

Article

Contribution of Online Trading of Used Goods to Resource Efficiency: An Empirical Study of eBay Users

Jens Clausen ^{1,*}, Birgit Blättel-Mink ², Lorenz Erdmann ³ and Christine Henseling ³

¹ Borderstep Institute for Innovation and Sustainability, Hausmannstr. 9-10, 30159 Hanover, Germany

² Department of Social Sciences, Institute for the Analysis of Society and Policy, Goethe-University, Robert-Mayer-Str. 5, 60054 Frankfurt am Main, Germany;
E-Mail: b.blaettel-mink@soz.uni-frankfurt.de

³ Institute for Futures Studies and Technology Assessment, Schopenhauerstr. 26, D-14129 Berlin, Germany; E-Mails: l.erdmann@izt.de (L.E.); c.henseling@izt.de (C.H.)

* Author to whom correspondence should be addressed; E-Mail: clausen@borderstep.de;
Tel.: +49-511-1640345; Fax: +49-511-1640391.

Received: 19 May 2010; in revised form: 10 June 2010 / Accepted: 14 June 2010 /

Published: 23 June 2010

Abstract: This paper discusses the sustainability impact (contribution to sustainability, reduction of adverse environmental impacts) of online second-hand trading. A survey of eBay users shows that a relationship between the trading of used goods and the protection of natural resources is hardly realized. Secondly, the environmental motivation and the willingness to act in a sustainable manner differ widely between groups of consumers. Given these results from a user perspective, the paper tries to find some objective hints of online second-hand trading's environmental impact. The greenhouse gas emissions resulting from the energy used for the trading transactions seem to be considerably lower than the emissions due to the (avoided) production of new goods. The paper concludes with a set of recommendations for second-hand trade and consumer policy. Information about the sustainability benefits of purchasing second-hand goods should be included in general consumer information, and arguments for changes in behavior should be targeted to different groups of consumers.

Keywords: online marketplaces; online auctions; consumer; electronic commerce; used products; second-hand market; sustainable consumption

1. Introduction

Online auction and trading platforms are increasing the opportunities for sustainable consumption. The potential of online based second-hand trading lies largely in the opportunity to extend the life span of products, thereby avoiding additional environmental stresses due to the purchase of new goods. To date, private households often failed to exploit the potentials for reusing products because of high transaction costs. Trade in second-hand goods remained limited to regional markets. These barriers frequently prevented local and regional used goods markets from attaining critical mass and becoming attractive for both buyers and sellers. In recent years, however, rapidly increasing use of the Internet and trading platforms, such as eBay, have fundamentally transformed the underlying conditions of such markets.

Online markets have not only significantly increased the numbers of market participants; they have also changed the roles traditionally assigned to consumers and producers. Exchange sites, auction platforms and other Internet-based trading models where users are not merely buyers, but at the same time, also active sellers of products or services, have shifted the role of consumers.

Against this background, this article examines consumption processes using the example of eBay, the world's largest online trading platform for used goods, by focusing on the following question: Which sustainability potentials are connected with the electronic trading of used goods, and how can these potentials be exploited? This question lies in the center of the research project "From Consumer to Prosumer—Development of new trading mechanisms and auction cultures to promote sustainable consumption." The project is intentionally linked with various streams of research and insights, especially concerning the intensification of use, lifestyle research, and life-cycle assessment, in the fields of information technology and telecommunications, and integrates them from the perspective of the research guiding question

After giving an overview of the scientific work on environmental attitudes and behavior in the context of internet based used goods trading, and an empirical look on internet usage in Chapter 2, the empirical results of an online survey on online trading and sustainability are presented in Chapter 3. Chapter 4 draws conclusions from the empirical study and Chapter 5 focuses on the ecological assessment of used goods trading. The paper concludes with some remarks on the consequences of second-hand trade, online platforms, and consumer policy.

2. Internet-Based Used Goods Trading from a Subjective Perspective

Sustainability researchers in the social sciences assume that environmentally-oriented behavior is supported to a non-negligible degree by positive attitudes toward the environment and by knowledge about the environment [1-7]. Time and again, however, representative surveys of the population provide evidence for a discrepancy between concern about increasing environmental devastation and its consequences, as well as knowledge about the environment on the one hand, and environmental behavior that is in line with such knowledge on the other. It is possible to identify groups of individuals who display environmentally-friendly behavior, but not the corresponding attitudes toward the

environment (e.g., older single women), just as there are groups of individuals who display a high degree of ecological awareness, but whose behavior is nonetheless not consistently environmentally oriented (e.g., families whose environmentally-friendly behavior is organized to the hilt, but who still drive a family car). Three bundles of characteristics that influence the sustainability of styles of consumption have emerged in the research [8]: the household's social situation (socio-demographic characteristics and time resources), consumer preferences (subjective preferences relating to the selection of products and behaviors), and actual consumption behavior. Socio-demographic characteristics that substantially influence differences in terms of sustainable consumption patterns include age, educational level, gender, marital status, and income, with women, well educated people, and parents striving for consistency of attitudes and behavior.

Grunenberg and Kuckartz [1] were able to identify the group they called the "environmentally committed" in their study, which was representative for Germany. "[A group] that takes environmental problems more seriously and is actively committed to solving them. Entirely consistent pro-environment behavior is not demanded of this group; that would require, for example, that these individuals would not just eat exclusively organically-grown food, but would also sell their cars and take bicycling vacations." (Grunenberg/Kuckartz, p. 204 [1]). The following indicators were used to define the group of environmentally-committed individuals: membership in an organization promoting conservation or environmental protection; donation to such an organization in the previous year; familiarity with the term "sustainable development;" high willingness to pay for improved environmental protection; frequenting of information about environmental problems from specialist periodicals; environmental mentality type 1 (motto: "Be a role model when it comes to environmental protection!"); declared shared responsibility for environmental protection (statement: "It isn't difficult for an individual person to do something for the environment!") (Grunenberg/Kuckartz, p. 204 [1]). Members of this group are often in the familial phase of life, have a relatively high level of education, often live in major cities or small communities, seldom in medium-sized towns or villages, tend to come from West Germany, as a rule have a higher professional position (senior staff, upper-middle-level or upper-level civil servants, the professions), have a medium to high, but not very high income, and tend to live in quiet neighborhoods in single- or two-family houses. Regarding their political preferences, the authors ascertained a more pronounced interest in politics in general, and a clear focus on post-materialist values.

As to trading in used goods as a specific area of consumption, a study of West Berlin showed that buying and selling used goods is linked fairly rarely to ecological motives [9]. Pragmatic reasons for selling used goods are mentioned more frequently, for instance "making room" or "getting rid of items we no longer need." In contrast, when purchasing used goods, financial motives are more important. The proportion of men who buy and sell used goods is somewhat higher than that of women. The average age is 36. More than two-thirds of those offering goods on the second-hand market have a job. Housewives and students comprise 10% of sellers each, the unemployed and pensioners about 5% each. The sellers often live in multi-person households, and live less commonly alone. Among the buyers of second-hand goods, 29.4% are in the 19- to 25-year age group and 35.7% are in the 26- to 35-year group. Most people have a job (61%), and students form 15% of the buyers, which is

substantially higher than their proportion of the sellers. Educational levels are above-average among buyers, too, as is the proportion of individuals living in multi-person households.

