Electronic Business

Planned Obsolescence in Electronic Business

Thesis

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Abstract

The more and more we can find landfills which are loaded with electronic components that are disposable, old-fashioned, broken, damaged or have simply become useless. Most of them are designed to age artificially, which means that they are limited to work for a certain period. This concept is called Planned Obsolescence and can also be found in the area of Electronic Business. Although this approach helps companies to sustain the demand and increase their market share, the resulting throw-away mentality has a negative impact on the environment, which becomes increasingly a problem nowadays. E-waste is a serious problem for the environment because its toxic materials are often not recyclable and pollute the water, the ground and the air with hazardous consequences for all animals. This paper deals with the different forms of Planned Obsolescence in the field of E-Business and shows the environmental consequences of our throw-away mentality with electronic gadgets. In addition to this, it is shown how this process could be interfered and what the latest scientific findings propose to reduce the amount of e-waste.

Keywords: Planned Obsolescence, Built-in obsolescence, E-Business, E-Waste, Hardware, Software, Externalities, Computers, Printers, Ink-Cartridges, Cell phones, Technical progress.

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1. Introduction

1.1. Background and Motivation of the Thesis

Obsolescence is part of our modern society. In our everyday life we are surrounded by products that are disposable, old-fashioned, broken, damaged or have simply become useless. In one word: obsolete. This natural process will occur when a product has fulfilled its task or lose this function, when the obstructed material is naturally wearing out.

On the other hand, one talks about Planned Obsolescence when products are designed to age artificially. Products are deliberately planned and produced with a limited useful life, so it will become obsolete or non-functional. The goal behind this strategy is to stimulate the demand of the consumers by encouraging purchasers to buy sooner if they still want a functioning product. While this strategy has its origins in the 1920s and 1930s, the concept still holds. The domain of Electronic Business is no exception.

The degree and the conspicuity of Planned Obsolescence are various and differ for every product. While some products are clearly adapted to the design of Planned Obsolescence such as cars or cell phones, which are produced in cyclic series, other goods may not appear manipulated at first sight.

The consequences of this throw-away mentality results in the high growth of waste. In 2004, about 315 million working PCs were retired in North America alone.

The goal of this thesis is to give a short overview of a topic related to Electronic Business and New Media. Although the term Planned Obsolescence is well known and widely discussed in general, its relation to Electronic Business is rarely considered.

1.2. Problem Statement

Planned Obsolescence is not always easy to spot. Nevertheless, it exists also in the domain of Electronic Business. Consumers buy new computers, printers and supplies even if the older ones are still (at least partially) working. The Software-Market is now and in the future a huge and important market. For the developer and designer of new software, Planned Obsolescence plays a major role. Although software plays a crucial role in the development of the Electronic Market it does not have yet the focus in the science that it deserves considering the importance it has in our everyday life.

An important characteristic of Electronic Business is the fact that a lot of goods are produced, used and sold online. These products are indicated as non-physical services. Nevertheless they are producing waste. This kind of waste is often not taken into account by the costumers because they cannot see it or bear it in mind. It is a goal to identify more information, share it in form of figures and facts of examples to get a better picture of the real cost of Planned Obsolescence in the domain of Electronic Business. Hard- and software for computer industry are in the focus of closer consideration. A last part deals with the question how e-waste can be reduced.

1.3. Research Questions

1) **What is Planned Obsolescence?**

   The third chapter deals with the phenomena of Planned Obsolescence. It is the goal to show what this concept means, where it came from and what the rationale behind this strategy is.

2) **What types of Planned Obsolescence exist?**

   Planned Obsolescence can occur in many different ways. While some forms, such as premature function failure, are well-known other forms may be unfamiliar. Chapter three deals also with the different forms of Planned Obsolescence in general while chapter four takes a closer look to products of E-Business.

3) **What are the consequences of 'modern' Planned Obsolescence?**

   When traditional goods create waste electronic products create e-waste. Chapter four shows the consequences of disposal of several products in the area of E-Business

4) **How can e-waste be reduced?**

   Chapter five and six take on the question who is responsible for the throw-away mentality and what can be done to reduce the amount of waste on the long-term.

2. Electronic Business

The following chapter will deliver an introduction to Electronic Business (*E-Business* or *eBusiness*). Is it important for the further understanding of the topic to clearly name some definitions to stake out the limitations of the research field that is covered in this thesis. A short disambiguation of Electronic Business and its different characteristics will help to situate Planned Obsolescence in this area.

2.1. History

It has been a long way to the information age and the knowledge-based society where we are right know. Our everyday life would be unthinkable without information technology and Internet. The most important characteristic is its ability to cross-link. It is possible nowadays that people, organisations or even markets can be connected with each other in a way that would have been unimaginable decades ago [Staudt 2001, p. 15]. The possibility to gain and exchange information from all over the world plays a catalytic role for the tendency of globalisation.

The Internet is working round-the-clock. This means that the economy has to adapt itself to the same rhythm. As a logical consequence, lifting substantial parts of the economy from a physic to a digital basis leads to a change in both the processes and market structure. Physic representation is replaced by virtual presence and “business hours” are no longer relevant. The exchange of services, goods and information becomes unlimited. The Internet goes beyond local or national borders. Every company can attract customers from all over the world and is in the same time in a worldwide competition [Staudt 2001, p. 21]. The factor information becomes increasingly more important compared to the factor production due to the technological change. Firms relocate their business process into the Internet and interact with their customers and suppliers via information and communication technology systems. [Meier & Stormer 2009, p. 2]. This is where Electronic Business takes place.

2.2. Definitions

The term Electronic Business includes a broad range of concepts and processes and has therefore various definitions, each placing emphasis on different aspects. The definition of Herden and Zwanziger delivers a general overview: *“E-Business means, the integrated execution of all automatable business-processes in a company, with the help of information- and communication-technology”* [Herden 2004, p. 355].

