



DELIVERABLE D2.7

Literature Study on Public Attitudes Towards Take-Back, Recycling and Buying of Refurbished Notebooks

Grant Agreement number:	ECO/13/630329
Project acronym:	RUN
Project title:	ReUse Notebook –Collection, Refurbishment and Distribution System
Funding Scheme:	FP7-Market Replication
Delivery date:	September 2015
Deliverable No.:	D2.7
Deliverable Type:	Report
Lead Beneficiary & Main Partner Responsible:	Ebelt Beratung UG (Part I: Take-Back and Recycling), SAPOS (Part II: Buying)
Status:	Version 1
Beneficiary Numbers:	1, 4
Beneficiary Names:	DrBE UG, VHS
Dissemination Level:	Public
Authors:	M. Regenfelder, F. Fuchs
Email:	max.regenfelder@ebelt-beratung.de ffuchs@sapos-goerlitz.de
Project Co-ordinator:	Dr. Ralf Brüning Dr. Brüning Engineering UG (haftungsbeschränkt) Kirchenstraße 26 • D-26919 Brake Tel.: +49 4401-7049760 Mobil: +49 160-3664468 Fax: +49 4401-7049761
E-mail:	info@dr-bruening.de
Project website:	www.run-project.eu

Introduction to the literature study

During the initial research it became obvious early on, that the two fields of public attitudes towards the take-back and recycling of reused notebooks and similar electronics and public attitudes towards buying reused notebooks or similar electronics are, for the most part, approached separately in research.

Furthermore, the results of the literature study on the areas of take-back and buying, will influence the decision-making process of the RUN project in two distinct operational fields and WPs. The public attitude about take-back and recycling will be a determining factor in the further development of the collection system and the choice of partners for collection points (WP2). The public attitudes towards the buying of refurbished notebooks will be taken into account during the further elaboration of the sales and marketing strategies (WP5).

Because of the aforementioned reasons, the project partners decided that each of the two fields merited its separate analysis and research. The literature study was thus carried out in two parts: “Public attitudes towards the take-back and recycling of notebooks” and “Public attitudes towards the buying of refurbished notebooks”. Each part is presented here in its own chapter. Part one comprises an analysis of research regarding the customers’ motivations to hand in used notebooks or electronics and thus focuses on the supply side of the RUN project. Part two focuses on the marketing side of selling remanufactured or reused notebooks or electronics and analyses factors in customers’ decisions to buy these goods.



DELIVERABLE D2.7

Literature Study Part I:

Public Attitudes Towards the Take-Back and Recycling of Notebooks

Grant Agreement number:	ECO/13/630329
Project acronym:	RUN
Project title:	ReUse Notebook –Collection, Refurbishment and Distribution System
Funding Scheme:	FP7-Market Replication
Delivery date:	September 2015
Deliverable No.:	D2.7
Deliverable Type:	Report
Lead Beneficiary & Main Partner Responsible:	Ebelt Beratung UG
Status:	Version 1
Beneficiary Numbers:	1, 4, 5
Beneficiary Names:	DrBE UG, SAPOS, VHS
Dissemination Level:	Public
Authors:	M. Regenfelder
Email:	max.regenfelder@ebelt-beratung.de
Telephone:	+49 30 3360537
Project Co-ordinator:	Dr. Ralf Brüning Dr. Brüning Engineering UG (haftungsbeschränkt) Kirchenstraße 26 • D-26919 Brake Tel.: +49 4401-7049760 Mobil: +49 160-3664468 Fax: +49 4401-7049761
E-mail:	info@dr-bruening.de
Project website:	www.run-project.eu

Change Log:

Name	Action	Date
Max Regenfelder	Created document and structure	22-06-2015
Max Regenfelder	Chapter 'Goals and Input to the Project'	03-07-2015
Max Regenfelder	Chapter 'Approach and Methodology for the Study'	07-07-2015
Stefan Ebelt	Review and Comments of 'Goals and Input to the Project' and 'Approach and Methodology for the Study'	14-07-2015
Max Regenfelder	Chapter 'Literature Findings' first version	
	23-07-2015	
Stefan Ebelt	Review 'Literature Findings'	23-07-2015
Max Regenfelder	Improvement and more Results to 'Literature Findings'	29-07-2015
Max Regenfelder	Chapter 'Attitudes and Motivation' first version	01-08-2015
Stefan Ebelt	Review 'Literature Findings'	06-08-2015
Max Regenfelder	Extension of 'Literature Findings'	
	07-08-2015	
Stefan Ebelt	Review 'Attitudes and Motivation'	10-08-2015
Max Regenfelder	Extension of 'Literature Findings'	
	17-08-2015	
Max Regenfelder	Extension of 'Attitudes and Motivation' + 'Discussion'	
	19-08-2015	
Max Regenfelder	Chapter 'Conclusions' first version	24-08-2015
Stefan Ebelt	Review 'Conclusions' + 'Discussion'	26-08-2015
Max Regenfelder	Completed 'Conclusions' and 'Executive Summary'	29-08-2015

Table of contents

1	Executive Summary.....	1
2	Approach for the Literature Study on Public Attitudes Towards Take-Back and Recycling of Notebooks	1
2.1	Introduction - Goals and Input to the Project.....	1
2.2	Structure of the study	2
2.3	Approach and Methodology for the Literature Search	3
3	Results of the Literature Study	5
3.1	Literature findings.....	5
3.1.1	Stage 1: Collection, Take-Back Systems and Results in General	5
3.1.2	Stage 2: Collection and Take-Back Systems for (Small) Electr(on)ic Appliances.....	8
3.1.3	Stage 3: Collection and Take-Back Systems for Notebooks.....	13
3.2	Attitudes and Motivations	14
4	Discussion of results	17
5	Conclusions for Take-Back and Recycling of Notebooks	20
6	Literature	21

1 Executive Summary

What do consumers perceive when they think of notebook recycling? What do they expect from a good take-back system? These are issues which are of vital importance to the RUN project. This literature study regarding the public attitudes towards take-back and recycling of notebooks has the goal to identify customers' perceptions and attitudes towards giving disused notebooks into the collection system of RUN. Which attitudes of consumers exist in practice and how can the RUN project make use of them? Thereby input for other work packages and tasks is delivered.

Academic databases were accessed and relevant studies were found in the fields of waste management/ recycling in general, the take-back and recycling of electr(on)ic appliances and a few studies for notebooks.

The public attitudes which refer to the aspects 'convenience of the take-back system' and 'provision of information about return channels' build the foundation for the planned take-back system and should be combined with financial and non-financial (environmental or charitable benefits which appeal on prevailing consumer awareness) incentives. In total, twelve relevant main attitudes were compiled. Also, concerns for private data security are involved in attitudes. This could be supported by good reputation and trust into the organisations which constitute the RUN consortium.

2 Approach for the Literature Study on Public Attitudes Towards Take-Back and Recycling of Notebooks

2.1 Introduction - Goals and Input to the Project

The literature study regarding the public attitudes towards take back and recycling of notebooks shall identify prejudices/ reservations as well as positive aspects in the customers' perception of giving the used-notebooks into the collection system of RUN. Exploring in detail public attitudes towards take-back and recycling of notebooks will deliver input to design the media campaign/ customer contact points (Tasks 2.5, 2.7 and 2.8) and will enable an effective collection network. Thereby, the strategic positioning of the collection concept is assured.

In literature often barriers to the implementation of waste electrical and electronic equipment (WEEE) recycling systems are addressed. Barriers are e.g. informal waste shipments, lack of legislative and practical commitment of governments, lack of recycling systems and insufficient policy instruments (Akenji et al. 2011; Chi et al. 2011; Chung and Zhang 2011; Hicks et al. 2005; Kojima et al. 2009; Manomaivibool 2009;

Manomaivibool and Vassanadumrongdee 2011; Seitz and Wells 2006). For the RUN project these barriers also exist but e.g. the legislative framework for its business environment is given and cannot be influenced, the recycling infrastructure is built by the partners in the project. Within existing remanufacturing literature, there is often differentiated between business-to-business relationships, where access is relatively feasible, and business-to-consumer relationships where the potential is limited by the hedonic and aesthetic motivations of private consumers, as against the utilitarian and economically rational motivations of business users (Watson, 2008). We also assume that this true at least in parts for small enterprises which are a target group for the RUN project, too.

This literature study aims to acquire detailed knowledge of the public attitude towards take-back and recycling of notebooks. This is necessary because it will deliver insights how to motivate consumers to give their used appliances into the RUN system. To do so, the consumers will need incentives – of ecological, social or monetary nature- and the design of those incentives will be a vital part to reach the throughput in the RUN project.

We also find a high willingness in the target markets to sell used goods. E.g. in Germany a large share of consumers (around 87%) is willing to intensify their sell activities on online platforms (Ebay). This is in line with a transition from consumer to prosumer. Prosumers include reselling products into their economic rationale and therefore threat products during their use more carefully. (Henseling and Behrendt, 2011)

This will be used to conclude which are the best international practices in motivating people to recycle their appliances.

The literature study is explorative. This means, there are no theses of the authors ex-ante regarding the nature of the public attitudes. Thereby, no empirically relevant attitudes are excluded and the results of this study are not predetermined or biased.

2.2 Structure of the study

The structure of the literature study on public attitudes towards take-back and recycling of notebooks is as follows: In Chapter 2.3 the approach and the methodology is disclosed. Then, in Chapter 3 the results are presented and discussed. First in Subchapter 3.1 'Literature Findings' the results are assigned to the several stages and main findings of single studies presented. In Chapter 3.2 'Attitudes and Motivations' are compiled out of these results. In Chapter 3.3 'Discussion' of Results their importance and appropriateness to the RUN project is discussed. This study ends with the conclusions in Chapter.

2.3 Approach and Methodology for the Literature Search

This report is a meta-study. This means that already existing studies, documents and publications are searched and –if suitable- their main arguments are analysed. From the overall quantity of existing studies, the main influence factors and results for the attitude towards take-back and recycling are compiled.

The study of public attitudes towards recycling accesses the dataset of the Academic Search Premier (EBSCO host) database (www.ebscohost.com). It is the one of the largest database of scientific literature (peer-reviewed and not reviewed; scientific journals, books and conference proceedings). It is a multi-disciplinary EBSCO-host-Database which includes over 8500 scientific journals from all disciplines, e.g. social sciences, humanities, education, computer sciences, engineering, physics, chemistry, language and linguistics, arts and literature, medical sciences, ethnic studies. In this database, the abstracts, titles and keywords were searched. This approach shall enable an open scope on possible attitudes towards take-back and recycling of notebooks which is not narrowed e.g. by the authors' mindsets which may be biased by the regional (German or Austrian) discussion of this issue. Nevertheless, the study has a special focus on the region Germany and Austria, because these are the key markets for collection in the RUN project. The literature found in this database is complemented by literature found in cross references and additional sources known to the authors.

International studies are also not excluded from this report because especially for the attitudes on the take-back and recycling of notebooks the evidence turned out to be of poor quantity. Thus, findings for similar products, e.g. smartphones are included. Especially for mobile phones a lot of studies can be found. Researching mobile phone take-back system was obviously in recent focus of academia. We argue that empirically assessed attitudes towards take-back and recycling can be transferred on notebooks to a certain extent and deliver input on how to motivate consumers to give their used notebooks into the Run collection scheme. The structure of this meta-study is as shown in the Figure 1.

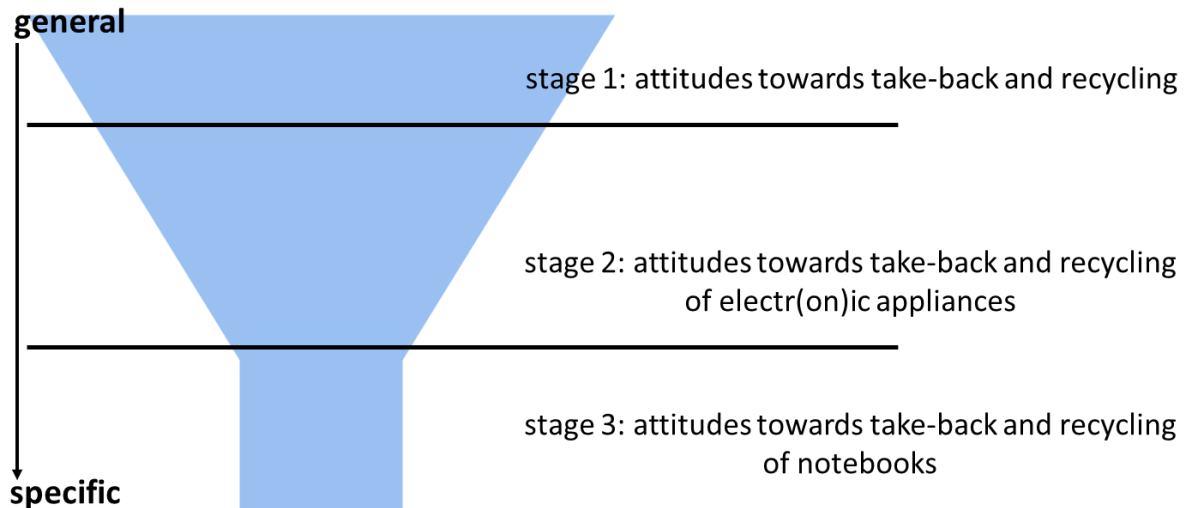


Figure 1: Structure of the Literature study

This literature study is deductive: Starting from the very general attitude towards recycling and take-back of products and waste (stage 1), it gets more specific towards the take-back and recycling of electr(on)ic products, e.g. computers and smartphones. These products are very similar to notebooks, e.g. in consumers' use patterns and functionalities. We argue that findings from this stage 2 analysis will deliver comprehensive input on how to design incentives for consumers to give their appliances to the RUN system and findings can be transferred on notebooks. The final stage 3 only assesses the attitudes directly on notebooks.