In the next step, it is necessary to elaborate what distinguishes Internet-based trading from used goods. A study of auction culture [10] with the goal of identifying the potentials for Internet-based used goods trading in Germany was commissioned by eBay, and the analysis distinguished a very current trend relating to people's attitudes toward consumption and their handling of their belongings. Belongings, the authors determined, served less and less to secure the individuals' futures, and increasingly to stabilize the present. Short-lived product cycles and a "yearning for high-quality products and premium brands" are the motors of this development, they found. The product characteristics "new" and "used" were becoming less important in relation to the desired increase in quality of life. This tendency to increase quality of life by means of consuming used goods is described with the term "upgrade." Higher-quality products seem increasingly desirable. This development is encouraged by underlying technical conditions (Internet-based trading) that significantly reduce the time and effort required for seeking out specific used goods (e.g., time and transportation costs to go to second-hand stores, antique shops, *etc.*) and for the purchasing transaction itself. In addition, flexibility of one's lifestyle is becoming more and more important. Social, emotional and professional ties are becoming more limited in time and support the (new) idea of "temporary ownership." In modern societies, this era of "auction culture" (beginning around 2000) has followed the "culture of accumulation" (1950s to 1970s) and the "throwaway society" (1980s and 1990s). The study identified five "auction culture types" of people: "convinced auction participants," "brand-oriented resellers," "open-minded second-hand purchasers," "prestige-conscious new-goods buyers" and "people distanced from consumption." These auction types differ along socio-demographic lines, but also regarding their motives for purchasing used goods. While, for instance, the "whole-hearted auction participants" (younger age groups, higher proportion of men, highly educated, holding a job), who use the Internet intensively and are also active on eBay, love surprises and enjoy buying and selling used goods, the motivations of the "open-minded second-hand purchasers" (medium age, more women than men, highly educated, more often working part-time), who also use the Internet very frequently, but trade much less often on eBay, include meaningfulness and pragmatism, a rational approach to value as well as discovering individual objects.

Let us take a final empirical look at Internet usage. How do Internet users differ from the other auction culture types identified and from the environmentally-oriented consumer types? The number of Internet users has grown continually since the breakthrough of the modern Internet in form of the world wide web (WWW) in 1993 [11]. For example, the (N)Onliner-Atlas produced by the Initiative D21 e.V [12] currently identifies 65.1% Internet users, in contrast to 29.9% who do not use the Internet and 4.9% who are planning to use it. The gender gap in Internet usage had been closing for several years; however, it grew again recently, with 72.4% of men and only 58.3% of women in Germany using the Internet [12]. Analysis by age group reveals that the groups aged 14–19 (93.7%), 20–29 (89.8%), and 30–39 (85.4%) all display fairly high Internet use. In the older age groups, the percentages decrease: the proportion of Internet users in the 40–49 age group is still 78.2%, in the 50–59 age group 63.5%, in the 60–69 age group 41.6%, and in the age group of 70 and older, only 16.3% ([12], p. 14). However, this data does not take the age distribution of the total population

into account. As a result, the younger age groups could be given too much weight. For this reason, and taking a different perspective, the age group 30–39 years is the largest group of Internet users, followed by the 40–49 year-olds (21.1%), and the 20–29 year-olds (17.2%) (based on 2002 data in [13], pp. 36–38). Online activity increases with educational level (33.3% of respondents with a lower education level *versus* 66.0% of individuals with a higher educational level are active online). Online activity also increases significantly with increasing income. Just 27.4% of households with monthly incomes between 1,000 and 1,500 Euros use the Internet, as opposed to 62.8% of households with monthly net incomes of more than 2,500 Euros. Significantly more Internet users are to be found among individuals with jobs (57.0%) than among homemakers (31.1%) or the unemployed (18.9%), and individuals in training display the highest proportion of Internet users (71.3%). Household size was also revealed to be a relevant factor: fewer Internet users are to be found in single-person households (33.4%) than in households of three or four (approx. 56.7%).

Online shopping, and in particular, online auctions, are considered among the most important uses of the Internet, following the use of search engines and opportunities for communication. In October, 2009, approx. 22 million Germans accessed the eBay website and spent 2 hours and 49 minutes there on average [14]. The socio-demographic characteristics of online buyers [14] are interesting: individuals who live in rural areas are more likely to use online purchasing sites than those living in or near cities. As to educational level, the authors demonstrate that online purchasing is dependent on education, as is Internet use per se. “By and large, the social demographics of the online buyers correspond to the social demographics of Internet users in total.” ([14], p. 75). Regarding the frequency of online purchasing, Groebel and Gehrke show that online purchasing is more likely the longer the person has been using the Internet, and that the frequency of online purchasing increases with growing online experience. Which reasons were given for online purchasing? Respondents agreed most strongly with the statements “shopping around the clock,” and “convenient shopping” ranked second. They agreed with the possible responses “saves time,” “easy to compare prices and products,” “easy to find certain products and services” and “easy to find information about products” to approximately the same degree. The opportunities to buy “the same products at lower prices” or “have fun when shopping” were mentioned most rarely. Convenience and flexibility appear to be more important motives for online purchasing than price, which is often discussed, or even the fun factor.

If we consider the insights gained so far, it is possible to develop some hypotheses concerning the relationship between online based trading of used goods and sustainable consumption.

1. Trading of used goods (offline as well as online) is only loosely coupled with environmental awareness and environmental motivations.
2. The motives to sell and buy used goods via Internet are multifaceted.
3. Socio-demographics do play a fuzzy role, e.g., women are less seldom online “activists” as men are, but women are more environmentally sensitive. Additionally, the level of education does have a role in terms of online trading of used goods. People in different life phases (e.g., young family, retirement) show different probabilities of selling or buying used goods.

3. Online Trading and Sustainability—Empirical Results

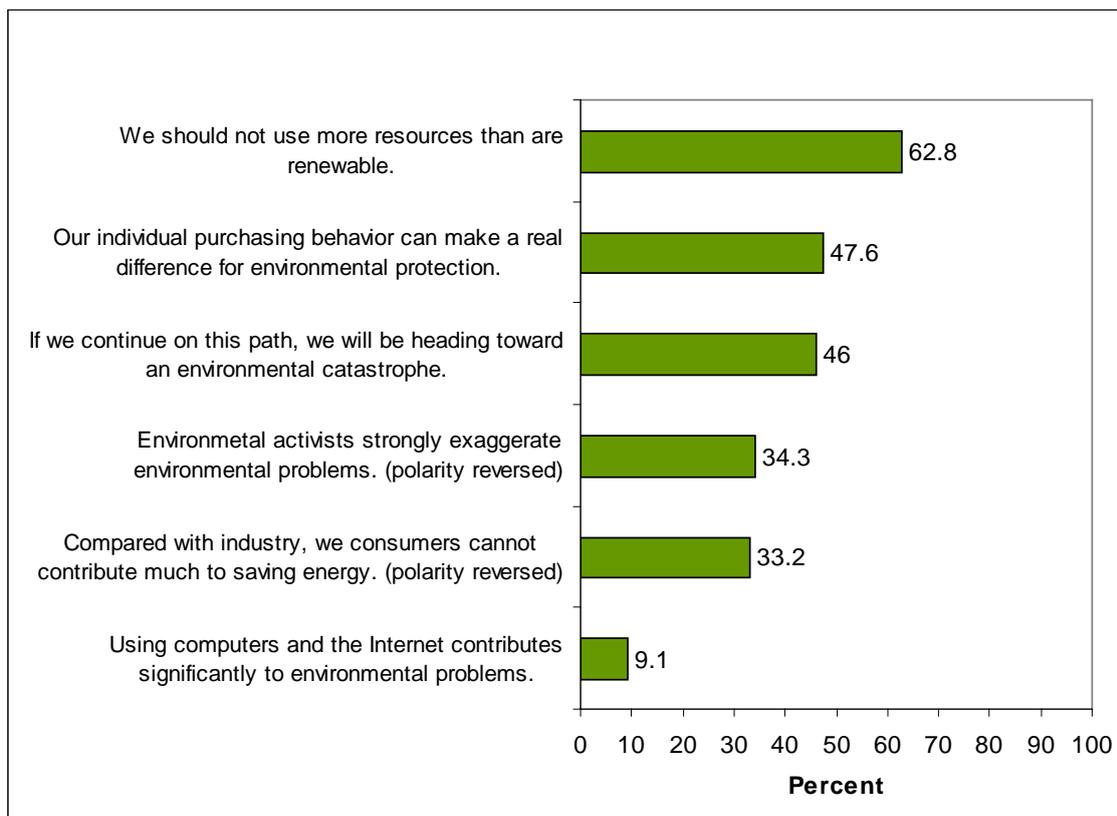
Taking the example of eBay, the above mentioned relationships were more closely looked at with an online survey that was carried out by the authors in November, 2008. The survey was intended to gain insight into eBay users' consumption patterns, their attitudes, and their ways of dealing with used products on eBay. The survey was directed to private eBay users who use the site, both for buying and selling, and who carried out at least one transaction during the preceding 12 months. In total, 2,511 valid questionnaires were analyzed. In contrast to Germany's total population, more men (57.1%) than women responded, more persons who live with their partners (73.4%), and more people living in households of three or more (52.4%). The sample also displays a relatively high educational (49.4% level A) and employment status (49.2% working full time), and the respondents tend to live in or near urban areas. The age distribution of the respondents (biggest cluster 40–49 years old; 29.8%) and their income distribution (40% medium to low income) are comparable with the overall population. More women (45.1%) than men (34.0%) of the sample live in households with children; the proportion of men increases with increasing age. The women who buy or sell on eBay have lower incomes. 48.7%, of all female eBay buyers earn less than 2,000 Euros per month compared to 39.8% of all male eBay buyers. Compared to the group of Internet users mentioned above, the sample analyzed here differs only in relation to income, with Internet users displaying higher incomes.