This definition shows that E-Business influences two processes: *transaction-cost* are kept low through integration of business-processes. Cross-linked information systems help to create an

efficient and quick communication. This applied information- and communication-technology accelerate also the *pass-through time* by the automated execution of business-processes.
The short definition given by AEDE (E-Agribusiness Working Group) places a special emphasis to the fact that there are people necessary to conduct eBusiness. They describe E-Business as a *"Business that uses computer media and involves a minimum of two players"* [AEDE 2003].
One aspect is still missing though. These electronic business relations have to add value to a product, in a monetary or immaterial way. Hence, the preliminary definition for this thesis will be the E-Business definition of Meier and Stormer:

"Electronic Business bedeutet Anbahnung, Vereinbarung und Abwicklung elektronischer Geschäftsprozesse, d.h. Leistungsaustausch zwischen Markteilnehmern mit Hilfe öffentlicher oder privater Kommunikationsnetze (resp. Internet), zur Erzielung einer Wertschöpfung. Als Leistungsanbieter und Leistungsnachfrager können sowohl Unternehmen (Business), öffentliche Institutionen (Administration) wie private Konsumenten (Consumer oder Citizen) auftreten. Wichtig ist, dass die elektronische Geschäftsbeziehung einen Mehrwert schafft, sei dies in Form eines monetären oder eines immateriellen Beitrags" [Meier & Stormer 2009, p. 2].

This additional benefit expresses itself mainly in two different ways. On the one hand the customer has the possibility to decide freely and unhindered what he wants to buy without entering into a commitment in an early stage. The consumer can compare different offers whenever he wants without taking opening hours into account. If personal help is desired the Internet offers several ways, such as chat function or email support, to contact a supplier. On the other hand products receive a new service quality in Electronic-Business. Products are linked with different kinds of software. The latest cell phone technology is a good example. It has many different functions such as GPS-localisation, several ticker services, photo and movie function which allows the costumer to use the cell phone for many more applications than just to call other people [Staudt 2001, p. 24].

2.3. Types of E-Business

In a functioning and modern business environment suppliers and customers are involved in the planning and manufacturing process. Connecting partners, customers or suppliers through electronic networks require therefore new business strategies and new business models. Figure 1 shows the three most important participants in E-Business (Consumer/Citizen, Business and Administration) and their possible relationships.

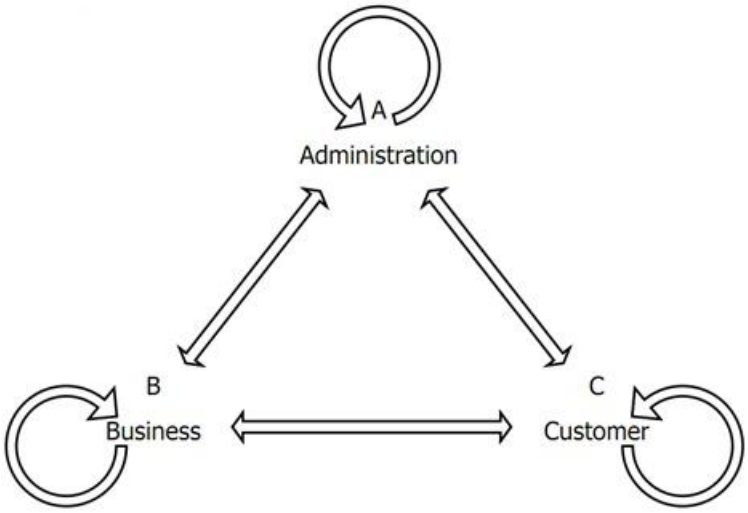

Figure 1: Possible E-Business Contacts [Meier SS2011].

Every market participant can be both vendor and consumer. This generates nine possible business relations. Business-to-Business and Business-to-Consumer cover the biggest part of all business relations: Companies offer their products and services to other firm or consumer. These relationships are better known as Electronic Commerce or eCommerce. The definition given by the OECD emphasises the digital aspect in this process: *"Electronic Commerce refers generally to all forms of transaction relating to commercial activities, including both organizations and individuals that are based upon the processing and transmission of digitized data, including text, sound and visual images"* [OECD 1997].

Another subset consists of the combinations A2A, A2B and A2C which are labelled as Electronic Government (eGovernment). E-Government describes the fact that information and communication technology is used in the administration to facilitate several processes. Not least, consumers are capable of offering their services to other consumers (C2C), companies (C2B) or administrations (C2A) [Meier & Stormer 2009, pp. 3-4].[1]

3. Planned Obsolescence

This chapter will deliver an introduction to the topic that will be discussed in the framework of Electronic Business. *Planned Obsolescence* is an issue that has been discussed in academic research for a long time. It is a topic that stands periodically in public interest. As Cooper states, a recent revival in the interest of product life spans has taken place in the context of increasing waste generation and the sensitisation for the environment [Cooper 2004, p. 421]. The first paragraph will help to understand the term Planned Obsolescence. Several definitions will provide a solid basis. For a better understanding of the concept it is necessary to know the different types of Planned Obsolescence. Hence, the different types of

[1] A more detailed spread sheet with examples to each combination can be found in the appendix.

obsolescence are characterised in the next part of this chapter. A quick look into the origins of the term will complete the statement. The sound background will further the understanding when the rationale behind the strategy is analysed in the last part of this chapter.

3.1. Definition of 'Planned Obsolescence'

Vance Packard was the first to criticise the concept of *Planned Obsolescence* in the 1960s. He criticised the artificial curtailment of product life spans in his pioneering book *The Waste Makers*. He understood Planned Obsolescence as *"a strategy to influence either the shape of the product or the mental attitude of the consumer"* [Packard 1960]. Therefore, products are deliberately planned and produced with a limited useful life, so it will eventually become obsolete or non-functional.

Although the definitions are rather similar each emphasises different aspects. Bulow adds the consumer's consequence to the definition: *"Planned Obsolescence is the production of goods with uneconomically short useful lives so that customers will have to make repeat purchase"* [Bulow 1986, p. 729]. This is a finding that will be very useful in the chapter *Rationale behind the strategy*. Another definition accentuates the active decision made by the company: *"[Planned Obsolescence is] A manufacturing decision by a company to make consumer products in such a way that they become out-of-date or useless within a known time period"* [Investopedia 2011]. Thus, we talk about Planned Obsolescence when a business strategy decision is responsible for the artificial aging or the impracticality of a certain product.

3.2. Types of obsolescence

Packard didn't just deliver a definition in his seminal work. His contribution persists in the further typology he proposed. Packard distinguished obsolescence of function, quality, and desirability [Packard 1960]. These three types remained more or less unaltered and will be presented below with some extension made by other researchers.

Obsolescence of function: In this situation an existing product becomes outmoded when a product is introduced that performs the function better [Packard 1960]. It is also known as *Economic obsolescence*. It occurs when financial factors cause products to be considered no longer worth keeping. The cost-benefit calculation becomes negative [Cooper 2004, p. 426].