The search is keyword-based. It was distinguished into three main groups of keywords. From each group at least one word has to be found in articles' titles, keywords or abstracts.

A special focus was on how to derive keywords for the study from the original task description. Therefore, a synonym database (thesaurus.com) was employed and synonyms were selected for suitability on the objectives of this report (especially attitude has manifold meanings).

The first main group addresses 'attitude': What sentiments, notions or perceptions do consumers have?

The second main group is built around the terms take-back and recycling.

In the third main group the addressed appliances are searched in three stages: from products to notebooks.

Figure 2 provides an overview of the search words and selected synonyms.

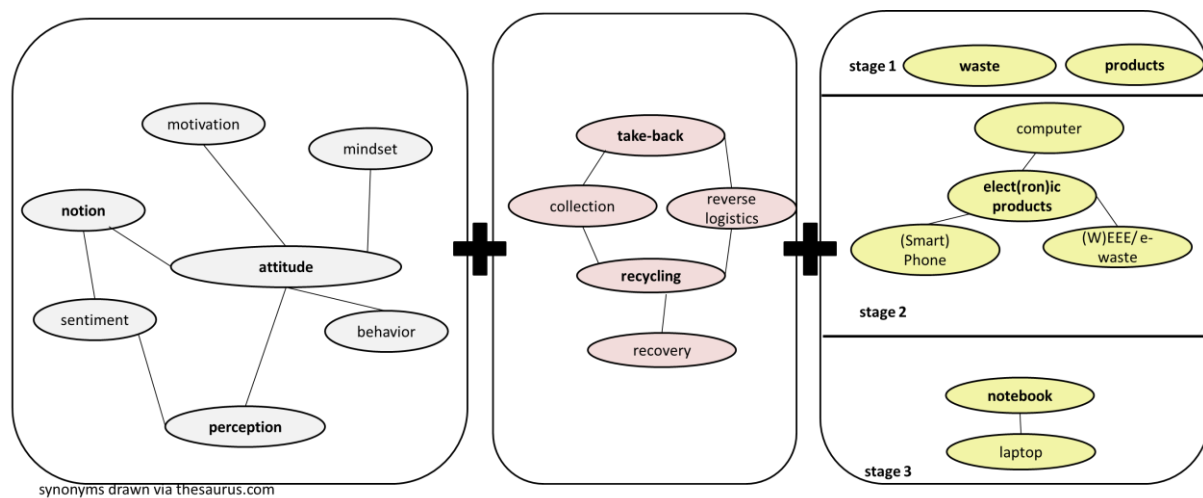


Figure 2: Overview of Search Words and Selected Synonyms

For each stage, there was a keyword search in titles, abstracts and keywords for finding at least one word for each of the three addressed main groups (e.g. attitude AND recycling AND notebook).

Search period was not limited, Academic Search Premier database has backfiles until 1975. We argue that electronics recycling and this collection schemes are an issue of recent decades and this limitation does not lower the evidence of this meta-study.

3 Results of the Literature Study

3.1 Literature findings

The findings are presented assigned to the three stages as introduced in Chapter 2.3. In the following subchapters the single studies and results are summarized.

3.1.1 Stage 1: Collection, Take-Back Systems and Results in General

First, the public attitudes in general towards take back and recycling were assessed. Note that manifold studies stress that environmental attitude or motivation itself is not equally resulting in recycling practice (Keramitsoglou and Tsagarakis, 2013). Schultz and Oskamp (1996) examined this in respect to recycling activities. The lesser the effort for the recycling activity was, the more the attitude was likely to result in recycling behaviour. As well as, the more environmental concern was present, the more will for effort was there. They conclude that effort is a strong moderator of the attitude behaviour relationship. Moreover, there is criticism on assumption that general attitudes like environmental concern are direct determinants of specific behaviours.

Environmental concern is discussed to be only an important indirect determinant of specific behaviour (Bamberg, 2003).

Nevertheless, there is a high percentage of consumers planning to resell products. As mentioned before, around 87% of German Ebay users are willing to intensify their sell activities. The potential of private households as source for still functioning used products is large and consumers include the reselling into their economic rationale (Henseling and Behrendt, 2011). Clausen et al. (2010) investigated more in detail the attitudes towards reselling goods in the internet/ Ebay (note that also the RUN project will offer an internet-based take- or buy-back option). 52.0% of respondents agreed or strongly agreed to 'I think reselling is a good idea because the products I no longer need may be of high value to other people.'; 44.2% to 'It's a good opportunity for me to sell things I don't need when my life situation changes, for example when I move to a new residence.'; and 29.7% to 'For many objects, reselling isn't worth the effort as I would receive only a very low price.'. Environmental reasons are only the fourth important motivation; 27.5% for 'I think reselling is a good idea because it contributes to environmental protection.' This shows that various aspects play an important role in reselling used products and not solely a general attitude of environmental concern. Barriers are seen when consumers think that products are not worth the effort for reselling them. Financial incentives and changes in personal life situations are a driver for selling used goods in contrast. Henseling and Behrendt (2011) in this respect underline the importance of a transition from consumer to prosumer for unlocking sustainability potentials and the influence of the personal life phase of sellers. In German households they estimate on average products worth 1,000 € (total for whole Germany 40 bn. €) lying dormant or been stored if the effort of selling is not regarded worth the value of products. Behrendt et al. (2011) see an ideal type of technophile seller as seller which has an unconscious sustainable behaviour in re-selling used products to environmentally conscious buyers.

De Brito et al. (2003) observe a large number of different tools used to encourage the return of used products in a meta-study of reverse logistics case studies. For post market returns, they observed buy back options, refund options, fees, trade in, or acquisition prices. Return mechanisms are rather case specific. Incentives were mostly monetary. Whereas in the USA economic aspects were the driver, in Europe also legislation is also an important driver.

Timmlet and Williams (2008) assessed the performance of several kinds of incentives for kerbside recycling in the United Kingdom (UK). Besides financial incentives also social norms and face-to-face interventions can be used (door stepping, personal feedback).

Barr et al. (2001) provide a framework analysing attitudes towards household-waste management and applied it for a case study in Exeter, England. Environmental behaviour is dependent of environmental values, situational variables and psychological variables and behavioural intention. Findings were that environmental values influence minimisation and re-use behaviour but not recycling. The participation in recycling is seen principally determined by

“the acceptance of the norm to recycle, the convenience of recycling sites, knowledge of recycling facilities, as well as ‘active concern’. Clearly, willingness to recycle is highly norm based. In other words, it appears that people are more willing to recycle if those around them do as well, such as neighbours, friends, and peers. Those who perceive they have the time to recycle, that recycling sites are convenient, and that they have storage space for recyclables are also much more willing to take part in recycling programmes.” (Barr et al., 2001, p. 2041).

Miafodzyeva et al. (2013) found similar results for Stockholm, Sweden. The most important aspect for the participation was the acceptance of legal norms.

Shaw and Maynard (2008) analysed incentives for enhancing participation for kerbside recycling in London, England. They found that financial incentives did play a minor role. Only 12% of respondents answered that this would enhance their participation. More important were an enhancement of service (more than 50%) and additional information and promotion. The most encouraging incentive for more recycling was if the local ‘community benefited from additional free services e.g. street cleaning and environmental improvements’, followed by ‘council tax rebates’ and ‘my neighbourhood benefited from community improvements’

A study for kerbside and drop-off recycling in Minnesota, USA concluded that variable pricing for waste disposal is effective as well as regulations. Combining curbside and drop-off recycling significantly rises the recycling rate. One measure alone was insignificant. (Sidique et al., 2010)

Best and Kneip (2011) examine in an experimental approach the incentive landscape for household waste recycling in Cologne, Germany. There the recycling system was changed from drop-off to curbside collection. They assessed hypotheses that

a) the type of recycling scheme and environmental concern have additive effects on the likelihood of participation in recycling (rational choice hypothesis),

b) the effect of environmental concern should be stronger when a curbside scheme is installed (low-cost hypothesis). The convenience of recycling systems and the knowledge about them is also an issue, and

c) the recycling scheme does not play a major role for persons with very strong environmental concern, but becomes more and more relevant when attitudes are weaker (dual-process hypothesis).

Results were that for the rational choice hypothesis curbside collection had a strong impact on recycling participation and attitudes had a moderate effect. The interaction is negative but statistically insignificant. Findings contradict the low-cost hypothesis and provide some evidence that environmental concerns moderate the effect of the recycling scheme.

Another issue is trust of consumers into the take-back system. Granström (2006) assessed the market for used furniture in Sweden. Findings were inter alia that people donate furniture because of altruistic motives and the reputation and trust into the organisation to which the goods were given is of importance. Rompf (2014) likewise highlights the role of system trust – trust in the reliability, effectiveness and legitimacy of social institutions- as main factor for the participation in recycling systems (even stronger than the rational choice or low cost explanation). This trust can moderate the influence of incentives. (Keramitsoglou and Tsagarakis, 2013) also researched this for a Greek town. Besides e.g. financial incentives they underline the importance of extrinsic factors on participation in recycling. The main concern of consumers was

“the credibility of institutions involved in the recycling programme implementation. They seemed to have greater trust in municipality services and their co-operation with other stakeholders than in the private sector or NGOs.” Keramitsoglou and Tsagarakis, 2013, p. 60)

The assessment of the general public attitudes brought the following insights. Environmental concern of consumers does not necessarily result in an environmentally sound behaviour. In terms of returning or reselling used products –which often still function and have a value- financial incentives play the most important role. Other attitudes such as personal life situation and environmental concern nevertheless contribute to the propensity to resell. Effective means to raise consumers’ or households’ recycling rates are also widely accepted legislation/ laws and regulation and making use of social norms (pressure groups). The reputation of the recycling/ take-back system respectively of the involved organisations is important.

3.1.2 Stage 2: Collection and Take-Back Systems for (Small) Electr(on)ic Appliances

Studies for the collection, behaviour and attitudes towards the recycling of e-waste can be found for a number of countries. There is an ambiguous relationship between general environmental concerns and willingness to recycle (positive: Saphores et al., 2012; no

impact: Kurz et al., 2007). For e-waste, attitudes have been found to play a positive role in explaining a greater willingness to pay for greener choices (Song et al., 2012; Wang et al., 2011; Nixon et al., 2009). Studies dealing with e-waste consider a number of different appliances: from mobile phones and computers and cameras to washing machines.

Concerning the consumer behaviour in recycling schemes for the USA, Saphores et al. (2012) found a great willingness to participate. Nearly 75% of consumers were ‘very willing’ (46.8%) or ‘willing’ (28.8%) to recycle their e-waste at drop-off centres and one third of all consumers have practically already brought e-waste to a drop-off centre. The knowledge that e-waste contains toxic materials is widespread (~ 60% of consumers) but also the distance to the next drop-off point matters (convenience). These findings are also supported by a study from Milovantseva and Saphores (2013). E-waste recycling could be enhanced not only by legislation/ laws but also by information combined with economic incentives e.g. deposit-refund systems. They further observed that recycling, re-using and storing are the top-3 end-of-life (EoL) options for televisions and mobile phones. Nixon et al. (2009) observed the favoured recycling options of consumers. They are depicted in the following Table 2:

Recycling Alternative	First Choice (%)	Second Choice (%)	Third Choice (%)	Fourth Choice (%)	Fifth Choice (%)
Option 1: Pay as you throw	15.0	20.0	15.7	17.9	31.4
Option 2: Drop-off at regional recycling centres	33.6	30.1	19.6	14.7	2.1
Option 3: Curbside recycling	29.1	19.1	19.9	15.6	16.3
Option 4: Drop-off at retail locations	6.4	30.0	25.0	30.7	7.9
Option 5: Deposit-refund program at retail locations	26.1	21.8	10.6	13.4	25.2

Table 1: Summary of Rankings of Recycling Alternatives (Nixon et al., 2009, Table 5, p. 114)

The results show that bringing in EoL electronic appliances to drop-off sites is most preferred by 40% of consumers but also referring to convenience of alternatives.