The following subjects will be approached: Attitudes toward the environment and motives for trading on eBay, attitudes of eBay users regarding used products and their handling of used products. Then, a typology of consumer patterns of eBay users that was derived from the data will be presented.

3.1. Attitudes toward Environmental Protection

The first question concerned eBay users' attitudes toward the environment. The result: a large part of the users do display attitudes that are sensitive toward the environment (Figure 1).

Figure 1. Environmental attitudes of eBay users. Values are percentage of respondents (n) who answered “agree or strongly agree” to the question: “Do you agree with the following statements about environmental protection?” Scale of six possible responses; source: authors' calculations. Valid n = 2,404; missing n = 107; total n = 2,511.

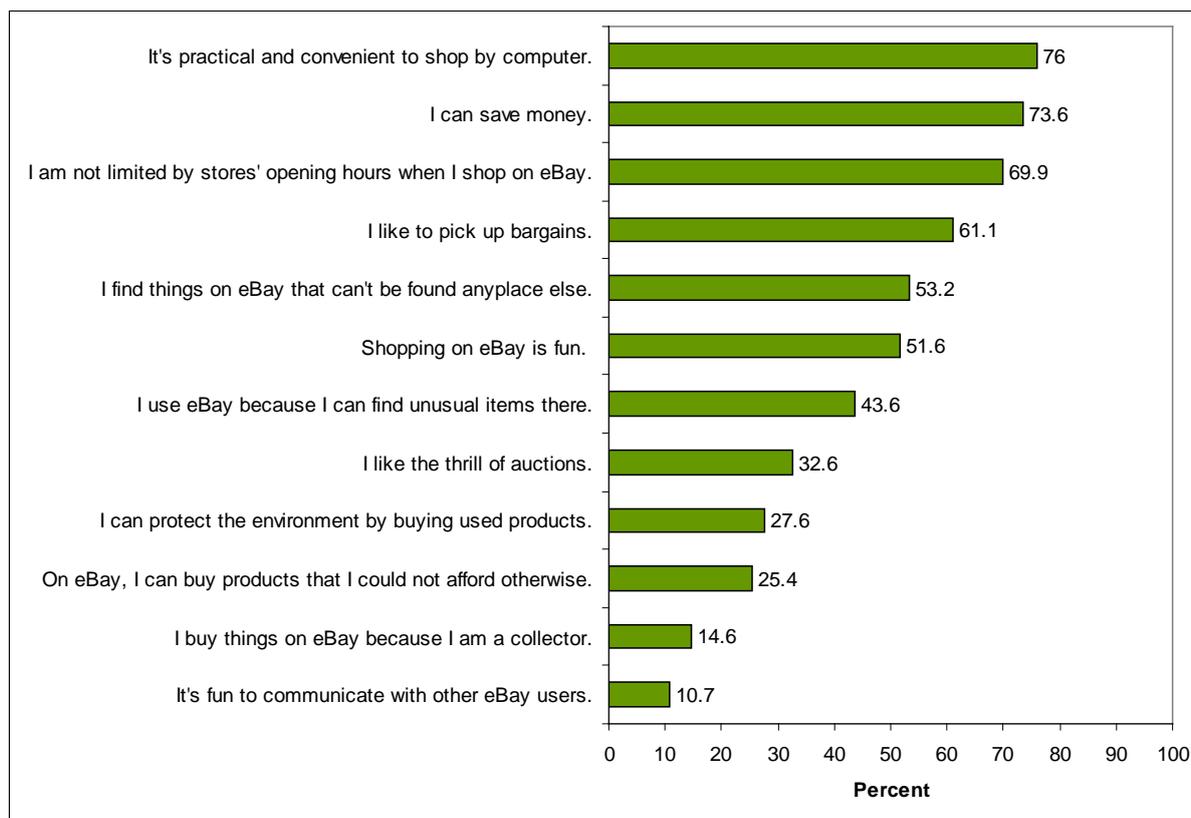


However, the majority of eBay users do not link the use of information and communication technologies with environmental problems. Only 9.1% of users—with no significant gender specific differences—are of the opinion that computer and Internet use contribute substantially to environmental problems.

One question studied more closely in the analysis is whether the surveyed eBay users are aware of the positive environmental potentials of trading used goods on eBay, and what role the environmental aspect plays for trading on eBay. The survey showed that only a small part of users generally considers selling used goods to be a contribution to protecting the environment (Statement: “I think reselling is a good idea because it contributes to environmental protection”; those who agree and agree strongly: 27.3%).

Currently, environmental protection also plays a minor role as a personal motive for people buying or selling goods on eBay. The environmental aspect is mentioned only in the bottom third of the motives mentioned—both for buying and for selling. Practical considerations and financial motives are most important for the people questioned (Figure 2). When it comes to the motives for selling on eBay, fun is also mentioned as a significant motive.

Figure 2. Motives of online purchasing. The percentage of respondents who answered “applies or strongly applies” to the question: “Why do you buy things on eBay?” Scale of six possible responses; source: authors’ calculations. Valid n = 2,370; missing n = 141; total n = 2,511.



The results of the survey confirm the hypothesis formulated by Paech [15] that eBay makes alliances of motives possible "... by which a certain degree of ecological awareness raising can be combined with other interests in new ways. People feel that winning an auction for a used article is precisely not a limitation of freedom or an imposition, but rather an enriching experience" ([15], p. 224).

Women in particular agree that protecting the environment (by trading used articles) is an important motive (applies or applies strongly: 34.3%) that can probably be combined with having fun (applies or applies strongly: 60.5%), but which surely is combined with an ecological awareness in different aspects in their eBay behavior (like the importance of ecologically friendly products in general). Men are much more indifferent about these aspects and do not accept the mentioned motives as strongly as women do.

An important question concerning the sustainability effects of trading on eBay is how the products are shipped. Shipping causes relevant environmental effects of online trading [16,17]. The majority of the used products bought on eBay is traded nationally and shipped by a parcel service. The data shows that approximately 90% of the products are shipped using a parcel service; buyers pick up about 10% themselves. But only a small fraction of those involved have given thought to the question of long transport routes. It has been found that 20.1% of the women and 17.4% of the men questioned often think that it is better for the environment to avoid long transport routes.

