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E-waste Generation from Mobile Phone and its Recovery Potential in Bangladesh

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Abstract

Waste from Electrical and Electronic Equipment (WEEE) or Electronic Waste (E-waste) comes under a special category of waste which is the result of industrialization and ever increasing demand of electronic products in our daily life. With increasing usage of these products waste production is also increasing and leads to continuous depletion of finite natural resources and leading us to an uncertain future. Total number of mobile phone subscribers was 116.55 million at June 2014, about 35 % of the active mobile phone subscribers were account for the dual Subscriber Identity Module (SIM) mobile phone set (MPS) and total volume of this is 990 m^3, cumulatively the total weight is 1125 ton. Most of the amounts of these mobile phone sets are added per year in the total waste stream of Bangladesh. Only 2-3 % of these amounts of MPS's were recycled through the informal sector and recovered some precious metals also. If we can recycled the entire amount of MPS's about 348.75 kg gold, 105.75 kg of platinum and palladium, more than 163.29 ton of aluminum and 214.32 ton of copper can be recovered. However, these can be the basis of a sustainable material recycle industry to recover materials from the end-of-life mobile phones.

Key words: E-waste, Management, Recovery, Recycle, WEEE

Introduction

The electronic and electrical industry is the largest and fastest growing manufacturing industry of the world (Radha, 2002; DIT, 2003). In order to need of new electronic products of consumers in the market, worse in quality and shorter life for many electric appliances would be happened as E-waste. It is an emerging problem as well as a business opportunity of increasing significance, given the volumes of e-waste being generated and the content of both toxic and valuable materials in them. Precious, nonrenewable resources embedded within e-waste have given rise to a global "mining" industry that operates on the economic, social and environmental logic of transforming waste into resource (Widmer *et al*., 2005; Williams *et al*., 2008). The fraction including iron, copper, aluminum, gold and other metals in e-waste is over 60%, while plastics account for about 30% and the hazardous pollutants comprise only about 2.70% (Widmer *et al*., 2005). Entrepreneurial activity in the recycling and recovery sector is flourishing in developing countries, where domestic markets for some Electrical and Electronic Equipment (EEE) are ever-growing (Schluep *et al*., 2009; SBC, 2011). At the same time, poor environmental and labor conditions and illegal transboundary movements of e-waste have led to calls for stricter international regulation of the recycling industry (BEA, 2004; IMPEL, 2006; GAO, 2008; EEA, 2009; INTERPOL, 2009; Van Erp and Huisman, 2010). Electronic waste describes discarded electrical and electronic devices. There is a lack of consensus as to whether the term should apply to recycling, reuse, recovery and refurbishing industries. Informal processing of electronic waste in developing countries may cause serious health and pollution problems, though these countries are also most likely to reuse and repair electronics.

Table 1. E-Waste types and their mass of item with estimated life cycle

Item	Mass of Item (kg)	Estimated Life Cycle (y)
Air-conditioner 2	55	12
Iron 3	1	10
Mobile phone (MPs) 3	0.1	2
Personal Computer (PCs) 1	25	3
Photocopier 2	60	8
Radio 3	2	10
Refrigerator 3	35	10
Telephone 3	1	5
Television (TVs) 3	30	5
Washing machine 2	65	8

(Source: Betts, 2008; Robinson, 2009; Cobbing, 2008 and Li *et al*., 2009)

Methodology

The sample of the study covered all of six mobile network operator those are doing telecommunications business in Bangladesh. So, the population considered as the sample of this study. This paper is organized based on both of quantitative and qualitative data collected mainly from the secondary sources. Mobile subscriber's base data collected from periodical online reports of GSM world, Trading Economics, Bangladesh Telecommunications and Regulatory Commission

(BTRC), Association of Mobile Telecom Operators of Bangladesh (AMTOB) and also from the websites of Mobile Network Operators (MNOs). Though the usefulness of secondary data the current problem may be limited but its importance is unavoidable and the information regarding mobile phone subscriber base of MNOs in Bangladesh anyone can collect from BTRC very easily and these are authentic as a legal and authoritative body which is controlling the telecommunications sector. Again, the strategies of MNOs are visible and transparent those can be observed from market movements and MNOs offering's. Furthermore, the same data has compared among different sources and have cross checked where observes slight fraction considered as moderately higher accuracy of information.

A survey about mobile phone waste was conducted among the mobile phone sale and repairer shops of the Chittagong metropolitan areas shopping malls to know the present situation of sales and repairer shops as well as the number of mobile phones added every year as e-waste in the total waste stream of Chittagong and also in order to ensure a higher response rate, face-to-face interviews were employed for data collection. Information from shopping malls mobile phone repairers and sellers and university students was collected through questionnaires. Data were compiled and analyzed. Finally, results were shown in tabular and graphical form.