Song et al. (2012) observed similar results in Macau. 17% of e-waste was stored at home while 48% was collected by recycling systems, e.g. given back to retailer. They found a main difference to mainland China where 70% of e-waste was stored at home. They explain this difference mainly with a higher income and lower collection prices in Macau. Consumers were aware of the environmental importance of sound e-waste recycling practices (70%) but not in detail. About 56.67% of respondents expressed a positive attitude towards handing over e-waste to government departments 37.18% of respondents indicated that their willingness would depend on the categories of electronic products and the collection procedures. If the obsolete electronic products were still in good working condition or could fetch a high sale price, they would be more willing to sell them to a second-hand shop. Consumers furthermore preferred convenient collection methods such as 'telephone reservation' system to collect e-waste (45.27%), followed by the availability of a 'fixed collection place' (34.51%), a 'designated collection time and collection place' (18.68%), and other collection methods.

A study for EoL electr(on)ic products in Malaysia yielded also evidence that not any more used appliances are stored, re-used, discarded into bin or stored at home (Afroz et al., 2013).

For not any more used electr(on)ic appliances the following can be stated: Consumers are aware of the environmental importance of sound recycling practice. They are aware of the worth of still working appliances, sell, store or give them away to friends. They are also open to bring those appliances to drop-off sites but strongly prefer convenient collection schemes.

For customer attitudes towards the collection and recycling of mobile or smartphones several studies were found. Collection systems for mobile phones seem to be of strong interest for academia and practice as well.

Ylä-Mella et al. (2015) assessed the recycling behaviour and consumer perceptions for mobile phones in the city of Oulu, Finland. They found out that the majority of consumers stored old mobile phones at home (45% of appliances), gave it to friends or children (13%), 2% which were not used anymore were sold, 7% were left at the shop when buying a new one and 15% were brought to a recycling centre. These figures are of interest because also the reasons for not bringing them to recycling centres or not re-using/ selling them were examined. 55% of consumers used them as spare phones, 38% of respondents answered that they 'not have yet returned' returned appliances while only 4% felt that recycling is too 'troublesome' and 17% did not have the information were to return the appliances. Nevertheless, nearly all consumers were aware of the importance of mobile phone recycling. More specific, the motivation for recycling mobile phones was rooted in resource efficiency (51% of consumers), environmental protection (38%), health issues (discharge hazardous substances, 28%) and recovering

economic value (28%). Moreover, financial incentives such as a deposit were seen as appropriate measure to motivate consumers to return appliances. As well, it is concluded by the authors that the local recycling system should be more convenient to access the appliances lying dormant at home (more return point at shops etc.) combined with financial incentives because consumers were already aware of the importance of recycling. This shall be likely to change the consumers' behaviour. (Ylä-Mella et al., 2015).

Similar results yielded a study for the United Kingdom (Canning, 2006). Consumers also stored 55% of disused mobile phones there although there are incentives by take-back system/ mobile phone firms (cash vouchers, upgrades). The study concludes that there shall be incentives combined with information about the importance of recycling, about the potential to earn money with their old appliances and about return channels. Consumers tend to store old appliances because they are easy to store or give them to friends and relatives. For the United Kingdom also the convenience of take back schemes for mobile phones was measured by Ongondo and Williams (2011a). They composed the factor 'convenience' out of collection methods; number of steps/ stages required to complete the online handset return process; ability to easily navigate the scheme's website; ease with which the web user was able to find information on the scheme's website, the clarity of the explanation about a scheme; and options available for contacting the scheme's customer services. They see the convenience as most decisive factor for the success of take back schemes. A survey under UK students from the same authors (Ongondo and Williams, 2011b) found that the main reason for not returning mobile phones was to keep them as spare parts (77.1%), followed by 'not knowing what to do' (33.1%), think that it was not worth anything (23.5%) and having valuable information stored on mobile (21.2%). On the other hand, the top-3-reasons for using take-back services were offered incentives (54.0%), easy access (51.4%) and convenience of service (32.8%).

Most (2003) conducted a similar study of existing mobile phone take-back programmes in the USA. The most common incentive for consumers was a tax receipt that allows donors to take a charitable deduction (based on estimated value of the donated unit) on their federal income tax return. Of interest for the RUN system is that financial incentives

"can be an effective tool in promoting cell phone donation. However, few of the programs investigated for this report make use of such incentives, and those that do have done so in only a limited way." (Most, 2003, p.23)

Moreover, supporting charity organisations was preferred by the take-back systems.

Note that this behaviour of storing old appliances for spare or giving them to friends relatives etc. was also observed in emerging countries such as India or China. In India, financial incentives are regarded as key factor to increase returns of used mobile phones (Rathore et al., 2011). For low recycling rates in China, the reason was that most consumers did not know where to send the phones (45.9%), or that they would rather give their phones to families or friends than recycle it for a small fee (28.3%). Moreover, some consumers were afraid of privacy disclosure (17.7%), and a few consumers used waste mobile phones purely as data storage equipment (8.1%). Also, the environmental awareness of consumers of the importance of recycling was low. Easy accessible take-back opportunities are favoured by Chinese consumers, e.g. 'Old-for-New Activity', the 'Green Box Program' and collection sites in communities (Yin et al., 2014). A study under Chinese students (Li et al., 2012) has similar results: The most common reason for not bringing their mobile phone for recycling was that respondents 'don't know how to deal with their retired mobile phones' (59,81% of students), followed by the inconvenience of the take-back services (35.24%). Privacy protection was with about 17% not one of the most important reasons but nevertheless plays a role. Stockpiling the mobile phones as spare seems to influence fewer students in China (as in contrast: for UK students it was the most important reason; see Ongondo and Williams, 2011b). The most effective incentives (top-5) were cash or voucher (81.21%), airtime (58.26%), environment (41.44), charity (40.36%) and data service. The authors state that

"environmental and charitable incentives are also efficient due to the concern of respondents. But compared to financial needs, they seem to be less important." (Li et al., 2012, p. 474).

Also, respondents think that the recycling cost of retired mobile phones should be shared by all the stakeholders (37%) or undertaken by the producers alone (34%). (Li et al., 2012)

For mobile phones in general, it can be concluded that there is a significant number of appliances stored at home – about 50% of appliances on average regarding the considered studies- which could be collected for recycling schemes if there was adequate information about how to return, incentives and a certain degree of convenience in the collection system. Data security plays a role and environmental importance of recycling is known by consumers. Studies' results for emerging and developed countries show similarities. The findings for mobile phones can be assumed to be valid for notebooks, too. For a transfer of findings on the 'case notebook' this is regarded as favourably since the products have certain similarities (e.g. high-tech consumer products, technical EoL later than disposed, data storage on appliance). Cox et al. (2013) have studied consumer understanding of product lifetimes. They differentiated in 'up-to-date', 'workhorse', and 'investment' products which share common characteristics within their group (way of use, sentiment of consumer

towards). Most consumer electronics are considered 'up-to-date' products with expected lifetimes of less than five years. Mobile phones (smartphones) have similar lifetimes like notebooks and their use patterns converge. Also personal data are stored on the appliances. Typically both are discarded before the end of their functional life. Therefore, the treatment of no longer used devices is assumed to be likewise.

3.1.3 Stage 3: Collection and Take-Back Systems for Notebooks

For stage 3 few studies can be found. Sciences mostly did not address specifically the public attitudes towards take back and recycling of notebooks but include them into broader studies about e-waste. Therefore, the criteria for the search were slackened. The attitudes towards recycling and take-back could have been assessed as side-aspects in single articles or more general studies. A search was conducted only using the terms from main group two and three. Also additional scientific databases e.g. Google Scholar were accessed. Then the abstracts -and where appropriate the full text- were reviewed for their relevance. Many of the found results were dealing e.g. with the eco-friendliness of new notebooks, their recyclability, e-waste generation, extended producer responsibility, OEM take-back programs and single projects with refurbished computers.

Of direct interest for the RUN project is the following comparison of Brazil to the USA. Quariguasi Frota Neto and van Wassenhove (2013) deal in their empirical study with the participation OEMs in take-back programs for computers and notebooks but also yield insights on how OEMs motivate consumers to return the used products as well as success factors. They state that the supply side of used products was the key to establish large scale take-back systems. And for the supply in term, the 'willingness to return' of consumers was the determinant factor. This willingness depends on different components such as:

- The provision of information on how to return products: On-line systems which deliver the whole information for return and different return channels and not only a telephone number
- The convenience of return: E.g. home service and pick-up; nearby located drop-off points; direct shipment to recycling sites

They conclude that the more information about return programs is provided and the more convenient the channels are designed, the more used products are collected. For the comparison Brazil (less engagement in remanufacturing) and the USA (high engagement in remanufacturing) they state that

"In summary, it is not only harder for consumers to find information on how to return products in Brazil, but it is also less convenient to carry out such returns." (Quariguasi Frota Neto and van Wassenhove, 2013, p.242)

Also higher recycling rates are reached if there exist social pressure groups, e.g. Greenpeace which raise consciousness on the e-waste problem.

Song et al. (2012) examined the EoL disposal of laptops in Macau. 25% of laptops are stored in home, 27.27% are retrieved by retailers, 22.73% are sold to recovery corporations, 13.64% are discarded into refuse bin and 11.36% are donated. They state that also the recovery price is an important impact consideration for residents' willingness to hand their e-waste into public recovery systems. In general, the higher the recovery price, the lower the willingness.

Chi et al. (2014) assessed the technical condition of disposed laptops, the preferred disposal options and the determinants for the collection channels in Taizhou/ China. More than 30% of disposed laptops are broken but repairable and additional more than 35% are in a usable conditions. The preferred choice for further use is for 11.5% of the laptops was giving them to others for re-use. The most important determinants for the choice of the collection channels were 'free door-to-door collection' (convenience) and 'appropriate collection price'

For notebooks the convenience of take-back and the provision of information on return channels seem crucial for successful take-back systems. When consumers disuse their notebooks, the main share is still functioning or in a repairable condition. Consumers tend to store notebooks they do not use anymore or give them to friends. Because functioning notebooks have still monetary value, consumers also sell them.

3.2 Attitudes and Motivations

The literature research yielded insights which are compiled into single attitudes or motivations of consumers towards the take-back and recycling. Three deductive stages were defined in order to transfer results from similar devices to notebooks because in the very most studies notebooks were not covered separately. Table 2 shows the results for the compiled attitude, discloses the limitations their evidence and the literature sources for them. Overall, twelve attitudes can be compiled. In the following Chapter 3.3 the single attitudes are discussed in detail.

Attitude	Evident for stage(s)	Evidence for developed countries	Evidence for emerging / developing countries	Sources
Consumers prefer convenient take-back systems (raise recycling rates)	1, 2, 3	Yes	Yes	Barr et al., 2001; Best and Kneip, 2011; Canning, 2006; Chi et al., 2014; Li et al., 2012; Most, 2003; Nixon et al., 2009; Ongondo and Williams, 2011a; Quariguasi Frota Neto and v. Wassenhove 2013; Saphores et al., 2011; Ylä-Mella et al., 2015
Easy provision of information on how to return fosters product take-back from consumers (consumers do not know how to return appliances)	2, 3	Yes	Yes	Canning, 2006; Li et al., 2012; Milovantseva and Saphores 2013; Ongondo and Williams 2011b Quariguasi Frota Neto and v. Wassenhove 2013 Yin et al, 2014;
Returning/ selling used products has to be financially rewarded or other incentives (deposit or acquisition by recycling system; upgrades; social pressure or recognition etc.)	1, 2,3	Yes	Yes	Canning, 2006; Chi et al., 2014; De Brito et al., 2003; Henseling and Behrendt, 2011; Keramitsoglou and Tsagakis, 2013; Milovantseva and Saphores 2013; Song et al. 2012; Most, 2003; Rathore et al., 2011; Shaw and Maynard, 2008; Timmlet and

				Williams, 2008;Ylä-Mella et al. (2015)
Consumers give used appliances to friends, children etc.	2, 3	Yes	Yes	Canning, 2006; Chi et al.,2014; Rathore et al 2011; Yin et al., 2014; Ylä-Mella et al. 2015
Consumers do not want to return appliances for using them as private spare	2	Yes	Yes	Milovantseva and Saphores 2013; ; Ongondo and Williams 2011b ; Rathore et al, 2011, Yin et al., 2014, Ylä-Mella et al. (2015)
Consumers store appliances (because it is easy etc.)	2, 3	yes	yes	Afroz et al.,2013; Canning, 2006; Song et al., 2012
Consumers are aware of the importance of recycling in terms of resource efficiency and environmental protection vs. Consumers are not well informed about the importance of recycling	2	Yes	Yes	Saphores et al., 2012; Ylä-Mella et al. 2015 vs. Canning, 2006; Yin et al., 2014
Consumers are afraid of private data disclosure/data security concerns	2	yes	yes	Li et al, 2012; Ongondo and Williams 2011b ; Yin et al., 2014
Consumers recycle because of social norms	1, 2	yes	yes	Barr et al., 2001; Timmlet and Williams, 2008
Consumer sell products because of changes of personal situation in life	1	yes	no	Berendt et al. 2011; Clausen et al., 2010; Henseling and

(children, moving etc.) when they think that they have value for someone else (prosumer)				Behrendt 2011
Consumers recycle because of (widely accepted) legislation/laws	1	yes	no	De Brito et al., 2003; Miafodzyeva et al. 2013; Sidique et al. 2010.
Consumers participate more in take-back systems when they trust in the involved organisations (reputation of organisations should be high)	1	yes	no	Granstöm, 2006; Keramitsoglou and Tsagakakis, 2013; Rompf, 2014.