One starting point for ecologically optimizing eBay trading is to offer climate-neutral shipping on the eBay website. Several parcel services already offer this kind of climate-neutral shipping (e.g., DHL with its "GoGreen" service). It involves calculating all the CO₂ emissions incurred by the shipment and

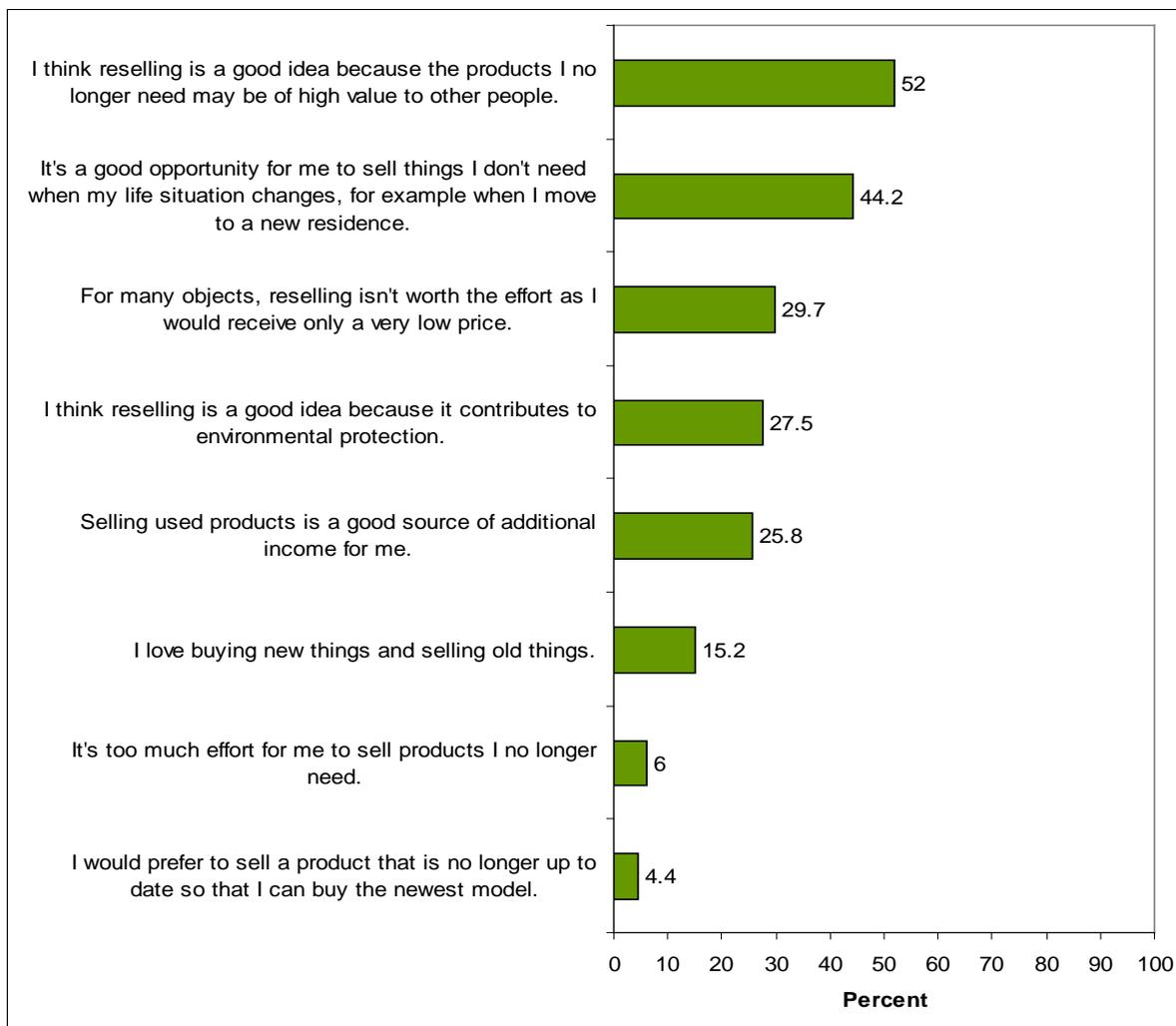
adding a small additional fee to the postal charges. This fee helps finance certified climate-protection projects. The survey shows that the willingness of eBay users to utilize such services is high. A clear majority of respondents (64%) can imagine using climate-neutral shipping options, and a relatively large group (44.6%) would also be willing to pay a small fee for them. Once again, there are more women (49.4%) than men (41.0%) who would be willing.

3.2. Attitudes toward and Handling of Used Products

One central focus of the study was the question of attitudes toward used products and the handling of such products. The results show that used products are widely accepted by eBay users. The respondents stated that about half the products they bought on eBay were new and half were used. An important aspect in this regard is the opportunity to obtain high-quality products for a reasonable price. The majority of eBay users (55.8%) agreed with the statement “I prefer a high-quality used product to a low-quality new product.” The sales figures reveal that the target group in our study sells almost exclusively used products. This is not surprising since the survey was limited to private individuals who do not trade professionally on eBay. But it also shows that there is still great potential to further intensify sales of used goods. In fact, 86.8% of the respondents could imagine selling used products on eBay more often in the future.

Attitudes toward reselling, as well as possible barriers, were examined in order to identify starting points for intensifying the trade in used products (Figure 3).

Figure 3. Attitudes toward reselling used goods. The percentage of respondents who answered “agree or strongly agree” to the question: “Do you agree with the following statements about reselling used products?” Scale of six possible responses; source: authors’ calculations. Valid n = 2,410; missing n = 101; total n = 2,511.

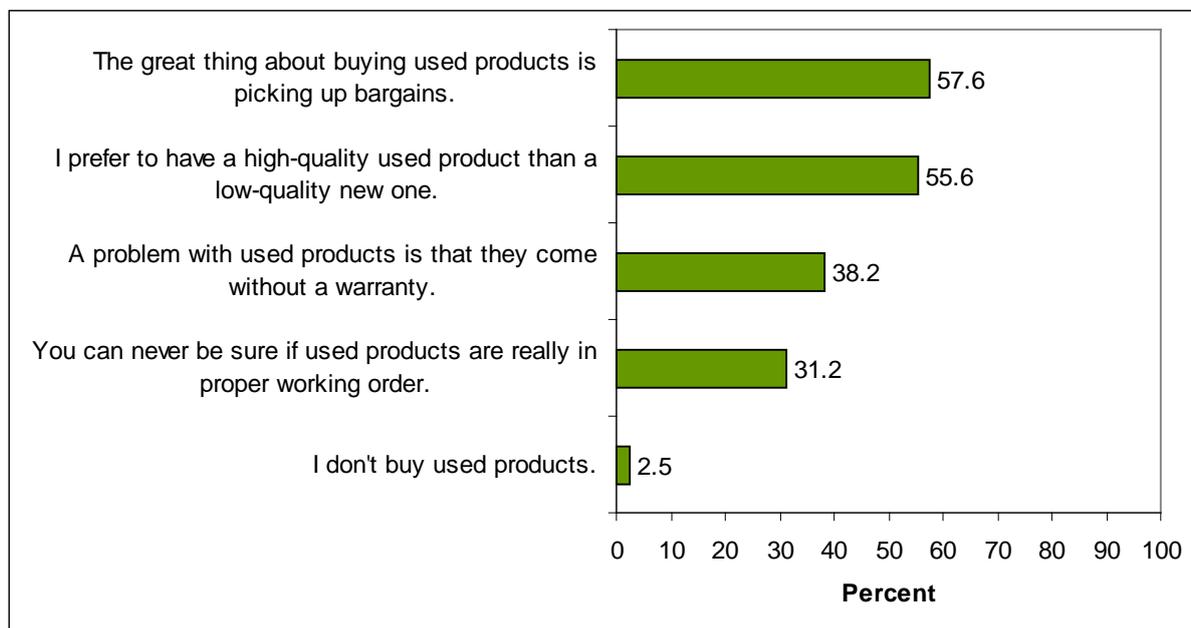


The results show various aspects that play an important role in reselling used products. To the surveyed eBay users, the value that products they no longer use might have for other people is very important. Important occasions for reselling used products include situations of change in life (e.g., moving, having a baby, moving out from one’s parent’s residence, changing jobs, *etc.*). Almost half of eBay users consider it a good opportunity to sell unused objects when their life situations change. However, the responses also provide initial pointers to existing barriers for trading used products. The sellers argue that reselling is not worth the effort. It is striking that the number of respondents who agree or fully agree with this statement is larger than the number who consider reselling a good additional source of income. It can be assumed here that at least certain product groups do not fulfil the expectations of financial gain.