Obsolescence of quality: Obsolescence of quality occurs when *"a product breaks down or wears out at a given time, usually not too distant"*

through deliberated intent [Packard 1960]. Producers shorten the usable life of a product through one or more of the following physical obsolescence mechanisms:

- *Limited functional life design (or "death dating")*. Products were produced to last for a certain period of time. This was a common practise in the 1950s and 1960s. Portable radios were designed to last only 3 years; light bulbs were limited to 1000 lighting hours. It is a concept that is still used in a few product planning, but not as obvious as in past times [Guiltinan 2008, p. 20].[2]
- *Design for limited repair.*
  Disposable single-use products that were designed to be non-repairable or aligned with disproportional costs to repair. Examples are single-use cameras or the replacement of lithium-ion batteries used for IPhones [Guiltinan 2008, p. 20].[3]
- *Design aesthetics that lead to reduced satisfaction*. Cooper shows that aesthetic characteristics can influence premature disposal. He names the example of *faultless forms and surfaces* on products such as small appliances (IPhone, MP3-Players and Navigation-Systems). The devices have a pristine and polished appearance which becomes damaged with everyday use, provoking user dissatisfaction and hence premature disposal [Cooper 2005].

Obsolescence of desirability:

Packard notes that obsolescence of desirability comprises *"products that are still sound in terms of quality or performance become "worn out" in our minds because a styling or other changes make them seem less desirable".*
This sort of *psychological obsolescence* comes from a subjective change in the user's perception. A change in

[2] A famous example is the fragile Click Wheel that was processed by Apple in its IPods. Further informations can be found in [Guardian.co.uk 2006].
[3] Several Consumer Interest Organisations and Tech-Sites accuse Apple to design deliberately their IPhones in a way that repair costs are higher than product replacement. Further informations can be found at [Ifixit 2011].

desirability originates in learned experience, status achievement or a transition in aesthetic quality [Packard 1960].

Guiltinan differentiates additionally into two categories:

- *Design for fashion.*

  Today, fashion plays an important role in the decision of replacement. If a product seems "old-fashioned" consumers perceive it as less desirable and tend to replace it more often. Producers are aware of this coherence and apply increasingly fashionable components to their products [Guiltinan 2008, p. 20].

- *Design for functional enhancement through adding or upgrading product features*

  With technological development, firms have the possibility to modify products from time to time and add several new functions. With an expanded number of uses or benefits (e.g. adding a camera feature) or an improved level of performance on existing benefits (adding memory to a computer) consumer tend to see their product as less desirable. See that this perception is close related with obsolescence of function [Guiltinan 2008, p. 21].

  An additional perception of this category is better known as *technological obsolescenc*e. Technological development leads to products that are better performing, smaller or less weighty. Older products are often not competitive compared to these goods or worse, not compatible [Maycroft 2009, p. 27].

Another similar approach by Granberg emphasises the question who is responsible for the decision that a product becomes obsolete. He differentiates between *absolute* and *relative obsolescence*. Absolute obsolescence arises from technical failure, that is to say it is no longer able to fulfil its function. Therefore, its intrinsic durability *"depends upon an ability to resist "wear and tear" and material degradation (e.g., when rubber dries and cracks), process*

quality (i.e., product consistency in manufacturing), and factors relating to maintenance (i.e., ease of repair, availability of parts)" [Granberg 1997]. These three factors lie in the responsibility of the manufacturer. The company decides how resistant a product is and if maintenance is effectively possible. By contrast, relative obsolescence appears from an evaluation of existing products in comparison with new models. In this case, the user decides if a product becomes obsolete or not. His decision is based on objective and subjective aims such as technological change or fashion. Although the concept is mainly the same, this perception allows showing who takes the final decision for obsolescence.

3.3. Origin

Although Planned Obsolescence is often seen as a phenomenon of the modern age, it has its origin in the early 20th century. With the change from man-powered to machine-driven production, manufacturers were confronted with the problem that they *could* produce more goods than were consumed. They suffered from overproduction. A simple answer to this problem is that *demand* must be raised.

The difficulty behind this is how demand can be created and sustained. Producers therefore elaborated several strategies: First, they developed innovative marketing campaigns to effectively advertise their products. Furthermore, *Branding* became more important for companies. Consumers should consume good from the same brand to increase a company's demand. Last but not least, manufacturers could increase their sales when products became less durable. Planned Obsolescence was born [Slade 2006, p. 33].

Several everyday commodities became less resistant. Products such as nylons, washing machines, mattresses and smoothing irons were produced with a lower life expectancy [Arte 2010]. The best documented business of Planned Obsolescence in the early 20th century was the case of the Phoebus cartel. The Phoebus cartel was a cartel that existed to control the manufacture and sale of light bulbs and consisted of Osram, Philips, General Electric and other important companies from December 23, 1924 until 1939 [Wikipedia 2011a]. With a territorial allocation among the members, the cartel reduced competition in the light bulb industry for almost twenty years. The cartel has been accused of preventing technological advances that would have produced longer-lasting light bulbs [Krajewski 2001]. Furthermore, the members agreed on lowering the guaranteed burn time of a light bulb to 1000 hours (previous 2000-5000 hours) while increasing the prices for a light bulb [Höge 2006].

Unlike today, Planned Obsolescence was more or less openly propagated and was seen as an appropriate way to overcome the problem of a saturated market. In 1932, Bernhard

London wrote his pamphlet *Ending the Depression Through Planned Obsolescence*, in which he hold the consumers responsible for the Great Depression. In his theory, the economy was faltering because they use *"their old cars, their old radios and their old clothing much longer than statisticians had expected"* [London 1932] and therefore, manufacturers couldn't sell their goods. His solution proposed a government agency, which would determine the lifespan of a manufactured object and tag it with an *expiration date*. Consumers who would use their products past this date would be penalised [White 2008]. Although such a law was never implemented, it was the first time that a bigger audience came in contact with the concept of Planned Obsolescence. Stevens, a US-American industrial designer definitely introduced the term in 1954. His definition of Planned Obsolescence *"Instilling in the buyer the desire to own something a little newer, a little better, a little sooner than is necessary"* [Adamson 2003], became his catch phrase and popularised the concept in a broad range of industries.

As mentioned before, Packard criticised the concept in the 1960s. His seminal work launched a lively discussion in society about the durability of goods. Planned Obsolescence did not disappear but was thereafter implemented in a more inconspicuous manner.