Table 2: Public Attitudes and Motivations Towards Take-Back and Recycling

4 Discussion of results

The literature search yielded insights on single attitudes of consumers. The importance and validity for the RUN project's take-back system are discussed in this chapter. Note that many of the appliances which are disposed can be expected to be still functioning or repairable. This was e.g. observed for notebooks in China.

Attitude: Consumers prefer convenient take-back systems

Attitude was proven in manifold studies, for all three stages of assessed products, directly also for notebooks, as well as for developed and emerging countries. Convenience seems to be one major issue for consumers if they participate in take back programmes and is well respected in research as one of the main attitudes. 'Convenience' itself means if consumers perceive the process of returning their product as 'easy' or with less effort. E.g. Wagner (2013) constructs 'convenience out of several components: knowledge requirements; proximity to the collection point/site; opportunity to drop-off materials; inducement of the collection point/site (e.g. desirability or availability of services); and ease of the process. Similarly convenience is composed by Ongondo and Williams (2011a). This is connected with the access to collection points and the provision of information about the return channels. Therefore,

a convenient to the customer design of the RUN take-back system is of crucial importance for the success the system. Convenience could be achieved by e.g. the implementation of local drop-off points for collection combined with postal collection with an online system and home service. This is assessed for the RUN project.

Attitude: Easy provision of information on how to return fosters product take-back from consumers (consumers do not know how to return appliances)

For some products e.g. small elect(ron)ic appliances consumers do not know how to return. This was also one of the attitudes which were found for notebooks in developed and emerging countries. For products which are not discarded every day such as notebooks, an on-line system which provides the whole information for return and different return channels is developed by the RUN system and shall support the convenience aspect.

Returning/ selling used products has to be financially rewarded or other incentives (deposit or acquisition by recycling system, upgrades; social pressure or recognition etc.)

Consumers want incentives when they bring back their used appliances. This is a main fact. It was proven for waste, e-waste and notebooks by several studies in developed and emerging countries. There has to be a focus on the nature of the incentive: While studies for online resell platforms such as Ebay (Henseling and Behrendt, 2011, Behrendt, 2011) and local waste management systems show that there is a strong focus on financial incentives - respectively lower costs charged from consumers or deposit-refund - non-financial incentives can also be used. The study from Li et al. (2012) also showed that incentives can be of environmental or charity nature. E.g. US mobile phone take-back systems avoid direct financial incentives; presumably because they are direct costs for firms. So incentives can be linked to intrinsic motivations of customers. Also the RUN project will appeal besides financial incentives on the environmental attitude of customers which return their appliances and provide clear information about the ecological benefits of notebook re-use.

Give used appliances to friends, children etc.

Many consumers give their disused electr(on)ic appliances to friends or relatives. Studies showed this for electr(on)ic appliances and directly notebooks in developed and emerging countries. Take-back systems such as RUN compete with friends and relatives for still functioning used products when the former user does not want to use them anymore. This could be addressed by an appropriate incentive system so that consumers prefer to donate or sell the product instead of give it away (for free) in their circle of friends.

Consumers do not want to return appliances for using them as private spare

For manifold electr(on)ic products this statement was found, especially for mobile phones because they are small and easy to store. This was found for developed and emerging countries. They rational calculus of this is obvious. Some of those consumers which show this behaviour may be open to incentives for returning their notebooks to the RUN project.

Consumers store appliances (because it is easy etc.)

Similar to keep appliances as spare parts, some of the consumers store old appliances at home; lying dormant. Some consumers may have forgotten their used appliances, others store them because electr(on)ic appliances are small and do not need much space. This was observed in developed and emerging countries for electr(on)ic appliances and for notebooks. Maybe, the RUN project could address this by media campaigns which remind consumers on these appliances and information about the environmental benefits.

Consumers are aware of the importance of recycling in terms of resource efficiency and environmental protection vs. Consumers are not well informed about the importance of recycling

The most studies found that especially for electr(on)ic appliances consumers know about the environmental importance of a sound recycling practice because e.g. of the incorporated natural resources or hazardous substances. In opposite, other studies claim that consumers could be informed better about this issue. This contradictory results were found for both developed and emerging countries. The RUN project assumes that there is a certain consciousness meanwhile in the target markets because this issue was intensively on the political agenda and media e.g. in Germany and Austria in recent years. This environmental consciousness nevertheless will be enforced by information (media campaign, articles) by the project partners.

Consumers are afraid of private data disclosure/data security concerns

This attitude was found especially in China, under UK students and only for mobile phones. It was not the most important but nevertheless a significant reason why they do not give their smartphones into a recycling system. On a mobile phone lots of personal data are stored. This is very similar to notebooks. Thus, the importance of this attitude is to highlight and it can be transferred on attitudes towards notebook take-back. The RUN project prioritizes data security for its customers from the beginning e.g. safe data erasure with erasure report or saving personal data and transfer it to new notebooks. We see a great chance to make use of this attitude for the project.

Consumer sell products because of changes of personal situation in life (children, moving etc.) when they think that they have value for someone else (prosumer)

Online platforms provide easy access for potential sellers and engage them to offer used products. The shift to the prosumer could foster returns of notebooks to the RUN project. Media campaigns could inform about the value for somebody else of disused notebooks if they still function.

Consumers recycle because of social norms

Is seen for developed and emerging countries for waste and electr(on)ic products. There seems to be a general sentiment that recycling is 'good' and if others participate, single person tend to do so, too. This attitude is in general in favour of the RUN project.

Consumers recycle because of (widely accepted) legislation/ laws

Consumers participate more in recycling systems if there is legislation and laws in place in favour of recycling and these laws are accepted by consumers. This was found for recycling in general and in developed countries. This attitude cannot be affected by the RUN project and is assumed to be given in the German and Austrian target markets.

Consumers participate more in take-back systems when they trust in the involved organisations (reputation of organisations should be high)

This was found by studies for recycling in general in developed countries. We assume that it applies on notebook take-back, too. The partners of the RUN consortium are widely recognized in their markets and are known for charitable and social actions. Also the participate in industry organizations such as the German Society for Waste Management (DGAW e.V.), the German Engineers' Association (VDI) or have business connections/ partnerships to charitable organisations e.g. ecclesiastical subsidiary organisations. We see the high reputation of the single partners behind the RUN project as positive for customers' trust. This may be a reason to give a disused notebooks to our collection system and could e.g. replace financial incentives which otherwise would be needed.

5 Conclusions for Take-Back and Recycling of Notebooks

This literature study regarding the public attitudes towards take back and recycling of notebooks had the goal to identify customers' perceptions and attitudes towards giving disused notebooks into the collection system of RUN. Thereby input for designing appropriate media campaigns and establishing a well-functioning collection system was explored and delivered to other tasks.

The literature study was deductively structured because only few results could be found for notebooks. Therefore, the scope was widened and recycling in general and electr(on)ic products were assessed. Studies to EoL elect(ron)ic products seemed to be relevant because under this term often also computers and notebooks were addressed (as part of a bigger waste stream or as single sub-aspect). Especially for mobile phones relevance is given because their use pattern is similar to notebooks and also private data are stored on them. The search was keyword-based and concentrated on international, peer-reviewed journals because of given high validity but did not exclude other sources.

Results were found for and structured to recycling in general, electr(on)ic products and notebooks. For notebooks it was found that the larger share of them is disposed when they are still functioning or can be repaired. The aspect 'convenience of the take-back system' with its side components and the provision of information about return channels are crucial for successful take-back systems. This should be combined with other incentives. Otherwise, appliances will continue to lie dormant in private persons' homes.

Twelve attitudes were found. The most important attitude seems to be the convenience of the take-back system. Paired with comprehensive and clear information to the consumer on take-back channels, this shall be the foundation for the design of the RUN system. Also, the choice of appropriate incentives is crucial. Financial incentives surely function but are costs. They can be combined with charitable and environmental incentives which can build on the environmental awareness regarding e-waste. Interestingly, data security is already an issue for mobile phone take-back. Data security is a key competence of the RUN project. The RUN system shall make use of the good reputation and trustworthiness of the project partners. The media campaign should address the people which store disused notebooks at home as spare or because can easy store these small appliances.

Addressing the explored attitudes with a combination of good design of the take-back system, clear information and a cost-efficient mix of incentives will be the key for the success of the RUN project.

6 Literature

Afroz, R, Mehedi Masud, M, Akhtar, R & Duasa, J 2013, ' Survey and analysis of public knowledge, awareness and willingness to pay in Kuala Lumpur, Malaysia - a case study on household WEEE management', Journal of Cleaner Production, vol. 52, pp. 185-193.

Akenji, L, Hotta, Y, Bengtsson, M & Hayashi, S 2011, 'EPR policies for electronics in developing Asia: An adapted phase-in approach', *Waste Management and Research*, vol.29, no. 9, pp. 919-930.

Bamberg, S 2003, 'How does environmental concern influence specific environmentally related behaviors? A new answer to an old question', *Journal of Environmental Psychology*, vol.23, pp. 21-32.

Barr, S, Gilg, AW & Ford, NJ 2001, 'A conceptual framework for understanding and analysing attitudes towards household-waste management'. *Environment and Planning*, vol. 33, pp. 2025-2048.

Best, H & Kneip, T 2011, 'The impact of attitudes and behavioral costs on environmental behavior: A natural experiment on household waste recycling', *Social Science Research*, vol. 40, pp. 917-930.

Blättel-Mink, B, Bender, S, Dalichau, D & Erdmann, L 2011, 'Nachhaltiger Konsum in der Internetökonomie: Entwicklung einer integrativen Forschungsperspektive' in: S Behrendt, Blättel-Mink, B & Clausen, J. (ed.) *Wiederverkaufskultur im Internet - Chancen für nachhaltigen Konsum am Beispiel von eBay*, Springer, Heidelberg/Dordrecht/London/New York.

Chi, X, Streicher-Porte, M, Wang, MYL & Reuter, MA 2011, 'Informal electronic waste recycling: A sector review with special focus on China'. *Waste Management*, vol. 31, no. 4, pp. 731-742.

Chi, X, Wang, MYL, & Reuter, MA 2014, 'E-waste collection channels and household recycling behaviors in Taizhou of China', *Journal of Cleaner Production*, vol. 80, pp. 87-95.

Canning, L 2006, 'Rethinking market connections: mobile phone recovery, reuse and recycling in the UK', *Journal of Business & Industrial Marketing*, vol. 21, no. 5, pp. 320 - 329

Chung, S & Zhang, C 2011, 'An evaluation of legislative measures on electrical and electronic waste in the Peoples Republic of China', *Waste Management*, vol. 31, no. 12, pp.2638-2646.

Cox, J, Griffith, S, Giorgi, S & King, G 2013, 'Consumer understanding of product lifetimes', *Resources, Conservation and Recycling*, vol. 79, pp. 21-29.

Granström, F 2006, 'Socio-economic evaluation of furniture re-use - an exploratory case study of a community waste scheme (NOAH), Master Thesis, University at Silsoe, Uppsala.

Henseling, C & Behrendt, S 2011, 'Chancen für nachhaltigen Konsum - Wiederverkaufskultur im Internet', *Ökologisches Wirtschaften*, no. 4, pp. 47-50.

Hicks, C, Dietmar, R & Eugster, M 2005, 'The recycling and disposal of electrical and electronic waste in China - Legislative and market responses', *Environmental Impact Assessment Review*, vol. 25, no. 5, pp. 459-471.

