DESIGN AND MANAGEMENT OF SUPPLY CHAIN AND LEGISLATION OF ELECTONIC WASTE

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Abstract- The environment issue from consumer waste and industrial waste has been the global impact. Electronics waste is the currently a largest emergent waste from the modern technology and lack of disposal strategy in the past when technology was invented. Electronic waste is harmful to community from some materials used in products which are hazardous depending on the category. The management of the electronic waste is a difficult and ambiguous until now because of the legislation follows the fast emergent of technology. The well established guideline is only recently developed to control production, sales, use, and dispose of electronic waste and only available in Europe and some developed countries. Yet, more countries are aware of the problem and has tried to follow the same guideline. One of the main limitation of the process is cost consuming recycle and disposal process. The parts of electronics like televisions monitor, computer hard disks, parts, copiers, fax machines, air condition, washer machines, cell phones, and batteries are e-waste and contain potential substances to health problem and causes damage to environment. This paper proposes a study of source at the process from the beginning of the production to analyze the total linkage in order to management and control of waste materials in electronics. Electronic waste is currently the largest growing current issue in the world. Not only the disposal after use, but the problem including the illegal import of waste to developing countries like for recycling. The smart phone, battery and computer parts are the largest source of waste material. The scope of the research is aim to propose the effective model of reverse supply chain and appropriate necessary legislation to manage the electronic waste. Nevertheless, the electronic waste has values such as valuable materials in some parts. Recycling electronic waste products, including the collection, preprocessing, recycling recyclable parts, recycled materials and waste treatment operations but can be good opportunity for recycle business. The total planning of the process from the production through the end of life of products can be seen by reverser supply chain to examine the model the opportunities can be analyzed. The conventional reverse supply chain mainly consists of producers and vendors or manufacturers and collectors. The reverse supply chain was modeled mainly by manufacturers, logistics service providers and government legislations to guide and control operators in the key parts. Manufacturers formulate electronics recycling program from the date of purchase until the end of products life including their producers responsibility to the end use of the products. Recycling processes, responsible for the development and application of waste transfer the electronic part with help of law to collect and cooperation with guideline for consumer to dispose the products in collection center or sale points such as retail stores. Logistics Service Providers. The logistics service providers cooperate with manufacturers, play a role in collection and carriage, collect waste according to the order from customers, and shipped waste mobile phones to detect node specified by the manufacturer. The precautionary principle must be applied with three preliminary conditions only: 1) Recognition of potentially environmental effects. 2)-Evaluation of the scientific data available. 3)-The extent of Legal issues and community cooperation. Therefore the environmental waste policies and regulations are aimed at controlling the amount of pollution released into the environment and the related local and central government regulations. When a governmental or private program for the electronic waste is to be planning for certain areas, the planners determines all related issues including economic, social, politics, and technology including health impacts, in a study of environmental impacts by follow the appropriate laws. Therefore, clarifications and exceptions raised and must be expected, with the appropriate misperception. Supervising the possible exceeding of the recommended limits in every e-waste procedure and guiding to keeping the appropriate measures for the environmental safety in the possible limitation of the area. In agreement the substance value meaning drives the local e-waste legislation that must includes all the scientifically existed appropriate substance limits, which must be applied in practice. The legislation should comprise at the beginning of the production and after consuming life of the products. The significant part including the collection sites of the dumping of the products after using. In the recycling processes that all the recycling procedures are covered by the appropriate recommended limits as well as the related garbage produced. In the garbage means that every rejected electrical and electronics, must be follow the recommended limits. Also must do the same and the related selecting and transporting procedures of the e-waste. All e-waste exposures to health and to the environment shall be kept as low as reasonably achievable, economic and social factors being taken into account". Therefore must be authorized scientists, with the appropriate training in as low as reasonably achievable, for monitoring and compare the e-waste procedures, in order to help the public and guide the involved personnel to the optimization principle applications and avoiding any possible exceeding of the minimum impact to the health and the environment in every e-waste procedure.

Index Terms- Reverse Supply Chain, Recycle, Electronic Waste, Hazardous Waste

I. INTRODUCTION

The e-waste handling solution is a preferable environmental action. The disassembly and recycling may be contaminate, risky and costly business to the environment and health, as well as is the throw out of the electrical and electronic wastes at the general rubbish dump, which already proved hazardous. The electrical and electronic products recovering and recycling is a very socially responsible action and the

best way of the sustainable development contribution. Therefore the correct legislating, design and management of the electrical and electronic waste, is one of the most urgent environmental problems, which must be solved in national and international level.