3.4. Rationale behind the strategy

Although Planned Obsolescence was widely discussed, empirical evidence and an economic theory of Built-in obsolescence have been notably weak [Bulow 1986, p. 729]. Nevertheless, Packard stated that Planned Obsolescence had its major development in the post war period. The main reason for this strategy has already been named: *increase of demand*.

The so called *durable goods problem*, that is to say maintaining high rate of sales growth in a durable goods market, happens when producers saturate in their markets. The more reliable and long-lasting the product is, the longer the repeat purchase cycle is and the slower the rate of sales growth is [Guiltinan 2008, p. 21]. Therefore, Planned Obsolescence helps the manufacturers to force the consumers in several ways to replace their products.

A rental service can be seen as a solution to receive a constant income flow over time, but once all products are disposed on the market, the *time inconsistency problem* occurs anyway. A company has then its interests no longer in the value of the produced goods. Instead its interests lie in the next generation of goods.

That issue further complicates the problem because these products start to compete with older versions of the same product. The more durable a good is the greater is the competition between old and new goods and the lower is the price of a replacement product. To overcome this situation, products durability must be lowered. Hence,

companies start to increase the rate of replacement. This sort of problem exists in all forms of competition and cannot just be found in the case of a monopole [Guiltinan 2008, p.21].

But Planned Obsolescence is not just used for maximising the profit. It becomes necessary to survive in more competitive markets. Production is adapted to demand and competitive actions. If a company spend more time in developing a product that is more persistent they risk producing *out-of-date* products due to technological change. In the worst case such *unplanned technical obsolescence* can have fatal consequences. If a firm uses obsolete components (for example VHS instead of DVD recorders in the 1990s) they won't sell their products. But the development and research costs remain. The result is a deficit that could seriously threat the existence of a company. Hence, it is inevitable to keep the length of the production process and the time required to adapt production to demand as short as possible [Maycroft 2009, p. 18].

There is also a disparity between durable goods and the willingness of competitive necessary self-cannibalization. The more durable a good is (and its more costly development) the lower is the willingness to replace it with a new innovative product which makes the old one obsolete. But the market shows that if a firm will not cannibalize its own product's sales, its competitors will.

A famous example is the Gillette's strategy of regularly replacing its market-leading razors. In 1962, Wilkinson Sword developed a stainless steel blade and took away 20% of Gillette's share because they hesitated to introduce stainless steel blade themselves which would have cannibalized their own market leading product [Guiltinan 2008, p.22].

In the age of Electronic Business this achieves even more importance. Worldwide information exchange and communication systems have led to global business competition. Technical progress and flexible, modular design software shortened up the production process. Hence, competitors can adapt relatively fast new demands. It is therefore crucial for companies to develop their products in time to be competitive.

Last but not least research shows that strategic planners set their focus on keeping consumers and sustain brand identification. The higher the *lifetime value* of customer is, that means his repeated multiple purchases, the higher is the company's profit. Because it is generally less expensive to preserve customers than to acquire new ones, companies tend to facilitate the access of costumers to their own new technology much rather than risk losing them to competitors. In contrast, durable products bear the risk of possible consumer retention. That's why it makes more sense for firms to produce goods which underlie (planned) obsolescence. Common examples are new cell phones which consumers can obtain for a give-away price when they resign their contracts.

4. Planned Obsolescence in E-Business and its consequences

Electronic Business has changed the way how products are developed, produced and delivered today. Technological progress and communication systems have led to new business strategies and global competition. This competition, the pressure to maintain and increase the market share of a company as well as the profit, has led to different forms of Planned Obsolescence in E-Business. In order to minimise the costs for a product, producer tend to externalise costs as far as possible. Hence, Electronic Business and Planned Obsolescence have led to a new form of waste which is increasingly polluting our environment.

The first paragraph will deal with the forms of Planned Obsolescence in the hardware sector and its consequences to the environment. Moore's Law will serve as an introduction to better understand the dimension of waste that is created with computers, servers, printers and cell phones. The second paragraph will examine the software market. Although software is non-physical, it nevertheless produces waste. A section about hidden costs which emerge from production and how they could be priced in, concludes the chapter.

4.1. Hardware

Although hardware is a general term for the physical artefacts of a technology [Wikipedia 2011b], it will be seen below as the physical components of a computer system.

In information technology, hardware is generally seen as the physical aspect of computers, telecommunications, and other devices. The term hardware was basically created to distinguish the *box*, the electronic circuitry and components of a computer from the program, which is activated to make do things. The program came to be known as the software. Hardware is characterised by permanence and invariability while software can easily be varied. With different kind of software, the hardware can be used to create a whole new experience. Meanwhile, processing power and memory capacity can only be increased when different parts of the hardware, such as cards or new adapters, are replaced [SearchCIO-Midmarket 1997]. A robust indicator for technological change is Moore's Law.

4.1.1. Moore's Law

Moore's law describes a long-term trend in the history of computing hardware. In 1965, Intel co-founder Gordon E. Moore predicted in the *Electronics Magazine* that "*the number of transistors incorporated in a chip will approximately double every 24 months*" [Intel 2011]. This trend has now continued for more than a half century and is expected to proceed until 2020 or more [H-Online 2008].