From the buyers’ perspective, a relevant problem is that used products come without a warranty. More than one-third of those surveyed consider this a problem (Figure 4). An additional 31.2% criticize that one cannot be sure if used products are really in proper working order. This is a central

weakness of trading in used goods: the lack of security with respect to whether a used product actually meets quality expectations.

Figure 4. Attitudes toward buying used goods. The percentage of respondents who answered “agree or strongly agree” to the question: “Do you agree with the following statements about used products?” Scale of six possible responses; source: authors’ calculations. Valid n = 2,455; missing n = 56; total n = 2,511.



3.3. Consumption Patterns on eBay and Sustainability

In the next step, cluster analysis was performed. The main result of this analysis was that the “reality” of online trading of used goods on eBay can be described by five consumption patterns. These are: people who prefer to buy new goods; people who do not like to sell things; used goods purchasers and sellers motivated by price; used goods purchasers and sellers motivated by their environmental orientation; and so-called prosumers, who buy (qualitative high ranked) things with the intention to sell them again and therefore take care of them, who yet do not have a particular environmental orientation.

3.3.1. Price oriented buyers of used goods

Price-oriented used goods buyers (20%) use eBay to purchase things they would otherwise not be able to afford. Saving money is one of their strongest motivations for trading on eBay. In contrast, environmental motivations are only weakly developed. Although the price-oriented used goods buyers display a stronger attitude toward the environment than most other user types, this stance is not manifested in a willingness to act in an environmentally-aware manner. A difference between attitude and actual behavior can also be observed in their changing consumption. Although a clear majority of the members of this group does state that they buy more used products via eBay than before, and has a relatively high economic and social motivation to resell goods, this does not result in more sparing or more sustainable use of products, with the goal of being able to resell them. The price-oriented used

goods buyers display the highest intensity of transactions of all user types, and their behavior is characterized more by purchasing than by selling used products. It is interesting to note, however, that they mostly do not purchase used goods on eBay, but offline, using other used goods markets such as flea markets and classified advertisements.

3.3.2. Used goods sceptics

Used goods sceptics (20%) are, as the name of the group implies, far more sceptical about used goods than the average. They display a low level of trading activity on eBay, as well as little use of the Internet altogether. Used goods sceptics rarely frequent other used goods markets, in contrast to the price-oriented used goods buyers, with whom such markets are fairly popular. *The respondents from this group stated that they buy mostly new goods on eBay.* This tendency toward *conventional* handling of products was visible, not only in their purchasing behavior, but also when they sold goods. Used goods sceptics tend to keep products they no longer use in the basements or attics of their homes. They consider the effort to sell such products to be too large. In addition, used goods sceptics believe that used goods *fetch* only very low prices. In a comparison of clusters, the used goods sceptics display one of the highest orientations toward trends. *Owning products that follow the newest trend is particularly important to them.* They also display one of the highest levels of willingness to act in an environmentally-friendly way on eBay. Just as price oriented buyers' of used goods attitudes toward the environment have little effect on their behavior, the used goods sceptics' behavior is very weak in environmental terms.

3.3.3. Online buyers

In contrast to the price conscious buyers of used goods who trade used products more often at flea markets, or use classified advertisements in newspapers, *online buyers* (15%) mostly buy used products online, and very rarely at classic used goods markets. As with the used goods sceptics, they often consider the effort to sell used products too large. Although they buy used products online, they sell them less often. They are motivated to shop on eBay especially by the opportunities to find exotic rarities and collectors' items. Convenience in everyday life, which is potentially linked to shopping on eBay, is also a strong motivation. In light of this, it is surprising that they do not observe any changes in their own consumer behavior. *This permits us to assume that this group actually considers eBay as a kind of substitute department store* that does not encourage them to consume more, or to consume in a different way. It is striking that financial motives seem to be entirely irrelevant. Therefore, we assume, that they spend money on eBay that they previously would have spent elsewhere for the same purpose, and that there is no potential for savings in this regard. Environmental aspects hardly play a role at all for online buyers.

3.3.4. Environmentally oriented buyers of used goods

Environmentally oriented buyers of used goods (22%) are the only group that display distinct environmentally oriented behavior on eBay. For example, they use the location or distance feature to find buyers or sellers nearby, and think about the fact that it is better for the environment if long

transport routes are avoided. Their environmental orientation is also visible in their motives for trading on eBay. *They believe that buying and selling of used products is beneficial to the environment.* It is also important to them to buy environmentally friendly products. The factor, “willingness to act in an environmentally-oriented way on eBay,” is striking. While the other consumer types often state their willingness to act in an environmentally friendly way without putting this into practice, the environmentally oriented buyers of used goods do in fact display both environmentally aware and environmentally oriented behavior even today (“while on eBay, thinking about the fact that it is better for the environment if long transport routes are avoided”; “using the location or distance feature provided by eBay”). However, their willingness to use possible future eBay options that would make trading on the site more sustainable (“willingness to use climate neutral shipping options on eBay”; “willingness to pay a small fee for this service”; the “general willingness to pay higher prices for environmentally friendly products”) is not as strong as that of the other groups. It is also interesting to note that their way of handling products is practically not oriented at all towards resale. In other words: they do not necessarily use products in a more sparing way in order to maintain an item’s resalability. Environmentally related motivations to sell play only a minor role in general. In addition, they tend not to be very active on eBay, and use offline used goods markets, such as flea markets or bulletin boards, more frequently. The members of this group did not observe a change in their own consumer behavior because of eBay. *However, the environmentally oriented buyers of used goods estimate the characteristics of sustainable products, such as long life span and quality, and they display the most environmentally oriented attitudes in comparison with other clusters.*

3.3.5. Prosumers

So far, (used goods) trading on eBay has been viewed mostly as the *purchasing* of (used) products. This raises the question of who is selling the products purchased by the other consumer groups. The prosumers (23%) provide the answer. The term “prosumer” was coined by Alvin Toffler [18,19]. He uses this artificial word to denote consumers’ private production activities. For Internet based trading in used goods, using the example of eBay, this means that users access the platform from home and contribute to optimizing it; secondly, they also post products on the online marketplace. If the seller handles the products for sale with care, this can be a motivation for buyers to purchase it; that is, sellers take good care of the products to be resold—which may be high quality products—in order to obtain a good price. The members of this group are distinguished above all by a *strong orientation toward reselling, both in the way they use products and in their motivation to sell in general.* For example, they use products with care in order to be able to resell them later. They are motivated to trade on eBay, especially for economic (and social) reasons. The effort they need to expend to sell used products does not daunt the prosumers. In any case, they use eBay very often, but offline used goods markets rarely. However, they not only sell, they also buy on eBay, and they do so with, by far, the highest orientation to current trends, in comparison with the other consumer types. Therefore, we assume that they tend to purchase new goods rather than used ones. However, in fact, most prosumers buy both new and used products, and display the highest trading activity on eBay in general. eBay’s fun factor lures the prosumers most, in the cluster comparison. But the prospect of tracking down exotic rarities for a reasonable price also plays a role. Environmental aspects, on the other hand, are less important.

