

Quality Labelling of Re-used Products in the Swedish IT-sector

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Abstract

Due to the depletion of earth's resources and the growing concern of electronic waste it is important to extend the lifespan of electronic products. Consumers often have the perception that re-used and remanufactured products are of lesser quality than new counterparts. This study aims to evaluate if a more comprehensive sustainability certification scheme for electronic products, covering criteria on product quality, could be a way to support the market of re-used and remanufactured electronic products. A detailed analysis, through interviews and literature reviews of a selection of identified existing initiatives generated some important lessons to be learned. The lessons suggest that there are some aspects that should be thoroughly considered including; marketing, funding, establishment of networks and the necessity of specific quality criteria on IT-products and electrical and electronic equipment. Interviews with stakeholders in the Swedish IT-sector reveals that there is a trade-off between the information communicated in a label of re-used and remanufactured IT and expensive to cover and verify these aspects. This can be explained by that the sector of re-used IT in Sweden consists of a few organisations unable to fund such a scheme themselves, like traditionally when implementing eco-certifications. This also limits the possibility to create a wide recognition of such a label and suggests that marketing is of great importance.

Abbreviations

ADISA - Asset Disposal and Information Security Alliance

APSRG- All-Party Parliamentary Sustainable Resource Group

BAN - Basel Action Network

BIS - Department for Business, Innovation and skills (former UK governmental department)'

BSI – British Standard Institute

CENELEC - European Committee for Electrotechnical Standardization

EEE - electrical and electronic equipment

EFQM - the European Foundation for Quality Management

EPRA - Electronic Products Recycling Association

FRN - Furniture re-use network

GPP - Green public procurement

HP- Hewlett-Packard

ICT - Information and communications technology

Int. – International

KERP - Kompetenzzentrum Elektronik & Umwelt

KOMOSIE – Koepel van milieuondernemers in de sociale economie,

OEM – Original Equipment Manufacturer

OÖ Landesabfallverband - Landesabfallverband Oberösterreich

OVAM - Openbare Vlaamse Afvalstoffenmaatschappij, Public Waste Agency of Flanders

PAS 141 - Publicly Available Specification 141

Reuse-Computer e.V. - Re-use-Computer eingetragener Verein

SERI - Sustainable Electronics Recycling International

SLL – Stockholms läns landsting

UKAS - United Kingdom Accreditation Service

UNEP – United Nations Environmental Program

WEEE - waste electrical and electronic equipment

WEEELABEX - WEEE label of excellence

WRAP - Wastes and Resources Action Program

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1. Introduction

Today the human population consumes resources in a pace that isn't sustainable in relation to the earth's generation of new resources and simultaneously we produce an extensive amount of waste. Circular economy is a developing concept that lately have been getting a lot of attention from decision makers around the world as a possible way forward towards a more sustainable society. In 2015, the European Union adopted a strategy for a circular economy (European Commission, 2015). Core parts of the concept of a circular economy is the aim of moving from a linear economic system, where we rely on extraction of raw materials and generation of waste towards a more circular economic system where products and resources (materials) stay as long as possible within the system and the generated waste is considered a resource (Ellen McArthur Foundation, 2012).

Electronic waste is the fastest growing waste stream in EU and most of the waste recovered is recycled rather than re-used (Eurostat, 2017). Electronic products such as computers, laptops, tablets and mobile phones contain materials of high value as well as hazardous substances (Tanskanen, 2013). Today e-waste is often collected in developed countries and then shipped to developing countries for recycling or re-use (Widmer et al., 2005). Therefore, there is a growing notion that we need to increase recycling to prolong the lifespan of these products. One way to do this is by increasing the durability of products, something that is discussed a lot within the EU and in academia (Maitre-Ekern & Dalhammar, 2016).

A second way to increase the lifespan of products is by giving them more than one lifecycle. Remanufacturing of products, a process of putting the non-functional or retired products back to like-new conditions, is often environmentally preferable to material recycling and manufacturing of new products (Sundin & Lee, 2012). This is due to alleviation of depletion of resources, reduction of global warming potential and safer handling of toxic materials (Sundin & Lee, 2012).