Keramitsoglou, K & Tsagarakis, K 2013, 'Public participation in designing a recycling scheme towards maximum public acceptance', *Resources, Conservation and Recycling*, vol. 70, pp. 55-67.

Kojima, M, Yoshida, A. & Sasaki, S 2009, 'Difficulties in applying extended producer responsibility policies in developing countries: Case studies in e-waste recycling in China and Thailand', *Journal of Material Cycles and Waste Management*, vol.11, no.3, pp. 263-269.

Kurz, T, Linden, M & Sheehy, N 2007, 'Attitudinal and community influences on participation in new curbside recycling initiatives in Northern Ireland', *Environment and Behavior*, vol.39, no. 3, pp. 367-391.

Li, B, Yang, J, Song, X, Lu, B 2012, 'Survey on Disposal Behaviour and Awareness of Mobile Phones in Chinese University Students', *Procedia Environmental Sciences*, vol.16, pp. 469-476.

Manomaivibool, P 2009, 'Extended producer responsibility in a non-OECD context: The management of waste of electrical electronic equipment in India', *Resources, Conservation and Recycling*, vol. 53, no. 3, pp.136-144.

Manomaivibool, P.& Vassanadumrongdee, S 2011, 'Extended producer responsibility in Thailand', *Journal of Industrial Ecology*, vol.15, no. 2, pp. 185-205.

Miafodzyeva, S, Brandt, N & Andersson, M 2013, 'Recycling behaviour of households living in multicultural urban area: a case study of Järva, Stockholm, Sweden', *Waste and Management Research*, vol. 31no. 5,pp. 447-457.

Most, E 2003, *Calling All Cell Phones: Collection, Reuse, and Recycling Programs in the US*, INFORM, USA.

Nixon, H, Saphores, JD, Ogunseitan, O & Shapiro, A 2009, 'Understanding preferences for recycling electronic waste in California: how environmental attitudes and beliefs influence willingness to pay', *Environment and Behavior*, vol. 41, pp. 101-124.

Ongondo FO & Williams ID 2011a, 'Mobile phone collection, reuse and recycling in the UK. *Waste Management*', vol. 31, no.6, pp.1307-15.

Ongondo FO & Williams ID 2011b, 'Greening academia: use and disposal of mobile phones among university students', *Waste Management*, vol.31, no. 7, pp. 1617-34.

Quariguasi Frota Neto, J & Wassenhove, L 2013, 'Original Equipment Manufacturers' Participation in Take-Back Initiatives in Brazil', *Journal of Industrial Ecology*, vol. 17, no. 2, pp. 238-248.

Rathore, P, Kota, S & Chakrabarti, A 2011, 'Sustainability through remanufacturing in India: a case study on mobile handsets', *Journal Of Cleaner Production*, vol. 19, no. 15, pp. 1709-1722.

Rompf, S 2014, 'System Trust and Cooperation: The Case of Recycling Behavior', Working Paper - MPRA Paper No. 60279, Institute of Sociology and Social Psychology (ISS), University of Cologne.

Saphores, JDM, Ogunseitan, OA & Shapiro, AA 2012, 'Willingness to engage in Proenvironmental behavior: an analysis of e-waste recycling based on a national survey of U.S. households', *Resources, Conservation and Recycling*, vol. 60, pp. 49-63.

Shaw, PJ & Maynard, SJ 2008, 'The potential of financial incentives to enhance householders' kerbside recycling behaviour', *Waste Management*, vol. 28, pp.1732-1741.

Schultz, PW & Oskamp, S 1996, 'Effort as a Moderator of the Attitude-Behavior Relationship: General Environmental Concern and Recycling', *Social Psychology Quarterly*, vol. 59, no. 4, pp. 375-383.

Seitz, MA & Wells, PE 2006, 'Challenging the implementation of corporate sustainability: The case of automotive engine remanufacturing', *Business Process Management Journal*, vol. 12, no. 6, pp. 822-836.

Sidique, S, Joshi, S & Frank Lupi, F 2010, 'Factors influencing the rate of recycling: An analysis of Minnesota counties', *Resources, Conservation and Recycling*, vol. 54, pp. 242-249.

Song, Q, Wang, Z & Li, J 2012, 'Residents' behaviors, attitudes, and willingness to pay for recycling e-waste in Macau', *Journal of Environmental Management*, vol. 106, pp. 8-16.

Timlett, RE, Williams, ID 2008 2008, 'Public participation and recycling performance in England: A comparison of tools for behaviour change', *Resources, Conservation and Recycling*, vol. 52, pp. 622-634.

Wagner, TP 2013, 'Examining the concept of convenient collection: An application to extended producer responsibility and product stewardship frameworks', *Waste Management*, vol. 33.3 pp. 499-507.

Wang, Z, Zhang, B, Yin, J & Zhang, X. 2011, 'Willingness and behavior towards e-waste recycling for residents in Beijing city, China', *Journal of Cleaner Production*, vol. 19, no. 9-10, pp. 977-984.

Watson, M 2008, 'A Review of literature and research on public attitudes, perceptions and behaviour relating to remanufactured, repaired and reused products', Report for the Centre for Remanufacturing and Reuse, Centre for Remanufacturing and Reuse and University of Sheffield.

Yin, J, Gao, Y & Xu, H 2014, 'Survey and analysis of consumers' behaviour of waste mobile phone recycling in China', *Journal Of Cleaner Production*, vol. 65, pp. 517-525

Ylä-Mella, J, Keiski, R & Pongrácz, E 2015, 'Electronic waste recovery in Finland: Consumers' perceptions towards recycling and re-use of mobile phones', *Waste Management*, in press, <http://dx.doi.org/10.1016/j.wasman.2015.02.031>



DELIVERABLE D2.7

Literature Study Part II:

Public Attitudes Towards Buying Refurbished Notebooks

Grant Agreement number:	ECO/13/630329
Project acronym:	RUN
Project title:	ReUse Notebook –Collection, Refurbishment and Distribution System
Funding Scheme:	FP7-Market Replication
Delivery date:	September 2015
Deliverable No.:	D2.7
Deliverable Type:	Report
Lead Beneficiary & Main Partner Responsible:	SAPOS
Status:	Version 1
Beneficiary Numbers:	1, 2, 5
Beneficiary Names:	DrBE UG, Ebelt Beratung UG, VHS
Dissemination Level:	Public
Authors:	F. Fuchs
Email:	ffuchs@sapos-goerlitz.de
Telephone:	+49 03581 318891
Project Co-ordinator:	Dr. Ralf Brüning Dr. Brüning Engineering UG (haftungsbeschränkt) Kirchenstraße 26 • D-26919 Brake Tel.: +49 4401-7049760 Mobil: +49 160-3664468 Fax: +49 4401-7049761
E-mail:	info@dr-bruening.de
Project website:	www.run-project.eu

Change Log:

Name	Action	Date
Julia Wolf	Created document and proposed structure	15-06-2015
Frank Fuchs	Reviewed and approved structure	17-06-2015
Julia Wolf	Created chapter 1.1 and 1.2	18-06-2015
Julia Wolf	Created chapter 2	19-06-2015
Ralf Brüning	Reviewed and approved text	23-06-2015
Julia Wolf	Added text to chapter 2	24-06-2015
Julia Wolf	Created chapter 3.1	26-06-2015
Julia Wolf	Created chapter 3.2	30-06-2015
Julia Wolf	Improved and added to chapter 3	04-07-2015
Julia Wolf	Improved and added to chapter 3	05-07-2015
Julia Wolf	Improved and added to chapter 3	08-07-2015
Julia Wolf	Modified and expanded chapter 2	22-07-2015
Julia Wolf	Modified and expanded chapter 2	28-07-2015
Julia Wolf	Modified and expanded chapter 3	30-07-2015
Ralf Brüning	Reviewed modifications	03-08-2015
Julia Wolf	Added text to chapter 3	06-08-2015
Julia Wolf	Created chapter 4	06-08-2015
Patrick Jaeger	Added text to chapter 4	14-08-2015
Patrick Jaeger	Added text to chapter 4	19-08-2015
Ralf Brüning	Reviewed text	21-08-2015
Julia Wolf	Worked in comments, modified and expanded chapter 2	26-08-2015
Julia Wolf	Modified and expanded chapter 3	31-08-2015
Julia Wolf	Added text to chapter 3	01-09-2015
Julia Wolf	Added text to chapter 3	02-09-2015
Julia Wolf	Added text to chapters 3 and 4	04-09-2015
Patrick Jaeger	Added text to chapter 4	08-09-2015
Julia Wolf	Created introduction	16-09-2015
Ralf Brüning	Reviewed	17-09-2015
Julia Wolf	Worked in comments and final changes to document	18-09-2015
Ralf Brüning	Reviewed and finalized document	21-09-2015

Table of contents

1	Introduction to part two: Public attitudes towards the buying of refurbished notebooks.....	1
1.1	Goals of the study.....	1
1.2	Structure of the study	1
2	Approach and methodology of the study.....	2
3	Findings in regards to the purchase of remanufactured and reused products.....	6
3.1	Research on success factors and barriers to reuse or remanufacturing from a customer perspective.....	7
3.2	Research on customers' willingness to pay for reused or remanufactured products.....	11
4	Findings in regards to consumer segments.....	15
5	Summary and conclusions	16
6	Literature	19

1 Introduction to part two: Public attitudes towards the buying of refurbished notebooks

1.1 Goals of the study

It is the goal of this literature study to explore public attitudes towards the buying of refurbished notebooks. Existing studies that examine customers' positive associations or reservations concerning refurbished or reused notebooks shall be identified and evaluated as to their relevance for the RUN project. The findings of the literature study will be implemented in the sales concept as well as RUN's social media campaign. Therefore it was decided that this literature study will also take a look at research concerning segments of customers who could be especially positive towards refurbished notebooks or green marketing. Attitudes and segments of customers will be looked at in countries addressed by the RUN project as well as in comparable countries. The groundwork of this deliverable D2.7 will also have some influence on the work package WP5. During WP5 it will be decided how to strategically place the product as distribution, sales and marketing strategies will be elaborated.

1.2 Structure of the study

In chapter 2 the methodology of the study will be described. The approach to the two major areas of focus, namely research in regards to the purchase of remanufactured and reused products research in regards to customer segmentation and reused or remanufactured products, will be described separately. The selection of search terms and databases will be explained. The scope, expansions and restrictions of the search will be explained. We will also discuss some challenges that occurred during the search.

In chapter 3 the selected findings of the search in regards to the purchase of remanufactured and reused products will be presented and systemised. Initially a brief overview over the areas covered in reuse or remanufacturing research will be given.

In sub-chapter 3.1 the literature that examines success factors and barriers to reuse or remanufacturing from a customer perspective will be presented. Relevant research dealing with remanufactured and reused products in general, as well as with electrical and electronic equipment will be discussed. In this chapter literature that evaluated multiple factors of the perception of reused or remanufactured products will be examined. Based on the research presented in this sub-chapter, conclusions about which factors influence the purchase decision (e. g. price and / or environmental awareness) should be possible.

In sub-chapter 3.2, selected research looking at the specific factor “willingness to pay” for reused or remanufactured products will be discussed. In regards to this research, the assumption that the price will be a determining factor in the purchasing decision is made a priori by the author. Areas that might lead to possible future lessons for the RUN project concerning the price aspect will be a focus of this chapter

In chapter 4 a brief overview over research on customer segments and reused or remanufactured products will be given.

In chapter 5 the findings of the chapters 3 and 4 will be summarised and possible conclusions for the RUN project’s marketing strategy will be suggested.

2 Approach and methodology of the study

This literature study is a meta-study, in that it examines and discusses existing research on consumer attitudes towards the buying of refurbished products.

In this study, existing literature that discusses reused or remanufactured products in general, as well as reused or remanufactured electrical and electronic equipment, was included. It is assumed, that some results in regards to general products and especially electrical and electronic devices can be transferred to notebooks and to the RUN project.

Furthermore, research on reused or remanufactured products of various quality levels is included in the keyword search and in this study. Works on industrial remanufacturing on reuse in the consumer sector and of the trading of used goods are examined. The assumption is that lessons from one field of study will be transferrable to others. The keywords for a database search were chosen accordingly.

The search and the literature review comprised terms and sources in German and English. German sources were used because a lot of research in both key markets Germany and Austria is only published in the official language (German) of these nations. English was used to broaden the study to international research results.

The database used for this literature study is google scholar. After some pre-trials were run, it became obvious that this was a favourable approach because of two reasons. For one, the database google scholar covers all subject areas equally, while a lot of other databases focus on specific subject areas, for example engineering, economics or environmental sciences. Such databases might be less suitable for this study, as it should cover diverse research areas, for example at least marketing (consumer behaviour) and engineering (remanufacturing).