Although prosumers state that they are highly oriented toward environmental protection, this is not manifested by a willingness to act in such a manner on eBay. Their general attitude toward the environment is among the weakest in comparison with the other consumer types.

Concerning their socio-demographic characteristics, the five consumption patterns identified display hardly any statistically significant differences. The only noteworthy feature is the high proportion of men among online purchasers. This group is also characterized by a relatively high proportion of self-employed workers (20%).

3.4. Second-Hand Trading and the Relevance of Life Course

As a further result, the survey has demonstrated that second-hand trading and presumptive activities are significantly influenced by the consumer's life course. The quantitative survey discloses that parents', unemployed persons', and retired persons' use of eBay as buyers or sellers is based on different motivations, as well as different attitudes towards consumption and sustainability. Parents are particularly motivated to buy second-hand by the opportunity to "make a bargain" (62.5%), and they are prone to consider second-hand purchases as "eco friendly" (33.3%). The parents in our survey also declare that the use of eBay changed their consumers' behavior insofar as they take into account their prospects to resell a product before making a purchase. In that sense they can be classified as prosumers, because they intend to use their purchases only temporarily.

In contrast, the responses of the group of unemployed persons in the survey mainly hint to economic motives for the use of eBay. They declare to purchase goods at eBay mostly because they would not have the means to afford them otherwise (39.8%). In their self evaluation of changes in their consuming behavior since the use of eBay, they accordingly focus on the "affordability of goods" (33.3%), and in their role as sellers they focus on the opportunity as a source of additional income (38.9%). Awareness for sustainability could also be found in this group. Almost 43% of the jobless participants in the survey declared they were content with the perspective of second-hand sales as a contribution to environmental protection. The third group, the retired persons, shows the greatest diversity in their motives to participate on eBay. They buy on eBay because they consider it as "convenient" (83.8%) and because they appreciate the opportunity for "dialogue with other users" (23.9%). They are also convinced they contribute to environmental protection with their purchase of second-hand goods (37.3%). Their responses to questions regarding the motivation to sell products on eBay focus on "fun" (57%), "the disposal of old stuff" (48.6%), "eco friendliness" (36.5%), "making money" (33.7%), and the "dialogue with other users" (22%). After all, 38.7% of the retired participants in the survey consider second-hand trade to be a contribution towards the conservation of the environment.

The data from the quantitative survey thus points out consumer's phases of life as not only relevant to the resources that are available to a person (of time and money), but also for a consumer's motives to buy and resell used goods. This is particularly noticeable in the findings for parents. Their responses highlight the fact that phases of life sometimes significantly influence the expected time of use of a product. Baby products are exchanged for toddler's products and so on. The cycle of use follows the stages of children's upbringing.

4. Conclusions from the Empirical Study

The results of the survey show that environmental aspects play only a minor role for the majority of the surveyed eBay users when trading used products. When concerning their motivations in particular, other aspects have been more important to date: practical and financial considerations, as well as having fun trading on eBay. Opportunities to make trading on eBay more environmentally friendly lie in providing information about the environmental relevance of used goods trading, e.g., directly on the eBay platform. In addition, the broad range of motivations that eBay speaks to offers good starting points for creating alliances of motivations that connect ecological aspects with other aspects of use. A concrete strategic point of intervention is the option to provide opportunities for climate-neutral shipping on the eBay platform, and eBay users have indicated a high willingness to use such an option.

The survey also made it possible to identify various starting points for intensifying used goods trading. When developing communications strategies in this regard, the value of used goods for others should be emphasized more strongly. This could happen, for example, by pointing more clearly to the quality, as well as the monetary value, of used products in such communications. Interesting approaches that take this direction include quality tests of used products, as well as tools with which users can learn about the prices they can get for used products. The test lab introduced by eBay in mid-2008 (<http://www.auktionskultur.de/web/testlabor/index.htm>) is an interesting approach. Certain used products were tested here to show their value in relation to the value of new products.

The results highlight the significance of situations of change in life for trading used products. Such phases, for example, the birth of one's first child or retirement can (under certain circumstances) function as times when people start trading used goods, or they can be situations in which the willingness to buy and to sell second-hand products is especially high.

An important aspect for used goods trading is that the effort invested in selling the product must be financially worthwhile. The responses showed, however, that this is not always the case. This aspect must be taken into account when developing measures to intensify used goods trading. Another finding: a central problem of used goods trading lies in the fact that many buyers are unsure of the quality of the products for sale (lack of warranties, doubts about whether the products are in fact in proper working order). In order to address this concern, it is important to develop mechanisms that increase trust in second-hand products and reflect their quality. Initial starting points include initiatives to refurbish used products. One example for this is the initiative www.asgoodas.nu which purchases, refurbishes and then resells used cell phones and provides a warranty.

Identification of the five consumption patterns in online used goods trading contributed to structuring the various behavior patterns of private eBay users. Above all, the fact that the respondents' differences in socio-demographic characteristics are very small is remarkable. The five types do differ significantly, however, regarding their attitudes and their behavior on eBay. They also differ with respect to their concern for the sustainability-related contexts of eBay trading. The *environmentally oriented buyers of used goods* and the *prosumers*, as different as they may be, are those upon whom we pin our hopes for sustainability. Although the former group displays a certain consistency in terms of attitudes and behavior, which is also characterized by increasing awareness of sustainability, it is the prosumers who treat new and used products with care in order to resell them, thereby contributing to

lengthening of the life spans of products, even if they are not aware of this effect.

5. Ecological Assessment of Used Goods Trading

In order to analyze the sustainability effects of private used goods trading on the eBay platform, we developed a systemic approach that translated the empirical results of the online survey into environmental effects by using simplified life-cycle assessment procedures. Approaching the issue via the environmental effects does not exclude the economic and social dimensions of sustainable development; on the contrary, it also permits economic and social assessments. For example, additional consumption by means of cheap used goods is to be considered negative from an environmental perspective, but positive from the point of view of social participation in consumption.

The environmental effects of information and communications technology—which includes trading on eBay—are often divided into primary, secondary, and tertiary environmental effects in the scientific literature [11,20].

1. Primary effects: The effects due to the physical existence of the information and communications technology and the related processes throughout its life cycle (e.g., electricity use due to Internet usage).
2. Secondary effects: The effects caused by the usage and application of information and communications technology (e.g., change of transportation routes due to online trading).
3. Tertiary effects: The effects due to the information and communications technology system that influence the development of the primary and secondary effects indirectly (e.g., changes in consumption behavior at the societal level).

All three mechanisms of the effects of information and communications technologies on the environment must be examined in order to gain a realistic overall picture of the environmental effects of private online trading on eBay. In the following, the three mechanisms of the effects of information and communications technologies on the environment will be discussed, using the example of greenhouse gases, as expressed in CO₂ equivalents.

5.1. Primary Effects

The primary effects of trading on the eBay platform include, above all, the energy used by the servers and computer centers, for data transmission and for the consumers' computer usage.

The total greenhouse gas emissions caused by the energy usage of eBay, Inc. amounted to 127,416 metric tons CO₂ equivalent in 2008 [21]. An estimated 10,000 to 15,000 metric tons CO₂ equivalent originated from the servers and computer centers for the eBay platform [22]. In spite of the fact that eBay, Inc.'s CO₂ emissions increased from 2007 to 2008, the company calls itself a CO₂-neutral business, and justifies this by pointing to energy efficiency measures in its computer centers and investments in projects to compensate CO₂ emissions, among others. As of February, 2009, the amount of CO₂ credits purchased for 2008 was insufficient [23].

For communication between the servers in eBay's computer centers, and between eBay and eBay users, the transmission channels are selected flexibly by means of dynamic routing. The electricity

consumption of the network components for online activities is significantly lower than the corresponding electricity consumption of the servers and computer centers, and also of the consumers' computers. We estimate the amount of CO₂ emitted by eBay in 2008 and caused by usage of network components to be between 50 and 100 tons CO₂ equivalent [22].