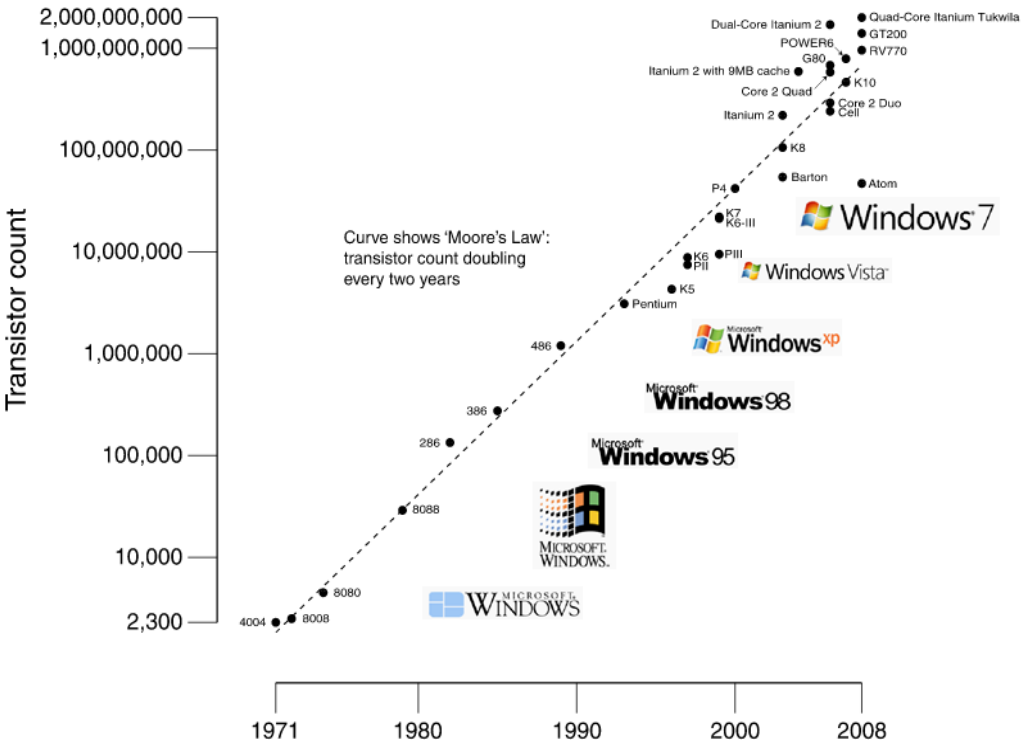

Figure 2: Moore's law in a chart with different processors over time. Y-axis is scaled logarithmically [Foolscap 2009].

The importance of Moore's law lies in the fact that the performance of many electronic devices is strongly linked with the number of transistors used. Processing speed, hard disk storage and memory capacity are increasing with exponential rates as well. This law is also reflected in the development and the possibilities of eBusiness. With increasing computing power communication-, distribution- and electronic systems in general become both more effective and sophisticated. Companies can enhance their product development processes and better satisfy the consumer's needs.

4.1.2. Computers

Thus, it is no big surprise that Planned Obsolescence is distinctive in this area. *Whatis?*, the leading IT encyclopaedia, describes a synergistic relation between the hardware and the software sector: *"New applications and operating systems (OSs) demand more*

memory, hard disk space, storage capacity and throughput. This demand leads to the development of improved memory technology, increasingly capacious hard drives and storage media and faster microprocessors. These developments, in turn, are followed by still more sophisticated applications and OSs, driving the cycle to continue." [Whatis? 2011]

The main form of obsolescence observed in this field is *technological obsolescence*. The interval between two purchases becomes shorter. Although it is possible to replace single parts of a computer such as motherboards, RAM modules or graphics cards users tend to replace the whole computer system. On the one hand vendors usually offer all-in-one packages where consumers economise money compared to the case they buy all the components manually together. On the other hand users often don't have the knowledge how they could replace single parts in a computer.

Consequently, computers systems have shorter life expectancies. In 1997, a CPU was expected to last four or five years. By 2003, consumers expected to use a new computer system for only two years. Today computers are expected to last for even less than a year [Slade 2006 p. 1].

Meanwhile, the number of discarded computers and their components is growing enormously. In 2004, about 315 million working computers were retired in North America alone. Of these, only 10 percent were reused [Slade 2006 p. 1]. The U.S. Environmental Protection Agency estimated that in each of the next five years 30 to 40 million pcs will end up on landfills in the USA [Anderson 2008].

The buzzword for the waste created by the new economy is *e-waste*. It can be defined as *"any refuse created by discarded electronic devices and components as well as substances involved in their manufacture or use"* [Whatis? 2006]." E-waste contains wide range of discarded electronic devices such as computers, mp3 players, televisions and cell phones. The main problem with this kind of trash is that it contains highly hazardous substances. *"Just one computer can contain hundreds of chemicals, including lead, mercury, cadmium, brominated flame retardants (BFRs) and polyvinyl chloride (PVC). Many of these chemicals are known to cause cancer, respiratory illness and reproductive problems. These chemicals are especially dangerous because of their ability to migrate into the soil, water, and air and accumulate in our bodies and the environment"* [SVTC 2011]. Responsible handling and a recycling concept is therefore strongly needed to deal with this upcoming problem. In general, this is not the case. The Environmental Protection Agency estimates that only 15-20% of e-waste is recycled, the rest of these electronics go directly into landfills and incinerators, where the toxic components are slowly released. From all the recycled computers approximately 50 to 80% are exported to countries such as India, China or other poor countries where they finally land on huge garbage dumps [Anderson 2008].

But exporting e-waste to undeveloped countries just lags the problem. It's a ticking time bomb. The U.S. National Safety Council calculates that 75% of all personal computers ever sold worldwide are no longer used and lurk in basements, garages and the backdoor rooms of bars, shops and so on [EPA 2008]. Meanwhile the growth of e-waste will rise rapidly. Projections show that fast growing countries such as India are estimated to produce 500 percent more e-waste in the next decade. The United States will remain world leader in producing electronic waste, with discarding about 3 million tones electronic components each year [UNEP 2010].

4.1.3. Printers

Another famous example of Planned Obsolescence is the ink cartridge that has to be replaced from time to time. While printers are usually one-time purchases manufacturers gain their profit from replacing ink cartridges. New ink cartridges cost about 40-50 Swiss francs, which corresponds around 30-50% the price of a new printer. Keith Gay, an analyst with Thomas Weisel Group, notes therefore that *"supplies account for probably more than 90 per cent of* [their] *gross profit"* [deBlanc-Knowles 2003]. In addition, consumers are often not allowed to use every single drop of ink that is available. Ink cartridges are often equipped with proprietary smart chips that disable printing when one of the colours has fallen to a certain critical level. Even if the job could be achieved with other colours the printer just stops. Therefore, consumers turned to remanufacturers, which offer them refilled units and prevent ink cartridges from being discarded. However, the remanufacturers face several obstacles. As deBlanc-Knowles notes the four largest printer companies - Lexmark International, Epson, Hewlett Packard (HP) and Canon - have all installed additional smart chips in their cartridges. These chips disable key features or exclude cartridges other than the original from being used. The use of these smart chips effectively shut down an aftermarket and forces users to buy new cartridges.

Another fact is that the average ink cartridge becomes smaller and smaller. Today's ink cartridges hold about 12 ml of ink compared to an average of 30ml ink ten years ago [Printers & Fixes 2011].

