for 3 to 4 years. Thus the growth of this e-product recycling is relatively new in Dhaka.

4. E-waste recycling in Chittagong

Port city Chittagong generates the highest quantity of e-waste due to the existence of ship breaking industry. The recycling process of the informal sector in Chittagong is shown by Fig. 8. Most of the second hand electronic products are purchased by recycle shop owners from auction held in the Vatiary area of the city.

4.1 E-waste hotspots

There are different areas in Chittagong that handles second hand electronic products. Among them following are the key areas dealing with e-waste recycling:

- CDA market
- Coxy market
- Ice Factory Road
- Vatiary
- Kadamtali

Box 1: Recycle Shop Owner's Voice

Name: Mr. Ali

Age: 42

According to Mr. Ali a shop owner in Nimtali, there are 200-250 purchasing agents who bring pc parts as wastage to them. After purchasing a waste product they first run a check to see whether the product is functioning or not. If the product is functioning then they sell it to a purchaser who looks for 2nd hand parts. Otherwise they break the product into pieces to separate iron, lead, copper, silver, plastic etc. and sell this to a purchaser of these things. Their buyers include personal users, factory users, mechanics,

According to Mr. Ali there remains nothing of a product to dump. He also denied the exposure to toxic materials while breaking these things. The reason he gave behind his opinion that he has been involved in this vangari business for 12 years and suffering no diseases because of it. When we asked whether he knows about the gas contained in picture tube, he said that he knows about it but the vangari shops do not break picture tube, they sell it in piece for repairing and reuse, because 1 out of 1000 becomes unusable.

4.2 Recycling flow

The recycling process followed by all the markets mentioned is almost similar. The shop owners buy the old electronic products from the auction held in the shipyard. This auction accumulates various items salvaged from ship breakage. The shop owners buy directly from the auction or form auction dealers, who purchased the end of life ship as scrap. After buying and taking the delivery they clean and repair the electronic products. The repaired and useable products are sold to showrooms, retailers and wholesalers. The non-recoverable items are also valuable as they include metals such as iron, steel, bronze, cables etc. These are then sold to scrap dealers. According to the shop owners and workers almost all the purchased items are either sold by repairing or sold as scrap. A very small quantity is thrown away and mixed with solid waste.

Fig 8. Informal Sector Recycling Process in Chittagong

4.3 Close look at the hotspots

CDA Market, Chittagong

CDA market area is one of the biggest markets in Chittagong handling electronic second hand products. This informal market has around 50 shops. They buy the products from auction in the Vatiary shipyard resulting from ship breakage. As shown in Table 13, it handles electronic products such as auto pilot, navtex, printer, SVDR etc. ship navigation related products. After buying these products from auction they clean and repair these products. From the survey it was revealed that, the shops can salvage 50% of the purchased products and sell these to the buyers at home and abroad. The rest of the non-recoverable items such as steel, iron, bronze and cable wires are sold as scrap (see Table 14). On an average in the shops located in this area there is 3/4 employees working for 12 hours daily earning BDT 3,500 monthly (see Table 15). The owners of these shops are in business for long with secondary level educational background. They think that their current informal recycling process is safe and do not agree that these electronic products contain toxic materials which can be hazardous for human health.

Table 13 Description of the Products Handled

E-products	Avg. Weight (K.G)	Purchase Price (BDT)	Qty Purchased (Per Month)	Selling Price
Auto Pilot	170	100,000	1	115,000-130,000
Printer	6	15,000-20,000	3	20000-30000
Eco Sorrunder	20-25	50,000-58,000	4	55,000-65,000
Navtex	2-3	12,000-15,000	4-5	15,000-25,000
SVDR	50	110,000-130,000	3-4	120,000-150,000
Gyno Compass	70	80,000-150,000	4	100,000-180,000
Reapter	9-10	4,000-8,000	7-8	6,000-10,000
AIS	3	40,000-45,000	3-4	60,000-70,000

Table 14 Quantity of dismantled materials

Materials	Steel	Iron	Bronze	Cable wire	
Qty Discarded (Per Month in K.G.)	70-80	70-80	70-80	70-80	