The 22 million eBay users in Germany spend, on average, two hours and 49 minutes per month on www.ebay.de [14]. During this time, PCs, monitors, laptops, and Internet connections are in use. Based on basic power consumption data for these devices [24], we estimate the CO₂ emissions caused by the consumers' computers electricity consumption to be 28,000–33,000 tons of CO₂ equivalents [22].

5.2. Secondary Effects

When it comes to the secondary effects of private used goods trading on the eBay platform, two cases can be differentiated: In the first case, the transaction on eBay replaces a conventional (e.g., flea market) or virtual (e.g., other online market) transaction in used goods. In the second case, usage of the used product would not continue in the absence of the transaction on eBay; the product would be discarded instead. This extension of the product's useful life creates a benefit that partially replaces the purchase of a new product.

In a simplified model, the greenhouse gas emission of an eBay transaction consists of the primary CO₂ equivalents per auction and the secondary CO₂ equivalents for packaging and shipping. We studied products, such as automobile tires, books, laptops, children's clothing, and sofas in more depth. Taking into account the fractions of the products offered on eBay that were actually sold [25], the primary greenhouse gas emissions are calculated at approximately 50–150 g CO₂ equivalents per auction, depending on the product [22]. In addition, data on packaging and shipping was collected in the online survey and transformed into operands. Depending on the product, the greenhouse gas emissions due to packaging are 10 g to 3 kg CO₂ equivalents, and those due to shipping are 50 g to 20 kg CO₂ equivalents [22].

The question as to how the extension of a product's useful life affects CO₂ emissions by partially replacing the production of new products can be answered only concerning a specific product. Initial estimates for automobile tires, books, laptops, children's clothing, and sofas show that the net balance of greenhouse gas emissions for private used goods trading on eBay is positive for the products that do not require resources during the usage phase, *i.e.*, used goods trading has positive environmental effects [22].

Central factors affecting secondary effects include the transaction costs for trading used goods, the remaining useful life of the used product, the difference in resource usage during the use phase between new and used products, as well as the actually saved costs for less production, distribution, and disposal of new products.

5.3. Tertiary Effects

eBay has significantly increased trading in used goods across a broad strata of society. The German Federal Statistical Office estimates that the trade in used goods in brick and mortar shops totalled 824 million Euros turnover in 2003 and employed 13,000 workers [26]; the stream of used

goods traded on eBay could be significantly more than that. For example, eBay stated that the value of all the goods and services traded on the German online marketplace was 6.6 billion Euros in the 2005–2006 business year [27]. In light of the results of the online survey, it is safe to assume that about 25% of this turnover, *i.e.*, 1.65 billion Euros, might be in used goods. A series of interviews with second-hand store owners support the assumption, that eBay does not jeopardize the offline second-hand market, but mainly adds volume to the turnover in used goods. They report that since eBay started its online business, their offline businesses nevertheless achieved additional turnover.

Possible time savings achieved through online trading with used goods are a matter of speculation, and are also not specific to trading in used goods. The situation is different regarding cost savings, which provide a strong motivation for trading in used goods. A study by TNS Infratest, commissioned by eBay [28], determined that every household in Germany stores unused products with a total value of 1,013 Euros. Assuming about 40 million households and recapitalization of 200 Euros per year and household on eBay, would yield an additional potential trade volume in Germany of 8 billion Euros. The households would receive this sum as additional income that would be available as part of their budgets.

Based on a Danish study [29], greenhouse gas emissions per additionally spent Euro are estimated at 1.5 kg CO₂ equivalents [22]. If the sellers spend this income according to this estimated figure, this would cause approximately 12 million tons CO₂ equivalents. Based on these results, we can formulate the requirement that, in a first approximation, the savings achieved by trading in used goods must be at least 1.5 kg CO₂ equivalents per Euro spent on used goods to ensure that the positive secondary effects are not compensated for by negative tertiary effects. The results for a used sofa traded on eBay are as follows: the primary, secondary and tertiary effects measured in kg CO₂-equivalents amount to 50 kg, while the avoided production of a (part of a) new sofa saves about 80 kg.

6. Consequences for Second-Hand Trade, Online Platforms and Consumer Policy

From the point of view of sustainability, trading in used goods is to be considered mostly positive. As a rule, it is beneficial to the environment if products are traded that the purchaser uses for a relevant period of time, and that use a small amount of energy or none at all during the usage phase. In addition, trading of used goods creates jobs, since the transaction work often exceeds the (mostly very efficient) production work. For this reason, supporting used goods trading makes sense as a resource-saving political strategy. A strategy of activating used goods for trading could support a sustainable consumption policy. In addition, the second-hand sector itself, including eBay as the single most important business, should actively promote its trade. While consumer policy might play a role as a source of credible information, reasonable activity must come from the sector itself and it would be good if online and offline businesses would co-operate. And there is much to inform about:

Few consumers are aware of the effects of used goods consumption in helping the environment and creating jobs. Therefore, raising public awareness in various ways should be a priority. Different user groups and people with various lifestyles are open to used goods purchasing and selling to very different degrees. Additional windows of opportunity open up in the context of certain life-events, like the birth of a child. These specific groups should be targeted with group-specific messages. Alliances of motives favoring the purchase of used goods can be expected to occur, and not only in the case of

ecologically minded people. The “environmentally oriented buyers of used goods,” as well as the “prosumers” are at the center of communication efforts. As the online survey made clear, it is important to the sellers that used objects may still have high value for other people.

As a rule, the messages should focus on conveying the goal of a long useful life of the product, but also realistic expectations for the (often high) quality of used high-quality products. Business actors, such as second-hand store owners and online platforms, should emphasize these arguments more strongly in order to support the development of alliances of motives for buying and selling used goods. Yet many consumers are still reluctant to sell products that can still be used. Barriers exist both in online and offline trading:

- Reservations about the quality of used goods are very important. They could be countered by means of detailed tests of used products and empirical studies of the actual lifespan and durability of products.
- Online marketplaces have made a quantum leap in making used goods trading possible, and more potential is yet to be captured. Auction markets, initially and most importantly established by eBay, however, use a fairly elaborate procedure and complex rules. On the one hand, this system makes supra regional trade in high value goods possible and reduces the risks involved, but on the other hand, they tend to hinder trade with used goods of low value in particular. For this reason, the fact that the usually regional online classified advertisement platforms provide more simple means of offering used goods for sale online is to be welcomed. The regional focus also lowers the transaction costs: since purchasers pick up the goods themselves, there is no risk of not receiving the goods, or not receiving payment. It is doubtful whether regional classified advertisement platforms can attain the effectiveness of international online marketplaces. After all, an important motivation to look for products on eBay lies in the huge amount of products for sale and the possibility of finding practically anything. And at least for the time being, both the number of articles for sale and the number of visitors to the classified advertisement platforms are significantly lower than those on eBay, the dominant online marketplace.
- To date, the usually small businesses involved in professional used goods trading have tapped the markets accessible to them to very different degrees. While the market for used computers appears to be developed to a large extent, due to the high degree of standardization of the products and the fact that they can be shipped easily, there do seem to be, as yet, untapped potentials in the segment of used furniture, for example. Merchants believe that huge amounts of furniture that could still be used well end up being discarded. Professional used goods trade is an important interface, and even today, it often handles online marketing of used products. When eBay sales agencies emerged, owners desiring to sell used goods expected to receive substantial amounts of money for them, yet this hope has proved untrue for many types of objects. Professional trading in used goods does work when the price that can be obtained is at least enough to cover the transaction costs, including the merchant’s costs.