The hazardous substances from the corrosion and decomposition of the e-waste components, may release some values of pollution or toxic substances in the air, in the solid and in the water (surface & underground), which trigger's deterministic and stochastic effects on humans, animals and plants, as proved in many other waste impact (i.e. polluted water, radiation etc). The appropriate scientific limit values between the deterministic and the stochastic effects, indicates the difference of the provable effects and of the possibly and under investigation effects in the environment and health. Therefore it is clear that every hazard limit value is a percent of the above limit of the deterministic and stochastic effects, derived from the specific hazardous substance and must be reviewed frequently, according to the new scientific evidences.

The many disposal natures and the collection efficiencies of e-waste, raise some obvious scientific, social and political concerns about the dangers to humans and to the environment. The e-waste legislating, design and management involves various principles, theories and practices, verified continuously according the science progress, in order to protect the health and the environment from any hazardous waste. The not so early (1998) involved general environmental precautionary principle [11] indicates "When an activity raises threats of harm to the environment or to the human health, precautionary measures should be taken, even if some cause and effect relationships are not fully established scientifically". This Legislation, design and management of the electrical and electronic waste (e-waste) procedures. Therefore the taking precautionary measures, in every scientific uncertainty, receives many interpretations, clarifications and specialisations, by exploring and drive alternatives to possibly harmful actions from the electrical and electronic wastes, in order of apply a protection value to the environment and to the general public, as well as for the working personnel in all the e-waste phases, mainly in the related recycling etc. The number of directives of the European Union, are an indication of the clarifications and specialisations needs of the related legislation in the frame of the precautionary principle application, for a sufficient international and national management of the electrical and electronic waste, which worsen the many details and exceptions derived from various public policies or from privet interests and/or from environmental initiatives.

BACKGROUND

The model proposed to analyze the reverse logistic of the E waste is SCOR model is a analytical tool for reverse supply chain management (RSCM) that allows to understand the processes involved in a flow chain of the waste from the manufacturing to the end at the recycle site to identify the features that lead to improvement to efficiency and effectiveness. The SCOR model and its management processes. SCOR is prearranged around five management processes (Plan, Source, Make, Deliver, and Return) that are further subdivided into process categories, elements, tasks and activities. SCOR enables companies to examine the configuration of their supply chains. It also identifies and eliminates redundant and wasteful practices along supply chains. As a supply chain process design, it defines the way these processes interact, how they perform and how they are configured from a supplier's supplier to a customer's customer [21]. The GreenSCOR extension of the model was first introduced in its fifth version, GreenSCOR is a modification that integrates environmental considerations through processes, metrics and best practices into SCM processes, while taking into account the impacts of operations at each stage of the product life cycle. The application of the SCOR model has been reported in the following industries to name a few: the lamp industry, petroleum, construction, tourism, range of the SCOR model application already reported in supply chain optimisation, Supply Chain Council (2010) notes that the model also provides a foundation for environmental accounting in the supply chain. Paradoxically, research combining green performance evaluation and the SCOR model has remained rare. The precautionary principle must be applied with three preliminary conditions only: 1)-Identification of potentially adverse effects. 2)-Evaluation of the scientific data available. 3)-The extent of scientific uncertainty. Therefore the environmental waste policies and regulations are aimed at controlling the amount of pollution released into the environment and the related national and international laws must serve this without exceptions. When a governmental or privet program for the electronic waste is to be applying, the planners must calculate all the possible environmental and health impacts, in a study of environmental impacts by follow the appropriate laws. In some cases this is possible and easy, in some others it is not, due to the insufficient regulations that need the precautionary principle, which concentrates on prevention rather than cure. Therefore more and more arguments, clarifications and exceptions raised and must be expected, with the appropriate confusion. An option to solve the above confusion referred in the Article 191 of the "Consolidated version of the treaty