Results and Discussion

a. Mobile Network Operators (MNO's) market share

Among six MNOs 116.55 million subscribers base of mobile telecommunications sector, Grameenphone has got the highest 42.24% market share having 49.23 million subscribers base where Banglalink is the second highest 25.23% market share gainer with 29.75 million subscribers followed by Robi 20.61% market share gainer with 24.02 million subscribers, Airtel 7.33% market share gainer with 8.54 million subscribers, Teletalk 3.08% market share gainer with 3.60 million subscribers and Citycell 1.21% market share gainer with 1.42 million subscribers.

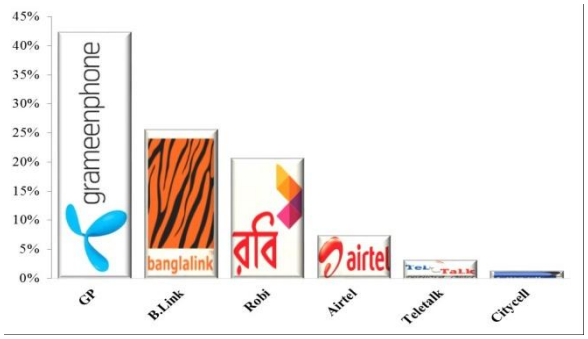


Fig. 2. MNO's Market share % (Source: BTRC, June 2014)

b. MNO's market penetration

Market penetration is another important tool to assess life cycle position of a sector. The mobile telecommunications sector has got 70.60% market penetration i.e. 116.55 million subscriber base among 165.10 million population in Bangladesh till June, 2014. Grameenphone has got the highest penetration at 29.82% among six mobile network operators (MNOs) followed by Banglalink 18.02%, Robi 14.55%, Airtel 5.17%, Teletalk 2.18% and Citycell 0.86%.

c. Waste stream analysis of e-waste due to mobile phone

According to the latest statistics of Bangladesh telecommunications regulatory commission (BTRC) and Association of mobile telecom operators of Bangladesh (AMTOB) the total number of mobile phones users in the country (up to June), 11 crore 65 lakh 53 thousand with 71% mobile phone penetration in touch. But the association of mobile phone operators (AMTOB) saying, the total number of active mobile phone subscribers identity module (SIM) whatever, the total number of mobile phone subscribers is about 75.6 million utmost. Considering that only 45% of the people are now using mobile phones. AMTOB also provide these information to the national board of revenue (NBR). They also say that, mobile phone penetration in many neighboring countries is about 150% but total number of actual mobile phone users is only 100%. According to AMTOB, 35% of the active mobile phone subscribers were account for the dual SIM mobile phone handset. Without them, the total number of mobile phone subscriber handset is about 7.50 million only.

1. Total volume of mobile phone sets as e-waste added per year in the total waste stream = 0.000132 x 7500000 m^3 = 990 m^3
2. Total weight of mobile phone as e-waste added per year in the total waste stream = 0.15 x 7500000 Kg = 1125000.00 Kg = 1125.00 Ton
3. Per capita amount of mobile phone waste generation

$$= \frac{\text{Total Amount of Mobile Phone Waste Generation}}{\text{Total Number of Population}}$$

= (1125000/161000000) Kg = 0.00698 Kg = 6.98 g

Total volume of mobile phones is 990 m^3, total weight of mobile phones is 1125 Ton and per capita 6.98 g of mobile phone waste generated per year in Bangladesh, that amount of mobile phone waste is added per year in the total waste stream of Bangladesh.

d. Metal recovery potential from the PCBs of mobile phone

The sizes of mobile phones are small and so the quantity of metals contained in each cell phone is also small. When many phones become obsolete, however, the quantity and value of the metals contained in those phones become significant. Table below shows the market value of the metals recovered from 1 ton of printed circuit boards (PCBs).

So, from 1125 ton of mobile phone wastes we can recovered about 348.75 kg gold, 105.75 kg of platinum

and palladium, more than 163.29 ton of aluminum and 214.32 ton of copper.

Table 2. Metal recovery potential from 1 ton PCBs of mobile phone

Recovered metal	Weight (kg)
Precious metals (Pt, Pd)	0.094
Gold	0.31
Aluminum	145.15
Copper	190.51

Conclusions

Solid waste management itself only is already a mammoth task in Bangladesh, is becoming more complicated by the invasion of e-wastes. There subsists an urgent need for a detailed assessment of the current and future scenario including quantification, characteristics, existing disposal practices, environmental impacts etc. Establishment of e-waste recycling centers should be encouraged in public private partnership model facilities employing environmentally sound technologies and methods for recycling and recovery are to be established. Governments should encourage e-waste recycling projects under public-private partnership mode and also criteria are to be developed for recovery and disposal of e-wastes. Policy level interventions should include in the development of e-waste regulation, control of import and export of e-wastes and facilitation in development of infrastructure. An effective take-back program providing incentives for the producers to design less wasteful products which contain fewer toxic components and also easier to disassemble, reuse and recycle may help in reducing the wastes. It should set targets for e-waste collection, reuse, recycling, impose reporting requirements and include enforcement mechanisms and deposit or refund schemes to encourage consumers to return electronic devices for collection and reuse or recycling.

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