Secondly, the database is not country or language specific but covers research from various countries and periodicals equally. This was seen as a major advantage over other databases that are often historically focused on specific countries or languages.

The search was keyword-based. German and English keywords are not identical but were adapted to comprise the commonly used terms in the relevant research. Terms for durable goods in general, for electronics and for notebooks were included in the search. The keywords were sorted into three major groups: synonyms for reuse or remanufacturing, synonyms for consumer attitudes and various terms for goods / electrical and electronic goods. All possible combinations of each keyword from group 1 with each keyword from group 2 and group 3 were searched for in google scholar.

Group 1	And Group 2	And Group 3
<ul style="list-style-type: none"> • Wiederverwendung • Wiederverwendete • Gebrauchte • Gebrauchtware • Aufarbeitung • Aufgearbeitete • Second Hand 	<ul style="list-style-type: none"> • Akzeptanz • Verbraucherakzeptanz • Einstellung • Verbrauchereinstellung • Verhalten • Verbraucherverhalten 	<ul style="list-style-type: none"> • Produkte • Ware • Elektronik • Notebooks
<ul style="list-style-type: none"> • Remanufacturing • Remanufactured • Refurbishment • Refurbished • Reconditioning • Reconditioned • Reuse • Reused • Repair • Repaired • Used • Recycling • Recycled 	<ul style="list-style-type: none"> • Attitude • Perception • Behavior • Motivation 	<ul style="list-style-type: none"> • Products • Goods • Electronics • Notebooks

Table 1: Keywords used in the database search

The results were scanned by titles and abstracts and relevant literature was selected. The selected research had at least to meet with two criteria:

- The publication-date had to be after the year 2000

- The research had to study consumers in developed nations (and markets)

The reason to filter for research with a publication date before the year 2000 is the rapid technological change in the market of consumer electronics that should be taken into account.

The assumption for including research from all developed nations in the study, is that they should be at least partly applicable to the European countries the Run project focuses on. Including findings from different (European) countries might become especially favourable, once the RUN concept will be copied to other European markets (work package 6 of the RUN project). Out of all corporate functions the marketing of goods or services is especially dependent on specific cultural preferences. The differences between developed and developing nations in terms of markets and consumer behavior were deemed too high to include marketing research from developing nations.

In the field of consumer research, studies that deal with the whole spectrum of used goods including electronics were selected, as well as studies that focused on one group of electronics. In the field of commercial products only research that dealt with electronic goods was included.

The selection of English keywords was very broad in scope (as can be seen in table 1), because of a great flexibility in the terms used in research.

Terms associated with reuse and remanufacturing are inter alia defined in the British Standard (BS) 8887. The terms “remanufacture”, “refurbish”, “recondition”, “reuse” and “recycling” are defined in part 2 of the BS 8887 (terms and definitions).

According to the standard, “remanufacturing” means “returning a used product to at least its original performance with a warranty that is equivalent to or better than that of the newly manufactured product”. It is also noted, that from a customer’s standpoint the product can be seen as equivalent to a new one.

The terms “refurbish” and “reconditions” are synonyms according to BS 8887 part 2 and mean “return a used product to a satisfactory working condition by rebuilding or repairing major components that are close to failure, even where there are no reported or apparent faults in those components”.

“Reuse” is defined by the standard as “operation by which a product or its components are put back into use for the same purpose at end-of-life”.

It is important to note that recondition (refurbish) and reuse may lead to a product quality equivalent or lower than that of the original product, whereas a remanufactured

product will have a quality equivalent or higher than the original product. A product is reconditioned (refurbished) before its end-of-life and reused after its end-of-life. In contrast to the operations that make a product usable again, to “recycle” is defined as process waste materials for the original purpose or for other purposes, excluding energy recovery”. An overview over the terms is provided in figure 2.

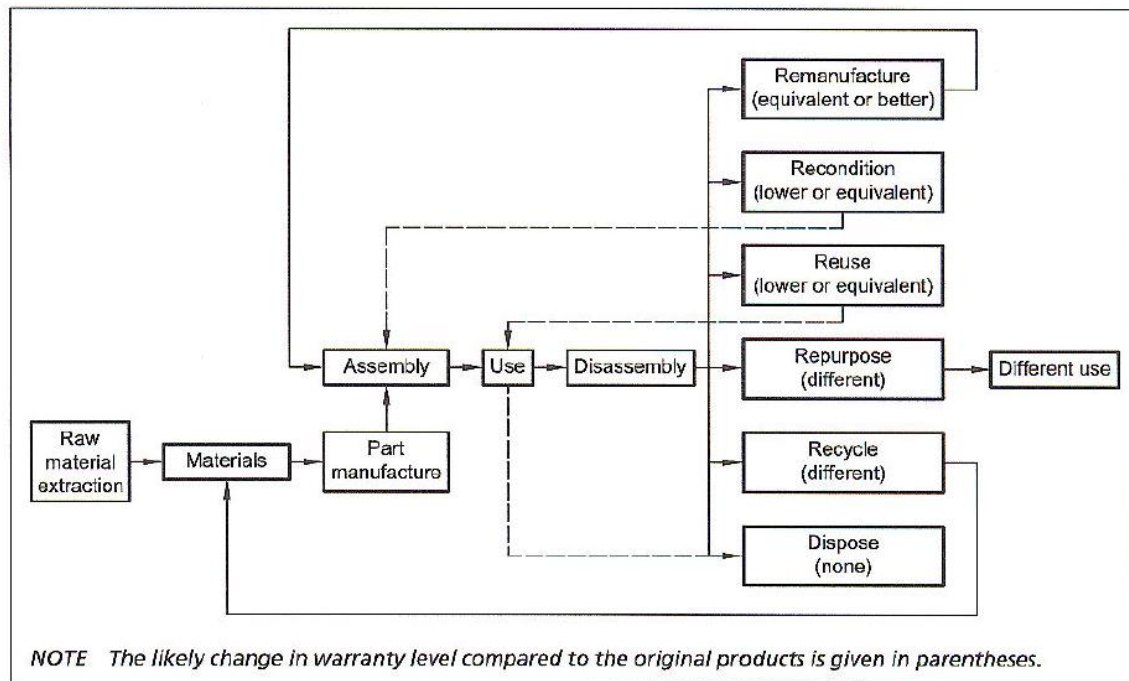


Figure 1: Product lifecycle in BS 8887 part 240

In the course of the search for literature it became obvious that in reality the terms are used with flexibility. Inaccuracies in translations may be one major reason.

As early as 2008, Watson noted that “part of the challenge in reviewing approaches and insights that have been applied to themes of remanufacture, repair and reuse is the flexibility with which these terms are used, and the extent to which other terms are used synonymously”. In 2015, Gharfalkar et.al. analysed the use of terms associated with reuse in 17 works and noted that in 10 cases there was a marked lack of clarity between reuse options because of the use of non-defined terms.

The flexibility in terms presented a challenge and a time factor in the elaboration of this study. The search had to have a broad scope and include, if possible, all terms that might be used as synonyms for reuse or remanufacturing.

For example, during the analysis of search results it was noticed that some authors even use the term “recycle”, if they describe the reuse and resale of whole devices (e.g. Hamzaoui Essoussi and Linton 2010). The search was thus expanded to include “recycling”. Thus a multitude of recycling related hits had to scanned for reuse-related

content, which contributed to a delay in the literature study. This approach was chosen, in order not to overlook important research because of the terminology used.

3 Findings in regards to the purchase of remanufactured and reused products

An overall result of this literature study is the observation that the majority of research in the area of reuse and remanufacturing has been undertaken in the area of industrial remanufacturing. Disciplines such as operational management, reverse logistics or closed loop supply chain management have looked towards remanufacturing. The majority of that research has traditionally dealt with the organisational planning of remanufacturing systems. Several authors have highlighted the need to consider the market factor in remanufacturing research.

Michaud and Llerena (2006) argue that optimizing the production system coordination is not sufficient to achieve profitability in remanufacturing but that consumer behaviour is a decisive factor. According to them, remanufacturing companies need to understand how consumers value new, used and remanufactured products in order for their remanufacturing business to reach economic viability.

Atasu et al. (2008) grouped remanufacturing research into four fields: the industrial engineering and operations research, design, strategy, and behavioural fields. They called for future empirical research on consumer behaviour in regards to remanufactured products.

A historical overview over closed loop supply chain research was given by Guide and van Wassenhove (2009). They observe an evolution from an engineering focused view to a holistic business model view and support the importance of the marketing perspective.

A majority of the literature available that does deal with the marketing perspective of remanufacturing does so from the viewpoint of original equipment manufacturers (OEM) who might want to market remanufactured products next to new products. A majority of the OEM centric literature available has focused on the connection between markets for new and remanufactured products. In most cases such research deals with an OEM's decision to optimally price their new and remanufactured products or how to avoid cannibalisation. Cannibalisation in this context means to lose a segment of customers who prefer to purchase a remanufactured product.

While the research in industrial remanufacturing is comparatively well established, literature on the purchase of reused goods in a consumer environment is comparatively

scarce. It can might be assumed that this could possibly be (in part) due to a lack of industry-interest in the field and a resulting lack of funds and researcher interest. (Two of the works discussed in this literature study (Clausen et al. (2010), Spitbart et al. (2007), were at least partly funded by public authorities.) It should be noted, that the quality of the reused products discussed in the literature is not always addressed by the authors.

3.1 Research on success factors and barriers to reuse or remanufacturing from a customer perspective

The literature presented in this chapter examines discuss multiple success factors or barriers to the marketing of reused goods, because this chapter primarily seeks to find answers to the following questions: Which characteristics of reused goods matter to customers? What considerations influence their buying behavior? Studies that assume a priori that the price of a reused product is a factor that influences buying behaviour are looked at in chapter 3.2.

Research that looked at the purchase of used goods in general was conducted by Cox et al. (2013) and Clausen et al. (2010).

Products can be divided by their suitability for reuse. Next to technical criteria customer perception of a product groups suitability for reuse might be important for marketing considerations.

Cox et al. (2013) have studied the consumer perceptions of product lifespans in regards to classes of products. They identified three classes of products that consumers view differently in terms of lifespans. These are 'up-to-date', 'workhorse', and 'investment' products. The latter are kept longest by consumers because of a greater financial investment and their lifespans are more readily extended by repairs than those of the other classes. Consumers prefer to keep 'Workhorse' products as long as they work properly and replace them as soon as they don't. 'Up-to-date' products and will in general be kept less than five years and are typically replaced before their functional life, in order to keep up with technological advances or for life-style reasons. Notebooks as well as similar devices were shown to be perceived as 'up-to date products' by consumers.

Clausen et al. analysed trading patterns on eBay and their environmental impact. The analysis included all used goods in general and was not limited to electrical and electronic devices. The analysis was part of a research project called "Wiederverkaufskultur im Internet" and funded by the German Federal Ministry of Education and Research (BMBF) within the research program of Social-ecological Research (SÖF) (Blättel-Mink et al. 2011). As part of the project an online survey was

carried out in November 2008. It was intended to gain insight into eBay users' attitudes toward the environment, motives for trading on eBay, attitudes regarding used products and the selling and buying of used goods in general and specifically on eBay. In total, 2,511 valid questionnaires were analysed. A synopsis of the results will be provided in the following paragraphs. Clausen et al. also provide a typology of consumers on eBay that was derived from the data. It will be presented in chapter 4.

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. But currently environmental protection only plays a minor role as a personal motive for people buying or selling goods on eBay. Practical considerations and financial motives are most important for the people questioned. "I can save money" was the second most given reason for buying used goods on eBay. 73.6 % of respondents chose that answer. In comparison, only 27.6 % of respondents agreed with the reason "I can protect the environment by buying used products". (It was the 9th most selected item out of 12.)

From a buyer's perspective a slight majority of respondents answered that it was important to them to obtain high-quality products for a reasonable price. 55.8 % agreed with the statement "I prefer a high-quality used product to a low-quality new product." In terms of barriers for buying used goods 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. While 57.6 % of respondents agreed with the statement "The great thing about buying used products is picking up bargains", 38.2 per cent also choose to mark "A problem with used products is that they come without a warranty" and 31.2 % even agreed with the statement "You can never be sure if used products are really in proper working order".

Research that analysed the purchase of reused electrical and electronic equipment specifically was conducted by Spitzbart et al. (2007), Schwabl and Hainzmann (quoted from Spitzbart et al.), Ylä Mella et al. (2015) and Jimenez-Parra et al..