Planned Obsolescence is not just limited to ink cartridges. Even printers carry smart chips that limit the use of the product to a certain number of papers printed or hours used. If these limitations are obtained the printer paralyses and an error message appears which says that the printer no longer works due to technical reasons. If the user is not willing to do research on his own he may not find out how these counters can be reset. Therefore, he is finally forced to replace the printer.

Ink cartridges act in different ways negatively on the environment. The ink itself contains several chemicals that are hazardous to the environment. Supplementary, a used ink cartridge consists of 40% plastic, 40% metal and other materials. Plastic is made of engineering-grade

polymers and takes at least 1,000 years to decompose. The tiny metallic and electronic components can pollute the ecosystem and contaminate the ground water, with devastating consequences for the wildlife.

4.1.4. Cell phones

Electronic components have extremely shorts lives. Cell phones are reported to have the shortest life cycle of any electronic consumer product. While they are built to last five years, consumers retire them after only eighteen months of use. In Japan, they are discarded within a year of use [Slade 2006, p. 261]. The cell phone market is a good example for the technological and fashionable driven part of Planned Obsolescence.

Consumers do not just replace their models faster, they also buy more and more cell phones. In 2008, Switzerland reached a cell-phone density of almost 100% [Landis 2008]. This trend continues as a study from Fishbein shows: *"in some countries such as Japan, Finland, Switzerland and Norway, penetration will exceed 100 per cent within the next few years"* [Fishbein 2003, p. 3]. In other words, the cell phone market is still growing and there is no end in sight. Therefore, e-waste from cell phones grows continuously. The marketing strategies of mobile phone providers to disperse cell phones to a give-away price exacerbate the problem further.

The consequences for the environment are dramatic. Every year, more than 100 million cell phones are discarded in the United States. This equates 50'000 tons of still-usable equipment [Slade 2006, p. 1]. In Switzerland only 15% of all cell phones are recycled, by an average of 2.8 million cell phones that are bought every year. More than 8 million cell phones are expected to lurk at home [Adlesgruber 2009]. Unlike computers or televisions, cell phones can easily be thrown away in rubbish bins, rivers or wooded areas. Therefore cell phones present the most dangerous risk for the environment.

Cell phones contain high levels of permanent biological toxins (PBTs), ranging from arsenic, antimony, beryllium, and cadmium to lead, nickel, and zinc. If cell phones are burned, dioxins, furans, and other pollutants are released into the air, with disastrous health consequences for humans and animals around the globe [Slade 2006, p. 261]. Not just the throw-away mentality causes problems; also the production of cell phones affects the environment. Mining for certain elements and minerals such as tantalum or coltan creates economic devastation points that are inhabitable for centuries [Slade 2006, p. 288].

4.2. Software

The strategy of Planned Obsolescence is widely used in the software market. New software or software updates are created in a certain way to reduce the value of a previous version. The most common way is to create software that is partially incompatible with older versions [Choi 1994].

4.2.1. General approach

This can be achieved when programmes work upwards compatible only. New products are capable of reading all the files that were created with a previous version but not inversely.
So if a file is created with a new version it is under certain conditions exclusively readable on the latest version. Users of an old version can only communicate with other old versions [The Economist 2009]. The new version becomes a little bit more stylish, more secure and better.

To use all the function a programme provides over time, the consumer has to upgrade the software. Users do often not have a real choice. Companies focus their development teams on the latest or on an upcoming version. As time passes by, older products are usually no longer updated. Users must then buy a new version to obtain support. Typical examples are operating systems for computers, such as Windows or Mac OS. Another way how consumers are forced to buy a newer version is when companies provide update or bug fixes for free only for the latest version of a product. Users of older version have to pay a little amount of money to receive the update for their respective version. [Elliott 2010].
Products are usually updated in a regular frequency. Interestingly, a study by Boone et al. shows that more frequent introductions of upgrades may be interpreted by consumers as a higher rate of intergenerational change. Therefore users think that their existing product is outmoded. Thus, more rapid replacement cycles may lead to a higher turn-over rate. This approach works best for programs in which copyright protection limits the amount of service third parties could perform [Boone et al. 2001].

4.2.2. Time-restricted software

Other software is more restrictive. While software in the previous section just couldn't be upgraded so called time-restricted software loses key-functions when expired. There are different sorts of time-restricted software. One category contains the demo or light versions. These kinds of programs are fully functioning for a certain time period. Usually it is a *try out phase* from 30 up to 90 days. After this period a consumer has to pay additionally a certain amount of money if he wants to further use the product with all its functions. Subscriptions are another category. Content and access is available for a certain period of time. Typical examples are online newspapers or databases. Another sort of subscription is used in the area of supporting software. Antivirus software such as Norton, Kaspersky Lab or McAfee is normally sold with a license to update the program regularly during a year. After expiration the program can no longer be updated. Hence, the user has to buy a new license to further update otherwise the product loses its key function (in this case efficient virus protection). These licenses are slightly cheaper than a

whole new version of a product (e.g. Norton Antivirus 2011), that is why users often buy the whole new package, which performs marginally better.

4.2.3. Environmental consequences

Software itself, as a non-physical good, does not create any waste. Nevertheless it produces indirectly waste. The majority of the software is still sold in the commerce as a *physical product*, means that the software is burned on a DVD, equipped with instruction manuals, wrapped in a proper packaging and then sold to the costumer. It is a small percentage that is bought online and then downloaded for use.

These accessories are usually no longer of relevance when the software is properly installed and works. More than 5.5 million boxes of software go to landfills and incinerators. Several million music and data CDs are thrown away each year. Software creates therefore a huge amount of e-waste ranging from plastic, metal, cyanine dyes, glass and paper to carton. In the production of these goods (also in producing the raw materials for example a CD!) toxic by-products occur, such as highly toxic fumes, which could harm animals. Hence, it is very important that these goods are recycled: On the one hand CD-ROMS and DVD's consist of high quality polycarbonate which can easily be recycled and on the other hand such discs do not decompose on a landfill [CD Recycling Center 2011].

4.3. Hidden costs

Additionally to the observable, there are hidden costs. These costs, which are relevant to this topic, are usually labelled as *spill over effects* or *external effects*. It simply means that *"the costs to society of industrial processes are not reflected in the price of the product sold"* [Science-Dictionary 2011]. As already implied in the preceding chapter the environmental costs are a common example. Companies tend to exclude these costs from their prices to remain competitive on the market [Maycroft 2009 p. 16]. Mining, producing, transportation and eventually disposal do often not include the environmental impact in cost accounting. Several studies show that prices for everyday commodities and especially for luxury goods would be substantial higher if all the environmental consequences would be priced in [Ackerman & Heinzerling 2002].