Table 15 Detail of employees

Number of Employees	Average Age	Payment Basis	Average Salary	Avg Working Hours	Other Benefits	Educational Background	Health Status
4	30	Monthly	3500	12	Tips	Secondary	Average

Table 16 Shop owner details

Gender	Age	Level of Education	Capital Invested	No. of years in the business
Male	42	Secondary	Tk._____	30 years

Coxy Market, Chittagong

Coxy market area is another relatively small second hand electronic products handling market in Chittagong. This informal market has around 15 shops. They buy their products directly from auction or from the auctioneers. The market is not as big as CDA market and has mainly fridge and air conditioners (see Table 17). They also follow the common procedure of recycling shops, i.e., buy, clean, repair and sell. According to the shop owners, they can salvage approximately 90% of the purchased products and sell these to the retail buyers. The rest of the non-recoverable items such as steel and iron are sold as scrap (see Table 18). This market in Chittagong has reported the percentage of discarded items to be lowest. On an average in this market shops employ 2/3 employees working for 9 hours daily were earning BDT 2,500-3,500 monthly (see Table 19). The owners of these shops are in business for relatively shorter period of time and invest approximately BDT 100 thousand. They think that their current informal recycling process is safe as these electronic products were originally produced in Europe having higher safety standards and believes that these do not contain any toxic materials.

Table 17 Description of the Products Handled

E-products	Avg. Weight (K.G)	Purchase Price (BDT)	Qty Purchased (Per Month)	Selling Price
Fridge	32-50	5000-8000	15-20	8000-10000
Air-conditioner	40	10000-15000	5-8	11000-16000

Table 18 Quantity of dismantled materials

Materials	Iron	Steel
Qty Discarded (Per Month in K.G.)	80-100	80-100

Table 19 Detail of employees

Number of Employees	Average Age	Payment Basis	Average Salary	Avg Working Hours	Other Benefits	Educational Background	Health Status
3	22	Monthly	2500-3000	9		Secondary	Average

Table 20 Shop owner details

Gender	Age	Level of Education	Capital Invested	No. of years in the business
Male	31	Higher Secondary	Tk.110,000	6 years

Ice Factory Road, Chittagong

The second hand electronic product market located in Ice Factory area of Chittagong is a medium sized market. There are approximately 12 shops. They also mostly buy the products from auction in the shipyard resulting from ship breakage. It deals with electronic products such as Generator, Hydraulic Pump, panel board and compressor (see Table 21). After buying these products from auction they clean and repair these products. From the survey it was revealed that, the shops can salvage 50%-60% of the purchased products and sell these to the local wholesale markets. The rest of the non-recoverable items are sold as scrap (see Table 22). On an average in the shops located in this area have 4 employees working for 12 hours daily earning BDT 8,000-12,000 monthly (see Table 23). The owners of these shops are in business for a moderate period of time. They think that their current informal recycling process is not safe. However they do not agree that electronic products contain toxic materials.

Table 21 Description of the Products Handled

E-products	Avg. Weight (K.G)	Purchase Price (BDT)	Qty Purchased (Per Month)	Selling Price
Generator	1-3 tons	10,00,000-60,00,000	1-3	1100000-7500000
Hydraulic Pump	1 ton	30000-40000	1-4	40000-50000
Panel Board	200-250 kg	250000-300000	1-2	270000-350000
Compressor	500-1000 kg	400000-1000000	1-2	500000-1100000

Table 22 Quantity of dismantled materials

Materials	Scrap
Qty Discarded (Per Month in K.G.)	5-10 tons

Table 23 Detail of employees

Number of Employees	Average Age	Payment Basis	Average Salary	Avg Working Hours	Other Benefits	Educational Background	Health Status
4	25	Monthly	8000-12000	12		Primary	

Table 24 Shop owner details

Gender	Age	Level of Education	Capital Invested	No. of years in the business
Male	40	Higher Secondary	Tk._____	10 years