Spitzbart et al. conducted two surveys in 2007. In the first survey, citizens were questioned at a municipal recycling centre as they brought waste there. In the second survey visitors of a second hand shop were questioned on-site. Both surveys covered the attitudes of the participants regarding the purchase of used electrical and electronic devices in general without a focus on specific product groups. Both surveys will be described in the following paragraphs.

The first survey at municipal recycling centres was answered by 49 participants. The question if they could imagine to buy a used device was answered positively by 47% of the participants and negatively by 53% of the participants. Respondents were also asked

if they had already bought used devices or gotten them from friends or family. This question was answered positively by 33% of the respondents and negatively by 67%. One question dealt with the aspects respondents rate as important when buying devices. Participants were asked to mark given items or name their own reasons. The items most chosen were the quality of the device (33 respondents) and the price of the device (33 respondents) followed by provision of a warranty (24 respondents) advice in the shop (16 respondents), brand name (12 respondents), repair services in the same shop (12 respondents), help with the initial operation of the device (12 respondents) and newness of the device (9 respondents). Transport services (7 respondents), large variety in the shop (5 respondents) and the design (3 respondents) were named the least (3 respondents). 12 participants formulated their own reasons, 7 of which were to do with the functionality of a device. Spitzbart et al. also asked some demographic questions and tested their connection to the customers' perceptions. The results of these tests will be summarized in chapter.

Spitzbart et al. conducted a second survey in cooperation second hand shops and questioned 62 participants on-site. 47% of them had already bought a second hand device and 53% did not. Participants in the second hand shop were again asked for the importance of several aspects given in purchasing devices. The items given were identical to the ones in the survey conducted at the municipal recycling centre (see paragraph above). The distribution of answers was very similar to the one in the first survey. The price and the quality of devices were again named most often and the design the least of all aspects. Spitzbart et al. tested for statistical connections between the answers of participants and socio demographics for both studies they did. Their main results will be summarized in chapter 4.

Spitzbart et al. compared his own results with those of Schwabl and Hainzmann in 2002, who interviewed 600 participants, also in Austria. They note that both results are remarkably similar. According to Spitzbart et al. in the Schwabl and Hainzmann study (2002) 38% of participants could imagine buying second hand devices, and 23% of participants had already bought such devices. Participants interviewed by Spitzbart et al. are thus slightly more positive about the buying of reused goods than participants interviewed by Schwabl and Hainzmann. Schwabl and Hainzmann asked participants to select given items that would be important factors to them when buying used goods. The price is chosen most often (marked as "very important by 71% of participants), followed by the functionality (marked as very important by 69% of participants) and a one year warranty (marked as very important by 67% of participants). According to Spitzbart et al. those results align well, with their own that showed price and quality as the most important factors to buyers. The most selected item for a negative attitude towards the buying of used goods in the Schwabl and Hainzmann study is, according to Spitzbart et al., a lack of trust in their functionality (marked 73% of participants).

Ylä Mella et al. (2015) studied the recycling and reuse of mobile phones in Finland. At total of 53 persons participated in the survey. The survey covered consumers' recycling behaviour, their awareness of the importance of recycling and reuse and their perceptions towards monetary incentives of recycling and mobile phone reuse. The third aspect is relevant for this literature study and will be presented in the following paragraphs.

Asked about their willingness to buy a used mobile phone, 51% or 27 participants answered positively and 49% or 26 participants answered negatively. Both groups were asked to name their reasons for being positive or sceptical.

Participants in favour of reused mobile phones were asked to name reasons for deciding to buy a reused phone. A cheaper price was the reason cited most often (38%). New features was the second most named reason (23%) followed by knowing the last owner (19%). 15% of the participants were of the opinion that the phone should be no older than one year old and, lastly, 6% of the participants gave other reasons.

Participants who were not willing to buy reused mobile phones were also asked to state their reasons. The possible lack of reliability turned out to be the most common reason to be sceptical of reused phones, named by 32% of participants. A reduced lifespan was mentioned by 21% and the existence of new budget models also by 21% of participants. 16% were sceptical in case of a lack of warranty or certain specific features (7%). 7% of participants named other inhibitory reasons. Yllä Mella et al. also note, that only one respondent mentioned information security issues.

Overall, Yllä-Mella et al. summarise that about half of people had an open mind about the reuse of mobile phones. The facts that a lack of reliability was the most cited reason against reuse and shortened lifespans and a lack of warranty were also mentioned, suggest to the authors that the establishment of a quality controlled reuse system might boost approval rates. It should be noted that participants were very price conscious and only 15% were ready to pay 80% of the original price.

Jimenez-Parra et al. analysed if and why consumers would be willing to remanufactured notebook computers. The results were published in Jimenez-Parra et al. (2014), Rubio and Jimenez-Parra (2014) and Jimenez-Parra et al. (2012). A sample of 1529 undergraduate students of two Spanish universities, aged 18 to 25 years, participated in the study (Jimenez-Parra et al. 2014). The survey was administered between april 2011 and January 2012 (Jimenez-Parra et al. 2012).

According to Rubio and Jimenez-Parra (2014) a majority of the participants are unfamiliar with remanufactured products. Only about 42 % of participants had heard of their existence and only 17.79 per cent claimed knowledge of what remanufactured

products were. The willingness to buy a remanufactured notebook, was significantly higher in participants with greater knowledge about remanufactured products. Jimenez Parra et al. note that companies could implement general information campaigns of remanufacturing, in order to increase knowledge about remanufactured products and thus sales.

Jimenez-Parra et al. (2014) published, that the price and environmental issues constitute positive motivations for the participants purchase intention of a remanufactured laptop. Both aspects could be important elements in a company's marketing strategy for remanufactured (electrical and electronic) products.

Furthermore, they demonstrate that the respondents are more willing to buy laptops remanufactured by on OEM rather than an independent remanufacturer. Respondents are willing to buy a notebook remanufactured by an OEM the price is at least 20% lower than the price of the original notebook.

A potential buyer's social environment, such as family and friends, does have an influence on the buying decision according to Jimenez-Parra et al. (2014). The authors conclude that marketing activities should involve referents in the buying progress.

According to Jimenez-Parra et al. (2014), technological aspects of notebooks can have a negative impact on the consumers' motivation. Their results suggest that consumers of remanufactured notebooks are not looking for a product with the latest technology. The consumers who search for the most up to date notebooks with the greatest number of additional features, would probably opt for purchasing an original product according to the authors. Consumers who chose the remanufactured notebook were instead looking for a "good enough" performance at an attractive price.

3.2 Research on customers' willingness to pay for reused or remanufactured products

Some authors build on research that indicated the price as a major factor in the perception of reused or remanufactured products. The majority of the research in this area looks at industrial remanufacturing rather than reuse. In this chapter selected research that analysed customers' willingness to pay for remanufactured or reused electrical and electronic devices is presented.

Customer willingness to pay, as well as the effects of cannibalisation, was intensively researched by Guide and Li (2010) in an empirical experiment. They ran eBay auctions in the United States with ascending prices for two electronic products—a consumer product (a jigsaw) and a commercial product (a network security device). Prices at which customers bought were recorded for 10 remanufactured and 20 new versions of

both products. The same seller profile with a 100% positive feedback was used for all auctions, in order to eliminate the factor of seller reputation.

The study shows a significantly lower willingness to pay for the remanufactured versions of both products. For the consumer product, the customers' willingness to pay was 15.3% lower for the remanufactured product than for the new product. Consumers' willingness to pay for the remanufactured commercial product was 9.7% lower than that for the new product.

Guide and Lee also analyse the bidding histories of the products and find some evidence for an overlap in bidders across the new and remanufactured versions of the commercial product. Evidence of an overlap in bidders across the new and remanufactured versions of the consumer product is insignificant, thus cannibalisation is not a concern.

Pang et al. (2014) analysed the drivers of price differentials between new and remanufactured electronics using data on purchases made on eBay UK. Their study did primarily include transactions carried out by non-manufacturer-approved vendors. It is thus reflects the situation of the RUN project closely. The prices analysed in the study were real prices paid rather than a willingness to pay only stated by consumers.

The authors' empirical results suggest that the seller reputation, length of warranties, proxies of demand and supply of remanufactured products, duration, end day of the auction and the availability of return policies are important determinants of differences in prices. Pang et al. remarked that the seller's identity and reputation played an especially important role in determining the price.

Subramanian and Subramanyam (2012) also examined the drivers of price differentials in eBay purchases. Their focus was on the differences between new and remanufactured electronic products. The data included eBay purchases made in the United States of America. Like the study by Pang et al. this study analysed real life transactions and real prices paid.

Their analysis shows that seller reputation significantly explains the price differentials between new and remanufactured products. They also find that products remanufactured by original equipment manufacturers or their authorized factories or resellers are purchased at relatively higher prices than products remanufactured by independent. They also found that, in cases where the seller reputation is high, a stronger warranty is not significantly associated with higher prices paid for the remanufactured products.

Hamzaoui Essoussi and Linton (2010) tried to determine the price that consumers state they are willing to pay for products with reused or recycled content. They used a survey to interview 49 Canadian graduate students about their willingness to pay. Seven different product pairs with different perceived functional risks were studied. The authors expected consumers to be less willing to pay premium prices for products associated with a perceived high functional risk. Different products looked at were:

- Paper versus recycled paper
- Single use camera versus reused single use camera
- Toner cartridge versus refilled cartridge
- Tire versus re-treaded tire
- Auto part versus refurbished auto part
- Cell phone versus refurbished cell phone
- Printer/fax versus refurbished printer/fax

The authors demonstrated that new products and products with recycled or reused content do not have the same value for consumers and thus do not evoke the same willingness to pay. They also confirmed the hypothesis that the perceived functional risk is an important determinant of the price that consumers are willing to pay for products that have recycled or reused content. This means that the lower the level of functional risk associated with the product, the more money consumers are willing to pay for the product with recycled or reused content. In the study consumers were willing to pay a higher price for recycled paper than all the other products considered. The willingness to pay for the recycled paper was higher at a statistically significant level, according to the authors, due to the low perceived functional risk of paper. For products with a higher associated functional risk and reused or recycled content, consumers expect a large price discount in relationship to new products.

The study did not consider product branding. Essoussi and Linton also caution that the willingness to pay varied between participants and that the sample size should be larger in order to depict consumer-related variables. It is also important to note that, in contrast to the studies by Guide and Li, Pang et al. and Subramanian and Subramanyam, the authors only analysed a statement by participants that might not quite reflect what customers would actually pay in real life.

Agrawal et al. (2015) conducted a series of behavioural experiments on student participants to assess how the presence of remanufactured products affects the perception of the OEM's new product. The experiments tested how the existence of remanufactured products influenced the willingness to pay for the new product. Furthermore, Agrawal et al. differentiated between the effect of products remanufactured by the OEM and independent refurbishers. They find that the presence of OEM-remanufactured products decreases the willingness to pay for the new product.

by up to 8%. The presence of products remanufactured by independent companies, however, increases the willingness to pay for the new product by up to 7%. The authors conclude that the presence of independent refurbishers may be beneficial for an OEM, while deterring such competition via preemptive remanufacturing may reduce profits.

Ovchinnikov (2011) conducted a study on 97 MBA student participants in the United States in order to understand consumers' relative preferences for new and remanufactured consumer electronic products. He finds that with the price of the new product being fixed, high-end consumers switch to the remanufactured product if the price is neither too high nor too low. At a very low remanufactured product price, fewer high-end consumers switch to the remanufactured product, because the low price is interpreted as a negative signal in regards to the product's quality and its popularity.

Abbey et al. (2015) investigated the optimal pricing of new and remanufactured products using extensive experimentation on customers in the United States. The study analysed the participants' willingness to pay for several scenarios regarding technology products, household products and personal products. Their investigation found two distinct segments of consumers. One group that is relatively indifferent between new and remanufactured products and a second group that shows a strong preference for new products. The first group is highly sensitivity to price discounts, while the second is not. In contrast to the usual finding that new product prices should decrease when competitive remanufactured products enter the market, Abbey et al. found that with the introduction of market segments the optimal price of the new product should increase. According to them an OEM can mitigate the effects of cannibalisation through appropriate pricing of new products, in this case higher pricing of the new products.

In two of the studies discussed in chapter 3.1 the authors asked participants about their willingness to pay next to general questions about the customers' attitudes.

Yllä-Mella et al. (2015) researched consumer attitudes towards the reuse of mobile phones in Finland (see also chapter 3.1). Next to questions about success factor or barriers for reuse, opinions concerning reasonable prices for used mobile phones (either as a maximum price or as a percentage from an original price) were enquired of participants who were positive about mobile phone reuse. In total, 78% of those participants were willing to pay a maximum of 50% from the original price, while 15% were ready to pay up to 80% or 300 euros. The authors note thus, that the majority of participants is price conscious.