There are several barriers to an increased market share of re-used, repaired and remanufactured products. The products themselves sometimes become a barrier as the product design influences the potential of recycling and re-use (Pérez-Belis et al., 2013). Furthermore, the re-use and remanufacturing industry rely on a supply of used products and thereby the collection of resources from various and diverse sources (Guide & van Wassenhove, 2001). Many of the

barriers are related to consumer perceptions and attitudes towards this type of product (Watson, 2008). One common assumption among consumers is the perception of lower quality with regards to re-used products compared to their new counterparts (Abbey et al, 2017; Guiot & Roux, 2010; Hazen et al., 2017). The often higher price of repairing compared to purchasing new equipment is another important barrier (Watson, 2008). Environmentally aware consumers constitute a consumer segment that could be a business opportunity for this industry, however studies indicate that this consumer segment seldom recognises the environmental benefits of re-used, repaired and remanufactured electronic products in particular (Abbey et al., 2015b; Guiot & Roux, 2010; Michaud & Llerena, 2011). Providing consumers with information regarding the environmental benefits may increase their willingness to pay for remanufactured products (Michaud & Llerena, 2011; Wang et al., 2016). It has been indicated that eco-certifications can increase the willingness to pay for refurbished products (Harms & Linton, 2016).

Abbey et al. (2017) state that providing information to the customers regarding the quality of products might decrease the risk perception. Kang et al. (2016) advocate international collaboration to create certification schemes or standards for quality assurance of remanufactured products. Labelling is also affecting and affected by other policy instruments such as public procurement which can be beneficial to use in combination with labelling (Frankl et al., 2005).

A Swedish re-use company engaged in reconditioning of IT-products have expressed an interest to explore the potential of introducing a quality label on re-used products in Sweden (Dalhammar & Milios, 2016). A labelling scheme or standard also constitutes one of the suggestions that should be further investigated according to a recent Swedish Government Official Report (SOU 2017:22).

1.1 Aim and Objectives

The aim of this study is to evaluate if a more comprehensive sustainability certification scheme for electronic products – whether it entails development of current certification schemes or the establishment of new schemes, including criteria regarding content, lifespan, durability, quality etcetera could be a way to support the market of remanufactured, re-used and refurbished electronic products. The study is addressing the following research questions;

- Are there existing labelling schemes and related initiatives aiming at increasing the re-use, repair and remanufacturing of electronic products?
- Which are the main lessons to be learned regarding the scope/criteria, organisation and implementation of the relevant initiatives?
- How could a certification scheme for electronics be designed to be suitable for communicating the benefits of re-use and remanufacturing of electronic products in the Swedish context?

2. Method and Approach

This study has a qualitative and comparative research design as the aim and research questions focus on perceptions and attitudes (Bryman, 2011). By making a qualitative comparison of existing initiatives regarding re-use, refurbishing and remanufacturing of electronic products and studying the specific Swedish market and policy context for this product category, the aim is to analyse the possibility of introducing a similar initiative in Sweden. Thus, the approach is inductive. The main critique against qualitative research is its limitations regarding external validity and possibility to generalise the results (Esaiasson et al., 2012). The intention has been to generate a picture of if, and how, a Swedish labelling scheme could be designed. The results are not intended to be generalised to other markets or policy contexts and therefore the external validity should not be of major concern (Esaiasson et al., 2012).

The research process used to conduct this qualitative study can be described in four parts (see figure 1.). Part I is a literature review and the three subsequent parts are representing each of the research questions. In part II an identification and categorisation of existing initiatives (labelling schemes, standards and other guidelines) aiming at improving re-use, refurbishment, remanufacturing and recycling of electronic products was performed. Part III of the method consists of a more detailed survey of a selection of initiatives identified in the prior part. The final part, IV, is an investigation of how a more comprehensive labelling scheme for electronics could be designed to be suitable for improving re-use, remanufacturing and recycling of electronic products in the Swedish context.