Vatiary, Chittagong

Vatiary is another big electronic products recycling market in Chittagong. As this is located inside the naval base, access to this market is restricted. It has around 80 shops. This market has wide variety of electronic products ranging from different types of lights to horn, radio, television etc. (see Table 25). After buying these products from auction in the shipyard they clean and repair these products. They have employed mechanics who are relatively more skilled than other recycle markets. From the survey it was revealed that, the shops can salvage 70% to 80% of the purchased products and sell these to the showrooms, retailers and wholesalers. The huge non-salvageable items generated from this market are sold to scrap dealers (see Table 26). On an average in the

shops located in this area there are 3 employees working for 12 hours daily earning a low salary of BDT 3,000 monthly (see Table 27). The owners of these shops are in business for long with low level of education. The owners of the shops in this market reported large capital investment, approximately BDT 40 lakhs having annual income of approximately BDT. 8 to 10 lakhs. They also think that their current informal recycling process is safe and do not agree that these electronic products contain toxic material which can be hazardous for human health.

Table 25 Description of the Products Handled

E-products	Avg. Weight (K.G)	Purchase Price (BDT)	Qty Purchased (Per Month)	Selling Price (BDT)
Charge Light	40-80	15000-30000	1-2	20000-40000
Deck Light	5-12	2000-3000	5-8	3000-4000
Security Light	1.5-2	1200-1500	10-12	1500-2200
Navigation Light	4-5	3000-6000	5-8	3500-7000
Hydraulic Horn	15-25	8000-10000	1-2	8500-11000
Radio	4-5	2000-4000	1-2	3000-5000
Television	10-15	8000-10000	1-2	8500-11000
Wind Direction Meter	8-9	12000-15000	1-2	20000-22000

Table 26 Quantity of dismantled materials

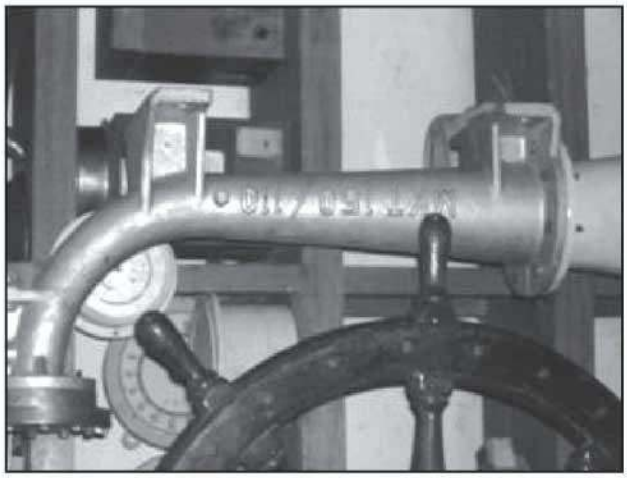
Materials	Aluminium	Bronze	Steel	Iron
Qty Discarded (Per Month in K.G.)	1-5	5-10	5-10	8-10

Table 27 Detail of employees

Number of Employees	Average Age	Payment Basis	Average Salary	Avg Working Hours	Other Benefits	Educational Background	Health Status
3	25	Monthly	3000	12	tips	Primary	Good

Table 28 Shop owner details

Gender	Age	Level of Education	Capital Invested	No. of years in the business
Male	45	Primary	40 lakhs	20 years




Kadamtali (Dhaniala Para), Chittagong

Kadamtala is another prominent electronic products recycling market in Chittagong having approximately 20 shops. They also buy the products from auction in the shipyard resulting from ship breakage. This market has fans, printer, fridge, washing machine, IPS etc. electronic products (see Table 29). From the survey it was revealed that, the shops can salvage 50% of the purchased products and sell these to the retailers. The rest of the non-recoverable items such as cable, plastic, steel etc. are sold as scrap (see Table 30). On an average in the shops located in this area have 4 employees working for 9 hours daily earning BDT 2,500 monthly (see Table 31). The owners of these shops are in business for relatively shorter period of time. Like others they also think that their current informal recycling process is safe and do not agree that these electronic products contain toxic materials.