It is in the best interests for every country to reduce e-waste and environmental pollution. Therefore many countries have tightened their environmental laws and try to change incentives. In Switzerland, the first electronic waste recycling system was implemented by SWICO in 1994. The SWICO recycling guarantee determines that companies have to take back used equipment free of charge and deliver it to recycling deliver points. The recycling

operations are financed by consumers who pay an amount in the form of an advanced recycling fee when they purchase new equipment. As e-waste.ch reports over 42,000 tonnes of used equipment were professionally recycled in 2005 [E-waste.ch 2011].
Several other states of the EU have similar if not tighter laws, where companies have to take back their products and recycle them. Such solutions are named *upstream solutions*. Companies have to take back products and dispose them, which therefore increases the unit cost of new products. The intention is to create and design greener or rather more durable products. Environmental policies in most of the European countries favour *upstream* solutions over *downstream* solutions. Downstream solutions do not try to change characteristics of a product. Instead they try to regulate what happens to a product after it is used. Common practices are recycling incentives (e.g. Switzerland) and taxes. Guiltinan notes that such practices only work if a country has a *"fully functioning recycling market in which recyclers pay each household for each recycled item and the price varies with the value of recyclable components of the product"* [Guiltinan 2008 p. 25], as it is the case in Switzerland.

5. Planned Obsolescence – necessary or not?

So far, it has been showed that the pollution of the environment is mainly due to the throw-away mentality of consumers. This behaviour results from the fact that goods are often replaced sooner than necessary due to Planned Obsolescence. Media often hold the companies responsible for the increasing ecological problem. They accuse the producers that they are just interested in profit maximising and maintain or heighten market shares in an aggressive manner.
But the whole problem is more complex than that. Users do have a choice. It is still the consumer who decides whether he wants to replace a product or not and if, when he likes to do that. Moreover, the user has often the choice between products that differ in their durability or in their environmental benefits and liabilities.
Marketers point out rightly that they just fulfil the demand of the market respectively of the customers. The rate of electronic product exchange has increased dramatically in the last two decades. Users attach more and more importance to possess the latest technology with all the available functions. A study of Grewal et al. confirms these predications because technical product obsolescence is clearly a more significant driver of replacement timing than physical obsolescence. They compared unforced replacement decisions driven by technological and fashionable obsolescence with replacement decisions that were justified by poor product performance respectively product failure. The results show that durable product replacement intervals were shorter for unforced

decisions. Grewal et al. explain their findings with the argument that, in the case of voluntary replacement, consumers are more excited about and interested in the decision to replace and thus more motivated to act [Grewal et al. 2004, p. 113].

Due to this findings and the fact that E-Business have led to worldwide competition, companies cannot afford to invest too much time in product development. The risk of producing an out-dated product becomes too high when they still elaborate manners to make a product more durable, which is apart from that ready for sale. In addition, it is questionable to produce goods more durable if they are replaced sooner anyway. Several studies show that there is little evidence that durability is a key consumer buying motive. Motives such as price, brand name, technical characteristics play a more important role in the purchasing process than durability [Cooper 2004]. Warranty or high prices are not seen as criteria for durability and therefore don't influence the decision of a customer to buy a certain product [Cervini 2005 and Utaka 2006]. To sum things up, the marketers argue that durability is not a characteristic that is demanded by consumers [The Economist 2009].

As it is often the case, the responsibility for the observed behaviour lies somewhere between these two positions. An alternative depiction of this process given by Guiltinan helps to analyse the problem. This model is useful to develop approaches how this problem can be reduced. It is presented in a modified version in this paper.

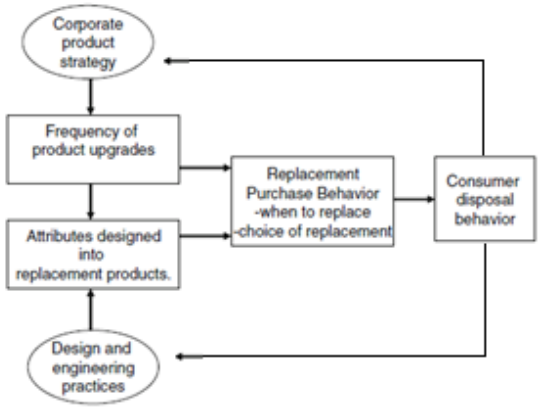

Figure 3: Product obsolescence and the environment [modified own figure based on Guiltinan 2008].

Guiltinan says that two aspects of new product development strategy drive the environmental problems. The upper part of the figure shows that frequent introductions of replacement based on technological change increase the opportunities and the motivation for firms to replace functioning durables. Rapid new product development and the incorporation of desirable benefits or styles made by industrial designers help to defend the market share a company possesses in the market.

On the other hand, the recyclability and durability of new products is influenced by choices of components or materials that were selected by product designers and engineers. This two processes influence the purchase behaviour in a certain manner. The more frequent companies replace a product and the less durable a product is the higher is the rate of replacement [Guiltinan 2008, p. 19].

Contrary to the depiction of Guiltinan, this figure has additional arrows which describe the influence of the consumer on this process. Consumers affect both, *corporate product strategy* and *design and engineering practices*. Every corporate product strategy has to take consumer trends into account. These assumptions and evaluations help to determine the approximate demand of the customers, which is crucial when a product should be sold on the market. The same can be said for the processed materials. If customers are not satisfied, designers and engineers of companies are obliged to adjust the raw materials or the method of production so that they don't to lose prospective buyers.

This is an important finding. The described process takes place two-ways. Especially in the E-Business market, the technological change drives consumers to replace products. On the other hand, the requests or demands of customers influence product decisions. And this is where it is possible to intervene in the process. If a particular problem or a challenge, such as the environmental consequences of e-waste, should be approached, an induced change in the perception of the customers can be a first important step. Then, companies have to adapt themselves to the new circumstances.

A short outlook in the next chapter will include the described model as one possible action to fight the growing amount of e-waste.