on the functioning of the EU" [13]. The referred "It shall be based on the precautionary principle and on the principles that preventive action should be taken" may be the adopt of a general clarification and specification, by the complimentary implementation of the three dominant environmental principles, the justification, the limitation and the optimization, well known in physical and medical sciences due to manage every radiation impact to the health and to the environment. The principles in details [14], are adopted by the EU. The justification, the limitation and the optimization principles, as well as applied for many decades in every radiation issue, may including some reference that the application is the e-waste also, by the addition of some special terms. Therefore the complimentary implementation of the justification, the limitation and the optimization to the precautionary principle application in the electrical and electronic waste procedures, may be the adding of the followed words 1.Justification: No (e-waste)practice shall be carried out unless its introduction produces a positive net benefit (to health and to the environment). 2)-Limitation: The dose equivalent (or the substance value) to individuals, (to public health and to the environment) shall not exceed the (e-waste) limits recommended. 3)-Optimization All (e-waste) exposures (to health and to the environment) shall be kept as low as reasonably achievable, economic and social factors being taken into account. According these three principles as the dominant clarification and specification, in every legislation with the precautionary principle, all the electrical and electronic waste actions, which may release hazard substances can be controlled and will enforce the minimizing of exceptions down to zero, as are all the implanted and infected medical devices, and/or the military electrical and electronics waste, built a three-level Reverse Supply Chain system, which including a manufacturer, a processor and a collector, and established a game theory model with uncertainties of both demand and collection. The contracts of premium and penalty between manufacturer and processor, processor and collector were designed. Four kinds of premium and penalty incentive mechanisms in RSC operation were proposed and the influences to the optimal strategies were discussed. established a centralized decision-making
model for waste electric products based on such
two modes as retailer center' and gave an examples tested the model. Results have shown that it's better to choose the mode that has a higher recovery price. Sun Mingbo [22] used the game theory to examine the online and brick-and-mortar sales channels and the closed loop supply chain under the charge of a third party under the dominance of the electronic product manufacturer. By comparison analysis, the third-party recyclers profit did not change in either supply chain model. [23] research shows that remanufacturing enterprise will eventually benefit in reverse supply chain is under the premise of collecting enough material in recycling links. Xu Bing [24] researched the competition between two closed-loop supply chains where each SC consists of one manufacturer and one retailer. A Nash equilibrium model and a Mathematical Programs with Equilibrium Constrains model are set up respectively to characterize the competition between two decentralized CLSCs, two centralized CLSCs, one decentralized CLSC and one centralized CLSC. Nina Yanp [25] distinguished the recovery process between the re-manufacturer and the retailers and then established two dynamic models under remanufacturing Reverse Supply Chain. Both of the manufacturers' and the retailers' expected profit were analyzed under the conditions of different recovery rate and recycling prices. Another research used the system dynamics to build the structure model of manufacturing enterprise's logistics operational cost. The result indicated that the complex relation among factors of manufacturing enterprise's logistics operational cost system could be better revealed with the use of system dynamics methodology. It will be used in the case of discarded car engine. With system dynamics, the trend of the recovering efficiency of discarded car engine in the future was simulated. The changes in the recycling efficiency were analyzed through the adjustment of main parameters that can assist enterprises to improve the efficiency of recycling.

The reverse supply chain network and product recovery system dynamics framework, and then through simulation analysis to study the collection of used products and remanufactured. The simulation analysis of the models shows that the cost will be higher and the income will be lower with more places of collection, and different quality of return product will lead to different ways of disposal, which will in turn have impact on the cost-income of return. It is known from the literature research that the reverse supply chain of waste electronic products has three recovery modes: recovered by the manufacturer, by the retailer or by the third party recyclers. Few researches on waste mobile phones recovery were conducted based on e-commerce platform. Therefore, this paper build waste mobile phones reverse supply chain based on e-commerce platform on the basis of previous studies. The Example of Mobile phone being eliminated by the consumers has a lot of durable pieces, if lost not only a waste of resources, but will also cause environmental pollution. If the good performance parts are reused by module assembling to form a new phone [11], not only can save resources, but also can make the enterprise to reduce costs.

- Reasons for the low waste part recovery have the following four points:

- Recycling nodes are inconvenient for consumers.
- Recycling price is low and time cost is high.
- The cost of manufacturers set up recycling nodes is
- higher than the benefits brought from recycling waste
- mobile phone.
- The price of waste mobile phones that manufacturers
- recovered from the retailer or third-party recyclers is
- higher than recovered from the consumers, resulting in
- increased manufacturers cost.

Therefore, this article build waste mobile phones reverse supply chain based on e-commerce platform from the perspective of consumer's convenience and manufacturer's costs.