Jimenez-Parra et al. showed that respondents are willing to buy a laptop remanufactured by an original equipment manufacturer rather than an original laptop when the price of the remanufactured product is at least 20% lower than the price of the

original one. It suggests that individuals would consider the price to be a significant attribute in the purchase of this kind of product.

4 Findings in regards to consumer segments

During the analysis of the research described in chapter 3 it became apparent that some authors also focused especially on the characteristics of the participants they questioned. Because this information which type of customer could be especially positive toward reused or remanufactured product could be relevant to the RUN projects marketing, their findings will be summarised in the following paragraphs. Out of the research analysed for the findings presented in chapter 3, Clausen et al. took the approach to group participants into clusters of customers with consistent attitudes and behaviours, while Spitzbart et al. analysed the answers of participants (for a summary of their work see chapter 3.1) depending on socio-demographic characteristics (e.g. age, gender or education).

Clausen et al. (2010) performed a cluster analysis as part of their empiric study of eBay users described in chapter 3.1. 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. There are price oriented buyers of used goods (20%), used goods sceptics (20%), online buyers (15%), environmentally oriented buyers of used goods (22%) and so called “prosumers” (23%).

Price-oriented used goods buyers use eBay to purchase things they would otherwise not be able to afford. They display the highest intensity of transactions of all user types.

Used goods sceptics are, far more sceptical about used goods than the average participant. Owning products that follow the newest trend is particularly important to them.

Online buyers use ebay mainly for convenience’s sake and treat it like an online department store. They are motivated to shop on eBay especially by the opportunities to find exotic rarities and collectors’ items. Clausen et al. note that environmental concerns are largely irrelevant and financial motives entirely irrelevant for this group.

Environmentally oriented buyers of used goods believe that buying and selling of used products is beneficial to the environment. It is also important to them to buy environmentally friendly products and they value characteristics of sustainable products such as a long lifespan and high quality. They also care for transport distances or other environmental aspects. Environmentally oriented buyers of used goods tend to buy at real life used goods markets like second hand stores or flea markets regularly.

Prosumers mainly sell goods on eBay and have a high orientation towards reselling in general. When they do buy, they do so with a higher orientation to current trends, than the other consumer types. Clausen et al. therefore assume that they buy mainly new goods. Environmental aspects tend to be unimportant to the prosumers.

Overall, the authors conclude that environmental aspects play only a minor role for the majority of the surveyed eBay users when trading used products. Other aspects concerning motivations such as practical, financial considerations and the fun aspect of trading are more important.

Spitzbart et al. searched for statistically significant connections between the answers of participants and the socio-demographic data they gave for both of their surveys (see chapter 3.2).

There could be no connection established for participants that would or would not buy a reused product. The authors do however note some connections in regards to specific answers. They state that quality and warranty are slightly more important to younger participants than to older participants. Wealthier participants show a tendency to see a warranty as more important than participants with less disposable income. The wealthier participants also named the newness of a device significantly more often as important to them (42%) than the participants with not a lot of disposable income (8%).

5 Summary and conclusions

In regards to the research on success factors and barriers to reuse or remanufacturing from a customer perspective it should be noted that the number of participants interviewed in the research presented in chapter 3.2 varied and was small in some surveys (e.g. 49 and 62 respondents in the Spitzbart et. al. surveys). The results should be perceived with that in mind.

The research discussed in chapter 3.2 still shows some markedly similar results that might indicate trends in consumer attitudes towards buying remanufactured electrical and electronic devices and notebooks. Clausen et al., Spitzbart et al. and Schwabl and Hainzmann all found, that the price and the quality are the factors most important to consumers in reused or remanufactured products. Yllä-Mella et al. and Jimenez-Parra et al. show the same result regarding the factor price. Jimenez-Parra et al. furthermore state that environmental awareness and the influence of a consumer's social environment are important factors. Clausen et al., Spitzbart et al., Schwabl and Hainzmann as well as Yllä-Mella found that lack of trust in the functionality of products constitutes an important barrier. Only Jimenez-Parra et al. state that a technological up to date product might not be decisive for buyers of remanufactured products, who instead seem to seek a "good enough" product at an attractive price. Jimenez-Parra et al.

also stress the importance of consumers' knowledge about remanufacturing. According to them the more informed customers are, the more likely they are to buy remanufactured notebooks.

The research of customers' willingness to pay confirmed that the price of products remanufactured by third-party sellers (such as RUN) should be lower than that of remanufactured products offered by an OEM or an authorised reseller, which in turn should be offered at a lower price than a new product. Only some research states price distinctions for products remanufactured by OEMs and the differences in range are too broad to generalise results. There is some evidence that extremely low prices in products remanufactured by an OEM might signal an inferior product to customers. If this is also true for products offered by independent reuse companies has not been addressed in the known literature. There is also some evidence that price differences between new and remanufactured or reused products are higher in technological products with high functional risks.

Overall the research overwhelmingly concluded that there exists a customer segment that has a positive attitude towards reused or remanufactured products. The price and the quality were repeatedly shown to be the most important factors to prospective customers.

For the RUN project it can be concluded, that (from a marketing point of view) prices asked should be lower than those asked by OEMs for new or remanufactured products.

Next to the price, customers also expressed concerns related to the quality and (less frequently) the functionality of devices and a lack of warranty. They might also be more reluctant to purchase reused or remanufactured products with a high functional risk. Therefore the RUN project should advertise its quality control refurbishment process. The research discussed was not conclusive of the necessity to provide a voluntary warranty. While customers expressed concern about a lack of warranty in interviews, empirical research showed that the seller reputation might have a greater influence on transactions. In each case, it is of great importance to the RUN project to gain a reputation as a refurbishment provider with a high quality standard.

The known research is not conclusive on the question of which customers should be targeted in terms of socio-demographic factors. Clausen et al. (2010) present evidence that a segment of customers exists that prefers to buy new products and then sell it on as used (so called prosumers). Clausen et al. as well as Jimenez-Parra et al. found evidence that other segments of customers are motivated by environmental concerns and price consciousness.

At the same time, these segments do not focus on acquiring the newest technology available. Considering these results it might be expedient for the RUN project to focus prosumers and early adopters of technology for the return of products and to focus on the customer segments motivated by price and / or environmental concerns as purchasers of devices.

6 Literature

Abbey, J., D., Blackburn, J., D., Guide, V. D. R., Jr., (2015) "Optimal pricing for new and remanufactured products", Journal of Operations Management, Volume 36, pp. 130-146, <http://dx.doi.org/10.1016/j.jom.2015.03.007>

Agrawal, V., Atasu, A., van Ittersum, K., (2015) Remanufacturing, Third-Party Competition, and Consumers' Perceived Value of New Products, Management Science 61(1), pp. 60-72,

Atasu, A., Guide Jr, V.D.R., Van Wassenhove, L.N. (2008), "Product Reuse Economics in Closed-Loop Supply Chain Research", Journal of Production and Operations Management, Volume 17, Issue 5, pp.483-496, <http://dx.doi.org/10.3401/poms.1080.0051>

Blättel-Mink, B., Bender, S.F., Dalichau, D., Hattenhauer, M., (2011), „Nachhaltigkeit im online gestützten Gebrauchtwarenhandel: Empirische Befunde auf der subjektiven Ebene“ in „Wiederverkaufkultur im Internet“ herausgegeben von Behrendt et al., Springer Heidelberg 2011

BSI 8887 Design for manufacture, assembly, disassembly and end-of-life processing, part 2: terms and definitions, (BS 8887-2:2009), ISBN 9780580632853

BSI 8887 Design for manufacture, assembly, disassembly and end-of-life processing, part 240: reconditioning, (BS 8887-240:2011), ISBN 9780580731693

Clausen, J., Blättel-Mink, B., Erdmann, L., Henseling, C., (2010) „Contribution of Online Trading of Used Goods to Resource Efficiency: An Empirical Study of eBay Users“, Sustainability 2010 (2), pp. 1810-1830, <http://dx.doi.org/10.3390/su2061810>

Cox, J., Griffith, S., Giorgi, S., King, G., (2013), "Consumer understanding of product lifetimes", Resources, Conservation and Recycling, Volume 79 (2013), pp. 21- 29 <http://dx.doi.org/10.1016/j.resconrec.2013.05.003>

Gharfalkar M., Zulfiqur, A., Hillier, G., Tinos 2015 "Clarifying the Definitions of Various Reuse Options for Effective Recovery of Resources from Waste Streams", 3rd International Conference on Solid Waste Management, Tinos Island, Greece; 07/2015 [http://www.tinos2015.uest.gr/proceedings/pdfs/Gharfalkar et al pres.pdf](http://www.tinos2015.uest.gr/proceedings/pdfs/Gharfalkar_et_al_pres.pdf) [Last downloaded 17.08.2015]

Guide, V. D. R., Jr., Li, J., (2010), "The potential for cannibalization of new product sales by remanufactured products", *Decision Sciences Journal*, Volume 41(3), pp. 547–572, <http://dx.doi.org/10.1111/j.1540-5915.2010.00280.x>

Guide, V.D.R. Jr., Van Wassenhove, L., N., (2009), "The evolution of closed-loop supply chain research." INSEAD, Faculty working paper, <http://www.insead.edu/facultyresearch/research/doc.cfm?did=19631> [last downloaded 01.06.2015]

Hamzaoui Essoussi, L., Linton, J. D., (2010), "New or recycled products: how much are consumers willing to pay?" *Journal of Consumer Marketing*, Vol. 27 Issue 5 pp. 458 – 468 <http://dx.doi.org/10.1108/07363761011063358>

Jimenez-Parra, B., Rubio-Lacoba, S., Vicente-Molina, M.-A., (2012) "An approximation to the Remanufactured Electrical and Electronic Equipment Consumer", 6th International Conference on Industrial Engineering and Industrial Management, Vigo, July 18-20, 2012 http://adingor.es/congresos/web/uploads/cio/cio2012/EN_05_Sustainability_and_Corporate_Social_Responsibility/433-440.pdf [last downloaded 16.07.2015]

Jimenez-Parra, B., Rubio, S., Vicente-Molina, M.-A., (2014) "Key drivers in the behavior of potential consumers of remanufactured products: a study on laptops in Spain", *Journal of Cleaner Production*, Volume 85, pp. 488–496, <http://dx.doi.org/10.1016/j.jclepro.2014.05.047>

Michaud, C., Llerena, D., (2006), "An economic perspective on remanufactured products: industrial and consumption challenges for life cycle engineering." *Proc LCE2006* <http://www.mech.kuleuven.be/lce2006/063.pdf> [last downloaded 09.07.2015]

Ovchinnikov, A., (2011), "Revenue and cost management for remanufactured products" *Production and Operations Management* Volume 20 (6), pp. 824–840 <http://dx.doi.org/10.1111/j.1937-5956.2010.01214.x>

Pang, G., Casalina, F., Papagiannidis, S., Muyldermans, L., Tsec, Y.K., (2015), "Price determinants for remanufactured electronic products: A case study on eBay UK", *International Journal of Production Research*, Volume 53 (2), pp. 572-589 <http://dx.doi.org/10.1080/00207543.2014.958594>

Rubio, S., Jimenez-Parra, B., (2014), „Reverse Logistics: Overview and Challenges for Supply Chain Management“, *International Journal of Engineering Business Management*, open access 2014, <http://dx.doi.org/10.5772/58827>

Spitzbart, M., Schneider, F., Obersteiner, G., (2007), „Schaffung der Voraussetzungen zur Bildung eines Wiederverwendungskreislaufes für Elektro(nik)altgeräte“, Ein Projektbericht im Rahmen der Programmlinie Fabrik der Zukunft im Auftrag des Bundesministeriums für Verkehr, Innovation und Technologie, Wien Jänner 2007, http://www.fabrikderzukunft.at/fdz_pdf/endbericht_0724_wiederverwendungskreislauf.pdf [last downloaded 14.03.2015]

Subramanian, R., Subramanyam, R., (2012), “Key Factors in the Market for Remanufactured Products”, Manufacturing and Service Operations Management, Volume 14 (2), pp. 315–326, <http://dx.doi.org/10.1287/msom.1110.0368>

Watson, M 2008, “A Review of literature and research on public attitudes, perceptions and behaviour relating to remanufactured, repaired and reused products”, Report for the Centre for Remanufacturing and Reuse, Centre for Remanufacturing and Reuse and University of Sheffield, <http://www.remanufacturing.org.uk/resource-detail.php?report=322> [last downloaded 14.05.2015]

Ylä-Mella, J., Keiski, R., Pongrácz, E. (2015), “Electronic waste recovery in Finland: Consumers’ perceptions towards recycling and re-use of mobile phones”, Waste Management, in press, <http://dx.doi.org/10.1016/j.wasman.2015.02.031>