Table 29 Description of the Products Handled

E-products	Avg. Weight (K.G)	Purchase Price (BDT)	Qty Purchased (Per Month)	Selling Price (BDT)
Wall fan	1.5	120-150	10-12	220-250
Table fan	2	180-200	10-12	300
Television	8	5000-6000	4-5	8000
Fridge	15-40	8000-9000	4-5	12000-13000
Washing Machine	10-12	2000-3000	4-5	5000-5500
Printer	5-6	3000-4000	2-3	4500-5000
Computer	12-15	8000-9000	2-3	11000-12000
Car Audio Set	3-4	800-950	20-30	1200-1400
IPS	5-6	3000-4000	2-3	6000-7000

Table 30 Quantity of dismantled materials

Materials	Cable	Plastic	Steel	Mother Board
Qty Discarded (Per Month in K.G.)	100-150	500	30	500 pcs

Table 31 Detail of employees

Number of Employees	Average Age	Payment Basis	Average Salary	Avg Working Hours	Other Benefits	Educational Background	Health Status
4	18	Monthly	2500	9	tips	Primary	Average

Table 32 Shop owner details

Gender	Age	Level of Education	Capital Invested	No. of years in the business
Male	27	Secondary		5 years

4.4 Hotspot Characteristics

Main source

The main source of e-waste in Chittagong is the ship breakage industry. Almost 95 percent 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.

Inefficient recovery Process

Although the recycle shop owners commented during the survey that, they employ skilled people to recycle the electronic products. However, the discharging of scraps up to 50% of the purchased quantity suggests that, their recycling process is elementary and less efficient. They have reported only the use of hammers, screwdrivers and chisels in recycling, which indicates their low level of operational efficiency.

Ignorance on hazards of e-waste

Almost all the shop owners and workers are ignorant about the hazards of e-waste. During the survey the interviewers felt that workers are largely unaware of the fact that these breaking down of electronic products without safety measures might be harmful for their health.

Low wages

The survey on the recycle shop workers revealed that, on an average they earn BDT 3,000 monthly working 12 hours a day. Compared to other professions, the workers engaged in e-waste recycling are getting lower wages. A day labourer in this city earns minimum BDT 200 for working 8 to 9 hours a day. Hence recycling as a profession is less financially rewarding in spite of being hazardous.

Recycling is highly profitable

This study also found that the owners of the recycling shops are selling their electronic products at 20 to 100 percent mark up. Thus the shop owners are extracting a higher profit margin. Also their net gain becomes even higher because of the opportunity to get labour at a cheap rate.

5. Recommendations and Conclusion

5.1 Recommendations

All the stakeholders: producers, sellers, users, recycle agencies and the policy makers must sit together to implement a sustainable solution to the problem of E-waste. The following recommendations can be forwarded for effective management of e-waste.

5.1.1. Legislation

Comprehensive and sustainable laws are needed to ensure hazard free recycling of e-waste, which will be based on 'polluter pay' principle. Government should enact rules for e-waste Management and handling. The legislation should ensure environmental justice and involve the participation of all the stakeholders.

5.1.2. Awareness Program

A large-scale awareness program should be initiated for all the stakeholders: producers, sellers, users, recycle shop owners and workers to enhance their understanding regarding the danger of e-waste and also to ensure their participation in the recycling process.

5.1.3. Developing the Infrastructure

Collection infrastructures such as collection points, refurbishing and recycling centers should be established in urban and rural areas. Here government can play a leading role by providing incentives.

5.1.4. Establish Recycling Plants

There is an urgent need to establish e-waste treat plant. This may be founded on public-private partnership (PPP/ Non-profit basis). Producers should be registered with the recycling agencies and treatment plants for paying the recycling cost. Treatment cost might be shared by producers and consumers. It can also be based on profit. But some control should be established as profit making opportunity might lead towards early recycling and inefficient utilization of resources.

5.1.5. Extended Producers Responsibility

Producer's responsibility should be extended so that they will ensure that hazard free disposal of e-waste is ensured. They should be responsible for the products after their useful life and pay the cost to the recycling agency. This will encourage redesign of products aiming at improved recyclability, reduce the use of toxic materials by developing alternative materials, encourage producing products with longer life span and promote research and development of environment friendly technology.

5.1.6. Registration of producers

Producer Responsibility Organization (PRO) should be established to make them more accountable.

5.1.7. Separation of Garbage

In Bangladesh household wastes are not separated before disposal. Initiatives should be taken to separate garbages into burnable, non-burnable and e-waste. This will help the households to segregate waste easily and isolate e-waste which will in turn increase recovery by reducing wastage.

