THE SPECIFICITY OF REVERSE LOGISTICS WITH AN EXAMPLE OF MOBILE TELEPHONY

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Abstract

The aim of article is to draw attention to the problem of reverse logistics of electronic products exemplified with mobile phones. This paper presents life cycle, the process of recovery and reverse logistics of electronic products exemplified with mobile phones. In the article the following hypothesis was formulated: artificial shortening of the life cycle of mobile phones increases the number of products used in the recovery process.

Keywords: Life cycle, reverse logistics, mobile phones

1. INTRODUCTION

Technological development and production of electronic devices shorten the period of their use and the formation of large quantities of post-consumer waste. The aim of this article is to draw attention to the problem of reverse logistics of electronic products exemplified with mobile phones. With such a posed purpose the following research question was formulated: what impact on the reverse logistics does artificial shortening of the life cycle of mobile phones have? In an attempt to answer such a specific research question, the following hypothesis was formulated: artificial shortening of the life cycle of mobile phones increases the number of products used in the recovery process. As justification for the subject of the paper, it is possible to point to some shortcomings in the field of theoretical analyses and empirical research in the reverse logistics of electronic products. Mobile phones are an example of electronic products, which significantly occur in the re-use market. It can be concluded that mobile phones are frequently reused than recycled. This paper presents life cycle, the process of recovery and reverse logistics of electronic products exemplified with mobile phones.

2. LIFE CYCLE OF ELECTRONIC PRODUCTS

The product life cycle consists of four phases: introduction on the market, increase of product sales, product maturity and the product end (**Figure 1**). The length of the particular phases of the product life cycle as well as the entire life cycle depend on its type. Electronic products are characterized by constant technical and technological changes, as well as the ability to meet the new needs of buyers.

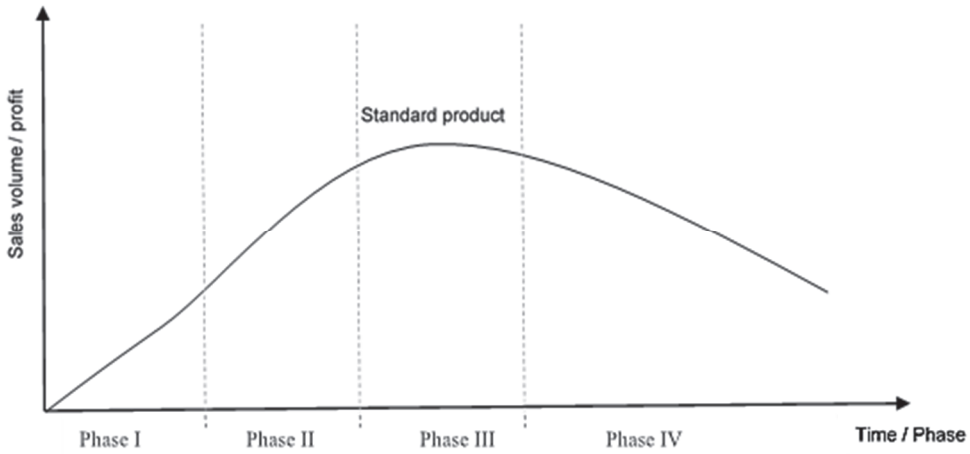

Figure 1 Life cycle of a product

Due to the continuous improvement of electronic products, both individual phases of the product life cycle and the whole cycle become shorter. A good example of electronic products are mobile phones. Mobile telephony market is characterized by a high level of saturation and the growing number of operators and consumers. It can be said that already in the maturity phase of mobile phone a new model occurs (**Figure 2**). In this way the life cycle of mobile phones shorten. All companies whose activity is the manufacture of mobile phones can exemplify that, such as Apple's iPhone and Samsung Galaxy. These companies constantly add new features to the phone user.