A. The construction of overall structure

Recycling waste products, including the collection, preprocessing, recycling recyclable parts, recycled materials and waste treatment operations, is a complex "Systems Engineering". The traditional reverse supply chain mainly consists of manufacturers and retailers or manufacturers and third-party collectors, and in this article the reverse supply chain was built based on e-commerce platform mainly by manufacturers, logistics service providers and e-commerce platform operators three core part, their role in the reverse supply chain are as follows: In the rejected electrical and electronics means the existence of the installation of an organized collection management of the rejected electrical and electronic (equipment or circuit or component), which, in comparison with others, must produces the minimum impact to the health and to the environment. In the dismantling and recycling means that all the dismantling and recycling procedures, in comparison with others, demonstrated that must produces the minimum impact to the health and to the environment. In the rubbish dump means that every waste area, for the rejected electrical and electronics, must be proved that will produce the minimum impact to the health and to the environment by the appropriate measures. And also do the same and in the related selecting and transporting procedures.

IV. RESULT AND SUMMARY

The analysis shows the factors having the largest significant factor the most issue is the community collaboration. In the model corresponding to This implies that in successful firms attention is paid to such strategic factors as partnering with supplier organizations, production sourcing, integration of procurement function with manufacturing requirements through procurement, and an emphasis on understanding the internal and external factors are also significant in the model for successful organization . As discussed previously, successful waste management rely much more on cooperative relationship with their community as the example of municipal waste, which must be locally treated by the appropriate rules. The legislation with the producer responsible principle, as suggestions and every regulation based on it, for the electronic waste, has being revising some times over the years. It appears that the principles of the validation, of the limitation and of the optimization, which works in the recycle principle is a useful tool in clarification and specialization of the electrical and electronic waste legislating, design and management. These principles may be an important addition to the producer responsible with purpose the well been in health and environment by the cleaner air, water and land after the process of recycle and dumping of the remain. This addition may help the regulatory bodies, mainly at the national level, to safely control the e-waste problem, The introduction of the justification, of the limitation and of the optimization in the precautionary principle for regulated dismantling and recycling, as well as for the rejected electrical and/or electronics and for the rubbish dumps, will block the very risky dismantling items from non professional poor people without the occupational safety standards, the improper e-waste characterization, the politically accepted try and error risky procedures etc and finally will permit environmentally correct and healthy regulations, without some detailed marks and exceptions. A well managed today e-waste rubbish dumb will be the future source of the usable substance recovery and must be viewed as an unusable mine, which expect the technology development. Therefore the legislation and management of the e-waste procedures with the introduction of the producer responsibility and community collabolation, as principles added to the waster management, will permit to the future design and policy to improve the e waster from collection to the efficientcy management to e-waste garbage dumb. To improve and engage all parties' responsibilities

1. *Physical Responsibility*: Extended producer responsibility (EPR) forms the basis of the above legislation, thus, physical responsibility lies with the producers. The manufactures should provide the channel and location and plan to collect the waste of electronics. The government should supervise and the manufacturers should provide the channelization of e-waste till the disposal process. Producers should set up collection centers individually or collectively for collection from private households.
2. *Financial incentive for the producer involvement and Responsibility: EU*

WEEE Directives put the financial burden on the producers for the entire process of collection, transportation, recovery and disposal. In additional, the incentive may include tax reduction and promotion to the producers are required to provide guarantee for financial management of product before placing it on market.

3. *Collection*: Though EU directives provide a framework for collection process. In developing country the collection of all hazardous waste is tropically not well plan and managing the Collection. Waste separation is also the foremost difficulty in many areas. The Collection centers have an responsibility to collect WEEE from disposer free of cost. Separate collection of hazardous waste and segregation of re-usable WEEE prior to recovery is promoted by the legislation.
4. *Monitoring*: Monitoring of regulations regarding implementation and compliance is very important task. The legislator should provide the clear supervising agency and well-defined regulation.

The promoting suggestions are awareness and Education through nationwide environmental programs and some education on environmental protection, general awareness of environmental threats caused by products is almost non-existent. Therefore, awareness on the effects of e-waste to the environment and human health should be created at all levels of government and the general public. Other responsible organization should conduct such awareness through workshops/seminars, TV campaigns and other means. Legal and Regulatory Issues At the moment, Although the government has rule out the plan on zero wase and good e-waste management, these conventions will not be effective without developing national regulations and policies. The government should therefore as a matter of determination convey and enforce regulations and policies that cater all stakeholders including individual consumers. Recycling and Refurbishments The e-waste recycling is an opportunity for developing countries since valuable items can be extracted from end-of-life or discarded. They contain many components that can be resell, reuse, refurbish and recycleed such as gold, silver, palladium, copper, aluminium, steel, and glass. Therefore, recycling them into secondary products can result into positive economic impact.

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