5.1.8. Incentives

Government should think of providing incentives for being environment friendly and encourage the use of cleaner material technology in recycling. Incentives in the form of tax exemption might be provided to the producers using toxic free materials.

5.2 Limitations and Suggestions for Future Research

This research is considered successful in meeting the research objectives. As in most studies, this study has a number of limitations. The first limitation may be due to the methodology employed in this research. The sample choice of the study was based only on the areas of Dhaka and Chittagong. Thus, the results cannot be generalized to entire Bangladesh. The second limitation comes from the small sample size which was mainly due to unwillingness of recycle shop owners and workers to participate in the survey.

They were afraid that the survey will recommend findings that will ultimately impose restrictions on their business. Future researcher can take initiative to conduct study on other cities of Bangladesh. Follow up work with large sample size is also needed to assess the validity of the findings.

5.3 Conclusion

While the problem of e-waste and the role of informal sector in recycling them were widely discussed, there was an urgent need to conduct in-depth studies in Bangladesh. This is to help policymakers with appropriate policy instrument as well as to dispel common myths that e-waste is yet to be threat in Bangladesh. This study attempted to take a modest attempt to investigate the informal sector recycling practice in Bangladesh by conducting literature surveys, interviews and observations. Results of the study indicate that contrary to the common belief, in Bangladesh the quantity and process of recycling of e-waste is very rudimentary and is emerging as a huge threat. It is high time for the stakeholders to act now.

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APPENDIX

Appendix A: Quantifying E-waste in Dhaka City

1. Personal Computers
   Method 1: Market Supply Method "A" (Sinha et al. 2007)
   Assumptions:

- The average lifetime of a PC is approximately five years
- After five years these PCs are discarded and come to the waste stream.
- Number of PC is estimated 500 thousand grows at 11.4%
- PC weight: 27.2 kg/PC

Table A1: Estimation of PC E-WASTE in Dhaka city using Market Supply Method "A"

Year	Sales	Average Lifetime (Years)	No. of obsolete PCs (5years)	Weight (in tons) @27.2 kg/PC for 5 years obsolescence
2004	500,000			
2005	557,000			
2006	614,000			
2007	671,000			
2008	728,000		500,000	13,600
2009			557,000	15,150
2010			614,000	16,701
2011			671,000	18,251
2012			728,000	19,802

Method 2: Market Supply Method "B"

Assumptions:

- All PCs are used for at least 2 years
- Disposal starts in the 3rd years, in which 10 percent of PCs are made obsolete
- Disposal rate is 20%, 40%, 20 % and 10% in the 4th, 5th, 6th and 7th year

Table A2: Estimation of PC E-WASTE in Dhaka city using Market Supply Method "B"

Year	Sales	Average lifetime					No of obsolete PCs	Weight (in tons)@ 27.2 kg/PC
		3rd year (10%)	4th year (20%)	5th Year (40%)	6th Year (20%)	7th Year (10%)		
2004	500,000							
2005	557,000							
2006	614,000							
2007	671,000	50.000					50,000	1360
2008	728,000	55,700	100,000				155,700	4235
2009		61,400	111,400	200,000			372,800	10,140
2010		67,100	122,800	222,800	100,000		512,700	13,945
2011		72,800	134,200	245,600	111,400	50,000	614,000	16,701
2012			145,600	268,400	122,800	55,700	592,500	16,116
2013				291,200	134,200	61,400	486,800	13,241
2014					145,600	67,100	212,700	5,785
2015						72,800	72800	1980

Table A3: Dhaka city PC estimates using Market Supply Method A and B

	Weight (in tons) Market supply method A	Weight (in tons) Market supply method B	Average
2008	13,600	4235	8917
2009	15,150	10,140	12645
2010	16,701	13,945	15323
2011	18,251	16,701	17476
2012	19,802	16,116	17959

2. Cell Phone

Method 1: Market Supply Method "A"

Assumptions:

- The average lifetime of a Cell Phone is 2-3 years.
- Cell Phones are sold in 2007 is 32.5 millions (Hossain et al. 2007).