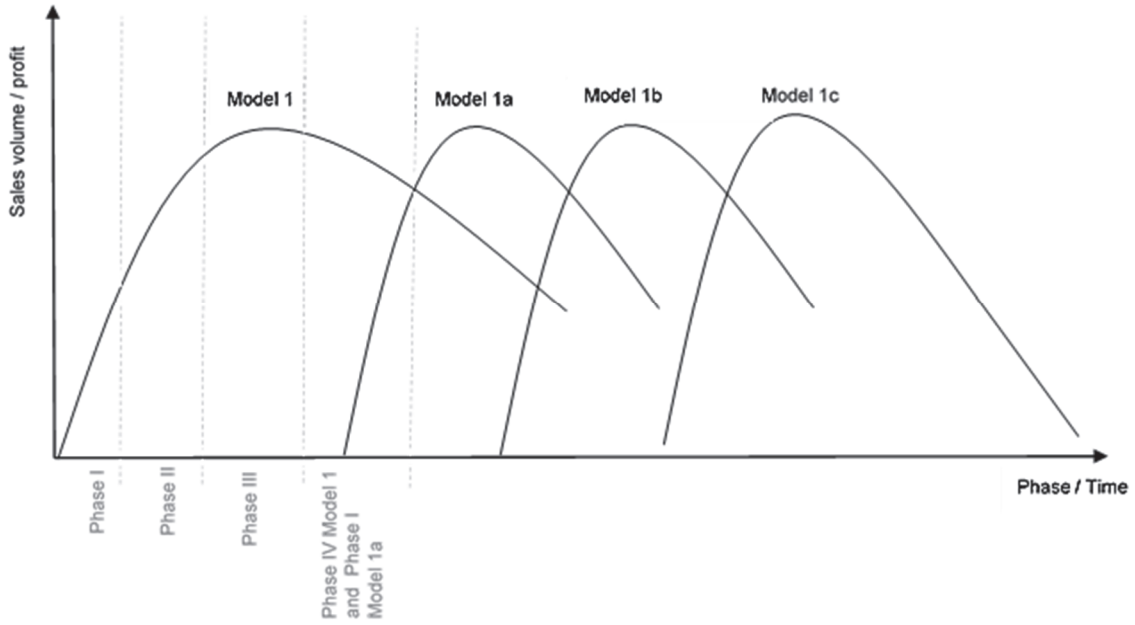

Figure 2 Life cycle of mobile phones

The shortening of product life cycle has now become, in stable condition market structures, one of the most important elements of the strategy development of both manufacturing and commercial companies. They are based on generating profits in line with the principle of 'high turnover at low profit margin, which is not totally consistent with the principle of fairness of manufacturers and traders'. Factors which force customers to make purchases more frequently are, among others: manufacturers conspiracy, technological similarity of products, the lack of market transparency from the viewpoint of clients, shrinking population of rich societies and finally - demand saturation [1].

Technical differentiation of available products, however, is so large that there must be properly diversified methods of shortening their life. Basically they can be divided into two groups associated with the planned acceleration of technical and moral (psychological) use. The methods of shortening product life can be divided into two groups, due to technical wear and moral wear [1].

The most common methods of accelerating technical and electronic wear of products include, among others:

- breaking connection of components,
- use of poor quality or undersized components in electronic circuits of processors,
- bonding of housings, for example in mobile phones, which is designed to prevent access to the interior and thus, in practice, impossible to repair,
- inflating the prices of spare parts or decreasing their availability,
- introduction of new products technically incompatible with the earlier models,
- fitted cycle counters (e.g. in computer printers, batteries of mobile phones and portable computers) [1].

According to specialists, in the electronic industry devices are aging even faster. Some experts noted the rapid evolution of Apple's iPhone model. The first model of 2007 did not have what many competitors had, e.g. GPS, possibilities of making films, sending MMS, it did not support a connection to a network of third-generation (3G). Those imperfections were eliminated in the next two versions of the iPhone. The S. Jobs' motto, the president of Apple Inc. was: 'it would be best if every year people bought the new iPhone' [2]. Thus, consumers wishing to purchase a new mobile phone model shorten the product life cycle. The methods that have an impact on the purchase of new equipment include, among others:

- connecting the brand with scientific, moral authorities and likeable celebrities who give their support not out of conviction but for a fee,
- apparent change of products usability which consists of a simple e.g. made from the software - Firmware - built-in device called firmware that provides the basic procedures for its operation,
- improvements to the software update by placing a flash memory or EEPROM (Electrically-Erasable Programmable Read-Only Memory),
- reducing the number of entries and deletions of memory, depending on the type and manufacturer, which ranges from 10 000 to 1 000 000 cycles, when exceeding this value memory fails,
- unlocking in newer or more expensive versions of the product some of the features that physically existed in the previous version, often in new products such technical parameters are changed that do not actually give users any new opportunities.