To date, positive environmental effects caused by the use of electronic marketplaces are unintended side effects. The increase in economic importance of electronic platforms for classified advertisements and auctions, however, makes it necessary to tap the potentials for reducing adverse environmental

impacts. The general tendency toward energy-efficient and lightweight IT equipment (“green IT”) will reduce the environmental impacts resulting from the growing number of transactions. Regional purchasing and climate-neutral shipping can also contribute to lessening adverse environmental effects stemming from the transactions. The online survey yielded a strong interest in the regional location and distance feature, as well as climate-neutral shipping.

Acknowledgements

The project was funded by the German Federal Ministry of Education and Research (BMBF) within the research program of Social-ecological Research (SÖF). The full report on the project will be available on www.izt.de at the end of 2010.

References and Notes

1. Grunenberg, H.; Kuckartz, U. *Umweltbewusstsein im Wandel, Ergebnisse der UBA-Studie Umweltbewusstsein in Deutschland 2002*; Leske und Budrich: Opladen, Germany, 2003.
2. Kuckartz, U.; Rheingans-Heintze, A. *Trend im Umweltbewusstsein. Umweltgerechtigkeit, Lebensqualität und persönliches Engagement*; VS Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2006.
3. Maloney, M.P.; Ward, M.O. Ecology: Let’s Hear from the People. An Objective Scale for the Measurement of Ecological Attitudes and Knowledge. *Amer. Psychol.* **1973**, *28*, 583–586.
4. Urban, D. Die cognitive Struktur von Umweltbewusstsein. Ein kausaler Modelltest. *Zeitschrift für Sozialpsychologie* **1991**, *22*, 166–180.
5. Langeheine, R.; Lehmann, J. *Die Bedeutung der Erziehung für das Umweltbewußtsein*; Institut für die Pädagogik der Naturwissenschaften an der Universität Kiel: Kiel, Germany, 1986.
6. Empacher, C.; Götz, K.; Schultz, I.; Birzle-Harder, B. Die Zielgruppenanalyse des Instituts für sozial-ökologische Forschung. In *Nachhaltige Konsummuster. Ein neues umweltpolitisches Handlungsfeld als Herausforderung für die Umweltkommunikation. Mit einer Zielgruppenanalyse des Frankfurter Instituts für sozial-ökologische Forschung*; Erich Schmidt Verlag: Berlin, Germany, 2002; pp. 87–181.
7. Umweltbundesamt (UBA). *Nachhaltige Konsummuster. Ein neues umweltpolitisches Handlungsfeld als Herausforderung für die Umweltkommunikation. Mit einer Zielgruppenanalyse des Frankfurter Instituts für sozial-ökologische Forschung*; Erich Schmidt Verlag: Berlin, Germany, 2002.
8. Empacher, C. Zielgruppenspezifische Potentiale und Barrieren für nachhaltigen Konsum—Ergebnisse einer sozial-ökologischen Konsumentenuntersuchung. In *Nachhaltiger Konsum. Auf dem Weg zur gesellschaftlichen Verankerung*; Scherhorn, G., Weber, C., Eds.; ökom Verlag: Munich, Germany, 2003; pp. 455–466.
9. Klocke, A.; Spellerberg, A. *Aus zweiter Hand. Eine sozialwissenschaftliche Untersuchung über den Second-Hand-Markt in Berlin/West*; Arno Spitz Verlag: Berlin, Germany, 1990.
10. *Auktionskultur: Leben im Jetzt, Besitzen auf Zeit*; eBay GmbH: Dreilinden, Germany, 2008.

11. Fichter, K. Bits statt Atome? Umweltrelevante Auswirkungen des E-Commerce. In *Auf dem Weg zur nachhaltigen Informationsgesellschaft*; Angrick, M., Ed.; Metropolis-Verlag: Marburg, Germany, 2003; pp. 187–210.
12. Initiative D21. *(N)Onliner-Atlas 2008*; Available online: <http://www.initiaved21.de> (accessed on 22 July 2008).
13. *Internet 2002: Deutschland und die digitale Welt. Internetnutzung und Medieneinschätzung in Deutschland und Nordrhein-Westfalen im internationalen Vergleich*; Schriftenreihe Medienforschung der LfM, Band 46; Groebel, J., Gehrke, S., Eds.; Leske und Budrich: Opladen, Germany, 2003.
14. Nielsen//NetRatings. *October 2009 Home & Work Usage*; Available online: <http://presse.ebay.de/news.exe?content=FD> (accessed on 24 November 2009).
15. Paech, N. eBay: Institutionelle Innovationen im Konsumbereich. In *Nachhaltige Zukunftsmärkte—Orientierungen für unternehmerische Innovationsprozesse im 21. Jahrhundert*; Fichter, K., Paech, N., Pfriem, R., Eds.; Metropolis: Marburg, Germany, 2005; pp. 203–236.
16. Reichling, M.; Otto, T. The environmental impact of the new economy: Deutsche Telekom, telecommunication services and the sustainable future. In *Ecology of the New Economy: Sustainable Transformation of Global Information, Communications and Electronics Industries*; Park, J., Roome, N., Eds.; Greenleaf Publishing: Sheffield, UK, 2002; pp. 119–129.
17. Erdmann, L.; Hilty, L.; Goodman, J.; Arnfalk, P. *The Future Impact of ICTs on Environmental Sustainability*; IPTS Technical Report Series, EUR 21384 EN; European Commission: Seville, Spain, 2004.
18. Toffler, A. *The Third Wave*; Morrow: New York, NY, USA, 1980.
19. Hellmann, K.U. Prosumer Revisited: Zur Aktualität einer Debatte. Eine Einführung. In *Prosumer Revisited. Zur Aktualität einer Debatte*; Blättel-Mink, B., Hellmann, K.U., Eds.; VS-Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2009; pp. 13–48.
20. Köhler, A.; Erdmann, L. Expected environmental impacts of pervasive computing. *HERA* **2004**, *10*, 831–852.
21. *Respondent CDP 2009: eBay Inc.*; Carbon Disclosure Project: London, UK, 2009.
22. Erdmann, L. *Methodik zur Erfassung von Nachhaltigkeitseffekten und Quantifizierung der Nachhaltigkeitseffekte am Beispiel von eBay. Bericht im Projekt Vom Consumer zum Prosumer—Entwicklung neuer Handelsformen und Auktionskulturen zur Unterstützung eines nachhaltigen Konsums*; Institute for Futures Studies and Technology Assessment: Berlin, Germany, 2009.
23. *Annual Report. For the Fiscal Year Ended December 31, 2008*; eBay: San José, CA, USA, 2008.
24. IZM & ISI. *Abschätzung des Energiebedarfs der weiteren Entwicklung der Informationsgesellschaft*; Bundesministerium für Wirtschaft und Technologie: Berlin, Germany, 2009.
25. Clausen, J.; Winter, W.; Fichter, K. *eBay: Vom Consumer zum Prosumer. Entwicklung neuer Handelsformen und Auktionskulturen zur Unterstützung eines nachhaltigen Konsums. Bericht zu Modul 2: Marktübersicht: Internet-Handelsplattformen für Prosuming*. 2008, (unpublished work).

26. Roßmann, P.; Wein, E. *Strukturdaten des Einzelhandels im Jahr 2003. Sektorstudie Einzelhandel 2006*; Statistisches Bundesamt: Wiesbaden, Germany, 2006.
27. eBay macht allein in Deutschland eine halbe Milliarde Umsatz. *Handelsblatt*, 26 May 2006.
28. *Dachbodenschätze. Presseinformation vom 06.05.2008*; eBay Deutschland: Dreilinden, Germany, 2008.
29. Thiesen, J.; Christensen, T.S.; Kristensen, T.G.; Andersen, R.D.; Brunoe, B.; Gregersen, T.K.; Thrane, M.; Weidema, B.P. Rebound effects of price differences. *Int. J. Life Cycle Assess.* **2008**, *13*, 104–114.

© 2010 by the authors; licensee MDPI, Basel, Switzerland. This article is an Open Access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/3.0/>).