Table A4: Estimation of Cell Phone E-WASTE in Dhaka City using Market Supply Method "A"

Year	Sales	Average Lifetime (Years)	No. of Obsolete Cell Phone	Weight (in tons) 0.079kg/Cell phone for 3 years obsolescence
2007	32,500,000			
2008	65,000,000			
2009	97,500,000			
2010	130,000,000		32,500,000	2567
2011	162,500,000		65,000,000	5135
2012			97,500,000	7702
2013			130,000,000	10270
2014			162,500,000	12837

Notes: Calculation of weight per cell phone is derived from Pervez et al. 2007.

Method 2: Market Supply Method "B"

Assumptions:

- All cell phones are used for at least 1 year
- Disposal start in the 2nd years, in which 10 percent of cell phones are made obsolete
- Disposal rate is 20%, 40%, 20 % and 10% in the 3rd, 4th, 5th and 6th year

Table A5: Estimation of Cell Phone E-WASTE in Dhaka City using Market Supply Method "B"

Years	Sales	Average lifetime					No of obsolete CP	Weight @ 0.079 kg/CP
		2st year (10%)	3nd year (20%)	4rd Year (40%)	5th Year (20%)	6th year (10%)		
2007	32,500,000							
2008	65,000,000	3,250,000					3,250,000	256.75
2009	97,500,000	6,500,000	6,500,000				13,000,000	1,027
2010	130,000,000	9,750,000	13,000,000	13,000,000			35,750,000	2,824.25
2011	162,500,000	13,000,000	19,500,000	26,000,000	6,500,000		65,000,000	5,135
2012		16,250,000	26,000,000	39,000,000	13,000,000	3,250,000	97,500,000	7,702.5
2013			32,500,000	52,000,000	19,500,000	6,500,000	110,500,000	8,729.5
2014				65,000,000	26,000,000	9,750,000	100,750,000	7,959.25
2015					32,500,000	13,000,000	45,500,000	3,594.5
2016						16,250,000	16,250,000	1,283.75

Table A6: Dhaka city PC estimates using Market Supply Method A and B

	Weight (in tons) Market supply method A	Weight (in tons) Market supply method B	Average
2010	2567	2,824.25	2696
2011	5135	5,135	5135
2012	7702	7,702.5	7702
2013	10270	8,729.5	9500
2014	12837	7,959.25	10,398

Appendix B. Survey Instruments

Survey Instrument for Assessing Informal Sector E-waste Recycling

Recycle Shop Owner

Questionnaire No._____

Interviewer's Name: _____ City: _____

Date of Interview: _____ Location: _____

1. Can you please name the kind of electronic products that you are selling, their average weight, purchase price, quantity and selling price of each product?

E-products							
Avg. Weight							
Purchase Price							
Qty Purchased (Per Month)							
Selling Price							

2. From where do you buy the above mentioned products?
3. How do you recycle them? Please explain the process.
4. What is your output after recycling?
5. How do you sell them?
6. What happens to the non-salvageable or discarded materials?

Materials							
Qty Discarded (Per Month)							

7. Do you think these segregation and recycling procedures of electronic products are safe?

a. Yes. Please specify the reason_____

b. No. Please specify the reason_____

8. Do you know that electronic products contain toxic materials?

a. Yes. Please specify some examples_____

b. No.

9. Please provide the following details about your employees

Number of Employees	**Average Age**	**Payment Basis**	**Average Salary**	**Avg Working Hours**	**Other Benefits**	**Educational Background**	**Health Status**
		D. W. M					

10. Please provide us the following details about you

Gender	**Age**	**Profession**	**Level of Education**	**Capital Invested**	**No. of years in the business**
				Tk._____	

Thank you very much for your cooperation

Survey Instrument for Assessing Informal Sector E-waste Recycling

Recycle Worker

Questionnaire No._____

Interviewer's Name: _____	City: _____
Date of Interview: _____	Location: _____

1. Can you please name the kind of electronic products that you segregate, salvage or recycle?

E-products							

2. Please provide the following details about you

1. Name:
2. Age:
3. Gender:
4. Educational Background:
5. Family size:
6. Number of years in this profession:
7. Employment: Permanent/ Part time
8. Payment basis: Daily/Weekly/Monthly
9. Working Hours:
10. Salary Amount: Tk._____
11. Health Status: 1. Current Diseases (if any)_____ 2. Hospitalization Record_____
12. Monthly medical expense:

3. Please describe your job?
4. Why did you choose this profession?
5. What are the tools that you use for this job?
6. Do you think these segregation and recycling procedures of electronic products are safe?
   a. Yes. Please specify the reason _____
   b. No. Please specify the reason _____
7. Do you take any safety measures?
8. Do you know that electronic products contain toxic materials?
   a. Yes. Please specify some examples _____
   b. No.
9. Please give us some suggestion to make your profession safe and comfortable

Thank you very much for your cooperation

Appendix C. Recycle Worker Profile

Box 1: Profile of Recycle Worker
E-waste Hotspot: CDA Market, Chittagong

1. General Details:
   a. Age: 46 years
   b. Gender: Male
   c. Educational Background: 8th grade
   d. Dependents: 9 persons
   e. Number of years in this profession: 28 years
   f. Employment: Full time
   g. Payment basis: Monthly
   h. Working Hours: 12 hours
   i. Salary Amount: Tk.12,000
   j. Health Status: Current Diseases: Back pain
   k. Average monthly medial expense Tk. 800
2. Electronic products handled: Auto Pilot, Navtex, Sbdr, Gyno Compass, Reapter
3. Job description: As a head technician repair the electronic products.
4. Motivation behind the profession:
5. Tools used: Hammer, screw driver etc.
6. Safety of Recycling Process: safe
7. Safety measures taken: Safety glass, hand gloves etc.
8. Toxic Content of Electronic products: None

Box 2: Profile of Recycle Worker
E-waste Hotspot: Coxy Market, Chittagong

1. General Details:
   a. Age: 22 years
   b. Gender: Male
   c. Educational Background: 8th grade
   d. Dependents: 5 persons
   e. Number of years in this profession: 2 years
   f. Employment: Full time
   g. Payment basis: Monthly
   h. Working Hours: 9 hours
   i. Salary Amount: Tk.2,000
   j. Health Status: Current Diseases: None
   k. Average monthly medial expense Tk. 300
2. Electronic products handled: Fridge, air-conditioners etc.
3. Job description: As a technician repair the electronic products.
4. Motivation behind the profession: To learn the job
5. Tools used: blow lamb, grip plus and other tools.
6. Safety of Recycling Process: safe
7. Safety measures taken: Safety glass
8. Toxic Content of Electronic products: None

Box 3: Profile of Recycle Worker
E-waste Hotspot: Ice Factory Road, Chittagong

1. General Details:
   a. Age: 20 years
   b. Gender: Male
   c. Educational Background: Secondary
   d. Dependents: 6 persons
   e. Number of years in this profession: 1 year
   f. Employment: Full time
   g. Payment basis: Monthly
   h. Working Hours: 12 hours
   i. Salary Amount: Tk. 8,000
   j. Health Status: Current Diseases: None
   k. Average monthly medial expense Tk. 300
2. Electronic products handled: Generator, hydraulic pump, panel board, compressor
3. Job description: Repairing and selling products.
4. Motivation behind the profession: To learn the business
5. Tools used: Hammer, screw driver, plus, brush etc.
6. Safety of Recycling Process: safe
7. Safety measures taken: None
8. Toxic Content of Electronic products: None

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Biography: Dr. Sarwar Uddin Ahmed is currently serving as the Treasurer of D.Net. He is an Associate Professor and Coordinator of Accounting and Finance at the Independent University, Bangladesh and Senior Research Fellow (pool) at the Development Research Network. He received his PhD in Environmental Finance from Nagasaki University, Japan. His research interests include environmental finance, corporate social performance, capital market, and relationship banking. He has authored over 65 articles, reports and conference papers on environmental finance, relationship banking, corporate social responsibility and capital market. He is co-author with K. Gotoh of Cost-benefit Analysis of Environmental Goods by Applying the Contingent Valuation Method: Some Japanese Case Studies (Tokyo: Springer, 2006). He is an Associate Editor for the Independent Business Review. He was awarded Environmental Science Paper Award in 2005 by Center for Environmental Information Science (CEIS), Tokyo, Japan.

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