6. How e-waste can be reduced – a short outlook

The explanations in the preceding chapter present the customers as a point of reference to influence the disposal behaviour of buyers. So called *green products,* that means goods that are durable, highly recyclable and environmentally friendly in production, have to be competitive in the market, otherwise companies won't produce them. So far, environmental attributes play a subordinated role in the purchase decision of customers. A study by Niva and Timonen indicates why this is the case: First, the consumers *lack knowledge* about the environmental implications of their purchases, even in product categories where the environmental influence is widely discussed in the media. Second, buyers believe that it is the responsibility of manufacturers to produce goods that are environmentally friendly and that they have little impact on these production decisions [Niva & Timonen 2001].

The simplest way is therefore also the most efficient method: User must be informed about the consequences of the throw-away mentality. Since e-waste is mostly exported to developing countries users cannot see the consequences and that's why they don't bear it in mind when they purchase a product the next time. Environmental authorities, private organisations or political parties should therefore start campaigns to sensitise the population for this topic. They should inform the people about the environmental consequences of the mining for raw materials, the production and the disposal. In addition, it is essential to inform about what happens to the ecosystem and how long it takes the nature to biologically degrade electronic components if products are just dumped somewhere in the environment. Furthermore, the consumers must be made aware of the fact that they can actually influence the decision how companies design product characteristics. If sustainability becomes an important issue companies will not risk to produce goods that have a low durability and could therefore harm their reputation [Guiltinan 2008].

Companies also have an ethical responsibility. This responsibility for the negative consequences of Planned Obsolescence is a shared one. It is questionable to introduce new products that suffer from premature physical obsolescence or make users believe that the utility of a product is diminished simply because a new version becomes available. The gains from some new products may not always be worth the consumer or societal cost in form of environmental pollution. Companies should take the environmental consequences into account when they work out a new product development strategy [Guiltinan 2008, pp. 23-25].

Among other approaches, the *sustainability product assessment module* by Byggeth et al. consider the costs of product disposal to be *real costs*, that someone must bear rather than externalities. So the decision-making script for each new product development process includes an ecological dimension [Byggeth et al. 2007, p. 1]. In his paper, Guiltinan present several possible approaches for companies and shows how they could be implemented [Guiltinan 2008].

Last but not least public policy initiatives are another way how e-waste can be reduced. It is difficult to persuade single companies to produce more durable, while other companies make more benefit with old production techniques. It would take industry agreements to assure that all sellers deliver products which are equally environmental friendly. Eventually, this would lead again to the *durable goods problem*. It is therefore necessary that the government enact laws which reduce the environmental impact but don't interfere in the competitive situation of manufacturers. The goal should be to offer incentives that companies improve their products on their own [Guiltinan 2008, pp. 25-26]. A possible

solution was already given in the chapter *hidden costs*. *Upstream solutions*, for example the law that companies have to take back their products and recycle them, give companies the incentive to develop products that are more durable and better recyclable. In that way, companies safe money when they discard old electronic components and the environmental impact is lower.

7. Conclusion

The technological change and especially the emergence of the Internet have changed the way how companies conduct their business. E-Business is the digital response to these developments. A first chapter described E-Business and dealt with the different forms of this concept. The presented advantages put the idea across why it necessary for companies to mark presence in the World Wide Web.

Planned Obsolescence is a concept that describes the fact that products wear out prematurely due to functional, technological or psychological reasons. They are deliberately planned and produced with a limited useful life time, so that the consumer has to buy a new version of a good after a given time. The goal behind this strategy is to maintain the demand of consumers. This first research question was treated in the second chapter.

As it was also described in the second chapter, Planned Obsolescence is a concept that had its origins in the early 20's of this century. Nevertheless it is still practised, albeit quietly in the background. E-Business is no exception. Chapter 3 dealt with the second research question and revealed several forms of Planned Obsolescence that could be found in the domain of E-Business. In the hardware market, the main form of Planned Obsolescence is based on technological reasons. The introduction of Moore's Law showed how fast technological innovation proceeds and therefore decrease the life cycles of a products. The software market uses various forms of Planned Obsolescence. Software have built in expirations dates that make them lose key functions after a certain period of time or programmed in a way that they are not adapted to synchronise with newer software, what makes them useless after a while. The consequences of these examples and the other mentioned forms of Planned Obsolescence in E-Business lead to one big problem: *E-Waste.*

The rapidly growing amount of discarded computers, printers, TVs and cell phones lead to an enormous ecological problem. The third research question dealt with these consequences and is threated as well in the third chapter. It is shown that electronic components usually consist of toxic materials that could bear hazardous risks for the ecosystem if they are not recycled in an appropriate manner.

The last two chapters gave attention to the question if Planned Obsolescence is necessary or not and how the e-waste problematic could be approached. It was pointed out that the problematic of Planned Obsolescence cannot just be pinned down on the behaviour of companies. The users demand influence the product developing decisions of companies and can therefore affect very well the outcome of what companies produce. A modified version of the depiction of Guiltinan, that shows the process how Planned Obsolescence and its environment interact, served as a point of reference to answer the fourth and last research question. There are several possible ways how the amount of e-waste can be reduced in the future. The aforementioned process allows the conclusion that users should be informed about the environmental impact of their behaviour. The customers should be made aware that the rapid exchange of electronic gadgets lead to an enormous amount of e-waste, which has a negative impact on the ecosystem due to all the toxic components, especially when they are just dumped somewhere in the nature.

Companies and environmental authorities have to take over responsibilities as well. Companies have to include also the costs of the environmental consequences of their products. It is no longer acceptable that these impacts are seen as externalities. The last chapter includes several approaches from scientists how this could be implemented in a product development process. But companies will not start with these implementations by themselves. Authorities have to determine several standards how e-waste can be reduced. Furthermore, public policy initiatives are an efficient way to set incentives that companies reduce their waste on their own.

8. Literature

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9. Appendix

		Demand		
		Consumer	**Business**	**Administration**
Offer	**Consumer**	**Consumer-to-Consumer** e.g. private individuals advertising in the internet	**Consumer-to-Business** e.g. a private website containing professional skills of the owner	**Consumer-to-Administration** e.g. citizen evaluates a environmental project
	Business	**Business-to-Consumer** e.g. online-shopping	**Business-to-Business** e.g. order good from a supplier	**Business-to-Administration** e.g. tax handling
	Admin.	**Administration-to-Customer** e.g. consulting services	**Administration-to-Business** e.g. open competitive bidding	**Administration-to-Administration** e.g. virtual municipality

Figure 4: Possible E-Business Relations [Meier & Stormer 2009].