3. LOGISTICS PROCESSES OF ELECTRONICS RECOVERY

According to the definition by S. Krawczyk, process creates a set of activities related to time and space relationships and technology-based logic that gives it a structure of a partially ordered set and allows to distinguish direct and indirect links transfer, implemented in order to achieve the intended result, performed in accordance with specific rules, including various internal and external factors that can promote or hinder the process. Processes of logistics however are the processes to support the production of the product, requiring coordination with both the basic manufacturing process as well as between them, form a group, which are dealt with in the framework of logistics [3]. Therefore, recovery processes are those processes that support the coordination of actions after the product life.

The standard examples dealt with processes in which actions lead to a product having value for the user receiving it, if the recovery actions involve dismantling and acquiring part of the product (raw materials, components).

The publications based on the definitions of reverse logistics are oriented to demonstrating the possibility of increasing the degree of recovery of recyclable materials from waste streams [4]. In the literature the term reverse logistics is translated often wrongly as return logistics however, it is assumed that this means the logistics of recovery [5].

Reverse logistics is defined as the process of planning, implementing and controlling an effective and cost-efficient flow of secondary material within the supply chain and information associated with these commodities in the direction opposite to the direction of flow in the traditional supply chain to recover the value or proper development [6]. Reverse logistics puts an emphasis on the recovery of the value inherent in the product or packaging [7]. Logistics in the traditional sense involves moving raw materials to manufacturers and products to end customers. After delivering the product to the final customer, that is the moment when it reaches the place of destination and use, the primary logistics process ends and thus another processes begin called return processes. These processes result, among other things, from product returns, their use and service, and at the end of compulsory development after the withdrawal from use [8].

Since decommissioned electrical and electronic equipment is a material object, supporting operations for dismantling and sourcing components are known from the traditional logistics transport operations and warehousing coordinated with the entities forming so-called removal chain, thus [9]:

- place of formation of useless products, including waste;
- entities organizing the collection;
- entities engaged in segregation and
- landfill or recycler.

4. REVERSE LOGISTICS OF MOBILE PHONES

In recent years a mobile phone has become a common electronics device. The amount of produced and utilized phones causes that it is currently the subject of a significant impact on the environment. According to data cited by the US Federal Communications Commission, the first mobile phone was introduced to general public in 1983 by Motorola's DynaTAC. Twenty years later, it was sold worldwide more than 1.2 billion items of phones within a year [10]. In recent years it has been possible to see some stabilization of sales, which in 2013 was estimated at 1.8 billion items [11]. According to the report of Ericsson Mobility the number of active phones in 2014 amounted to about 7 billion [12].

In addition, the abrupt technology and usage changes of mobile phones should be considered, which are signalled even by calling them Smartphone or iPhone. While users appreciate features offered to them, which is the software, so much in our perceptions we look at the composition of the material, preciousness used in the production of materials and the possibility of their recovery after use of the phone.

To be aware of the economic potential of the recovery of materials from which the mobile phone is produced, it is sufficient to take into account that its composition is:

- plastics - 56%
- metals - 25%, including copper - 15%, iron - 3% aluminium - 3% nickel - 2% and other rare metals (gold, silver, platinum, palladium) - 1%
- glass and ceramics - 16%
- other materials - 3%.

Percentage indications should be complemented by quantitative data. It is estimated that - of course depending on the phone model - with one item there can be recovered about 9 grams of copper, 150 milligrams of silver, 25 milligrams of gold, as well as small amounts of platinum and palladium. It is therefore estimated that sales in 2013 of 1.8 billion items of the phone gives at least 280 tons of silver, 25 tons of gold, 10 tons of palladium and 16 000 tons of copper, of which only less than five percent was recovered [13]. The reported figures clearly suggest that the mobile phone sector deserves more perspicacious attention both from the point of view of marketing as well as operations on products withdrawn from use.

In the case of mobile phones the removal chain should take into account highly skilled sourcing of rare materials and dangerous for human health and the environment. The awareness of the presence of such materials suggest that in places where segregation is made there should be employed workers with the right skills in the field of handling hazardous materials.

Taking into account the hierarchy of worn mobile phones, it is possible to distinguish the following phases and corresponding tasks:

- re-using,
- re-producing, creating seamless logistics chains for components subjected to the process of repair or regeneration,

- recycling, creation of an efficient system of sorting, collecting and receiving used goods and their components in the recycling system,
- storage, creating an effective system of sorting, collecting takeback goods and their components, and transport to landfills or recycling station [4].

The diagram of recovery processes shown in **Figure 3** presents flows of the used mobile phones according to the above phases.

According to the *Package of closed-circuit economy* adopted on 2 December 2015 by the European Commission in re-use, re-manufacturing and repair sectors, the cost of re-generation of mobile phones would be about half that if it would be easier to break them into parts and 'if it would be possible to collect 95 % of used mobile phones, it could bring savings in material costs in the amount of over 1 billion euros'. The Commission shall take the initiative in a number of areas that will be aimed at the promotion of products that can be more to repair: in the context of future work relating to new or revised implementing measures on ecodesign. The application of standardization for efficient use of materials in the framework of ecodesign includes work on standards to facilitate carrying out repairs (2019.) The Commission is preparing a programme of independent research on issues related to the practice of the potential deliberate shortening of product life cycle [14]. The environmental awareness of enterprises and population is growing. However, giving mobile phones to special points is not the only solution. It is essential to re-use as them an option. According to the 3R principle (Reduce, Reuse, Recycle - in Poland it is a 3U principle (avoid buying unnecessary things, use again, dispose) - electro-waste can be reused. On the market there are many companies receiving broken, unwanted mobile phones. This reduces the scale of environmental pollution due to harmful emissions generated in the production process as well as due to the accumulation of waste.

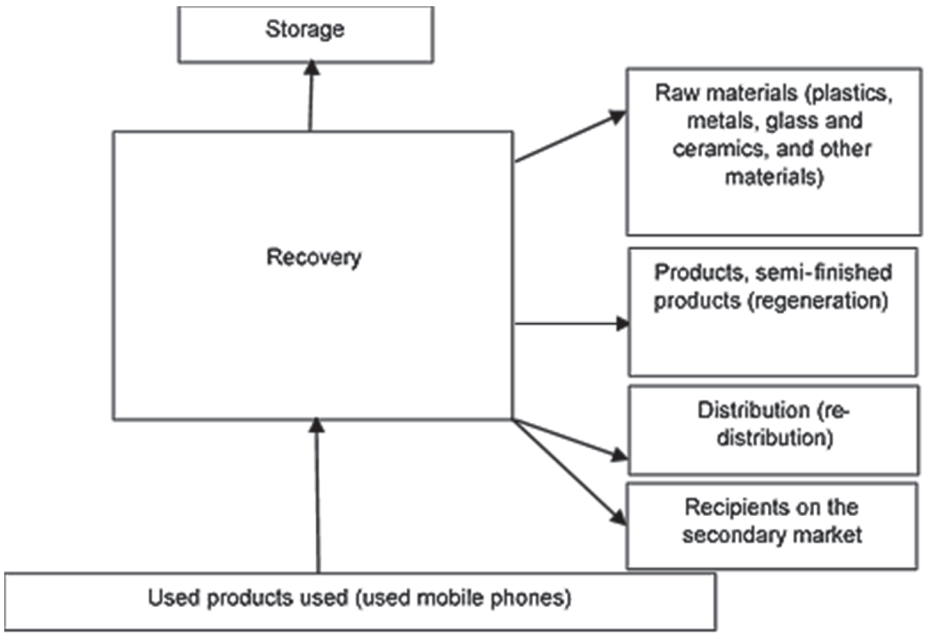

Figure 3 Diagram of recovery processes of mobile phones

The reuse of telephones saves valuable and scarce raw materials. Specialised companies maintain collection and purchase of phones, taking not only efficient, but also wrong items. They are managed in a fully controlled and environmentally friendly recycling or recovery process. A high number of acquired phones after improvement and possible repairs is re-used, mainly in the markets of developing countries, where the barrier is access to telecommunications technologies most often caused by a too high price of new phones. Mobile phones, which are not suitable for re-use, are recycled in an environmentally safe way.

5. CONCLUSION

The benefits of reverse logistics is certainly an impact on human health and the environment, which will not be exposed to toxic substances and elements included in this type of waste as mobile phones. Plastics, glass, metals, including precious metals, some substances can be re-used. Electrowaste is the fastest arriving type of waste. Thanks to its recovery and partial re-use of resources we save valuable space that could be used for its storage. The companies included in the repair, renewal and disposal market of mobile devices recovered from the repayment of warranty and post-warranty schemes and in Europe offer a refund of after leasing or damaged mobile phones, tablets and other mobile devices, renewing and re-utilization, which results in lower costs. It should be noted that any discoveries and achievements of man in time are translated into the current economic life, transforming them significantly. Reverse logistics is the answer to such transformations [5]. Due to a shortening life cycle of mobile phones more and more used products go to recycling and thus more and more raw materials, semi-finished products are involved in the process of reverse logistics.

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