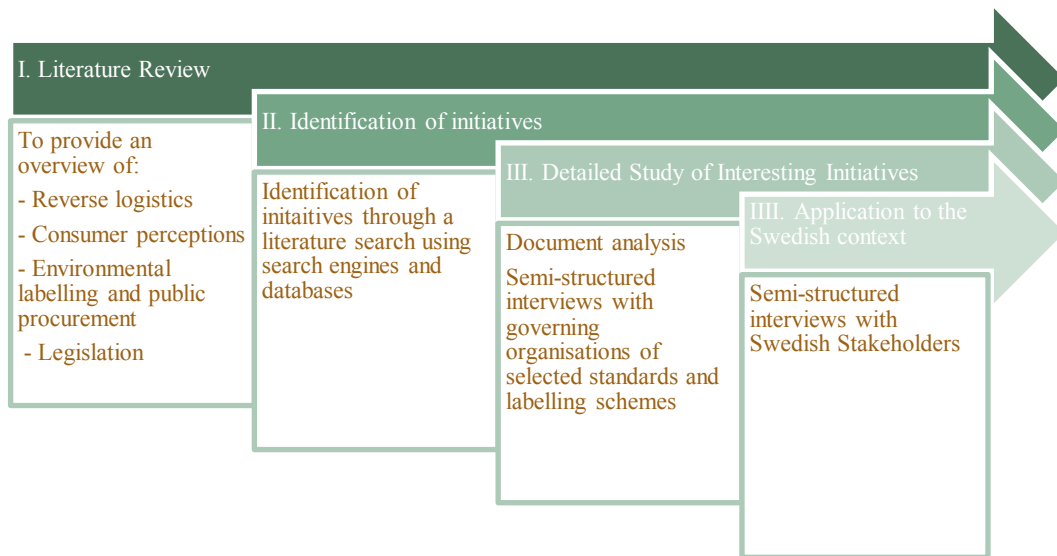


Figure 1. The Research Process

The research process described as four parts. Each part of the research process generated information used in the subsequent parts.

2.1 Literature Review

The literature review is an overview of the relevant research fields and specific aspects of the re-use industry. The selection of literature was based on the aim of this study and the research questions. The literature search was performed via LUBsearch (Lund university search engine containing all databases accessible at the university). For information on consumer attitudes and perceptions the search terms *remanufact** and *re-use* in combination with each of the respective terms *perception*, *attitude*, *procurement*, *legislation* and *reverse logistics* were used together with the Boolean operator AND. Selections of articles were based on reading title and abstract.

2.2 Identification of Initiatives

To identify existing initiatives aiming at improving the re-use, refurbishment, remanufacturing and recycling of electronic products a literature search was performed via the search engines Google and GoogleScholar, using the following search strings: Eco-label electronics, remanufacturing labeling/labelling, re-use labeling/labelling. A literature search was also performed via LUBsearch (Lund university search engine containing all databases accessible at the university) using the search terms *remanufact** and *re-use* in combination with each of the respective terms *label**, *certification* and *standard* using the Boolean operator AND. As a few first initiatives were identified they were used as search terms in the Search engines mentioned above to identify additional initiatives. For every initiative, I aimed at identifying several characteristics such as; scope and included criteria, organisational aspects, link to national and international authorities and link to private and public procurement. Relevant information was obtained from the webpages of the governing organisations of the different initiatives. The result from this part was the foundation of the second part of the study.

2.3 Detailed Study of Interesting Initiatives

In the second part of the study a selected number of initiatives identified in the first part of the study were subject of a more detailed survey and description resulting in a comparative analysis between these selected initiatives. Initial mail contact with the governing organisations of all identified initiatives was set up to get more detailed information regarding the organisation of the schemes and their implementation, and thereafter four initiatives were selected for a more thorough investigation. The limitation of initiatives for further investigation is due to the timeframe of this study. Criteria in the process of selecting initiatives for a more thorough study, apart from willingness to participate, included:

- I. Relevance to the Swedish market context
- II. Amount of product quality aspects covered in the schemes' criteria

Consequently, the initiatives included in the detailed survey and description represents a strategic purposive sample (Bryman, 2011).

A more in-depth qualitative analysis of relevant criteria documents of the initiatives was performed to analyse the incorporated criteria, included areas/themes and criteria regarding product quality specifically. The analysis was conducted through a coding scheme including themes of interest to be identified in all documents (Bryman, 2011). The following themes were identified; visual inspection, electrical safety test, data eradication, functionality, specific product

category tests, cleaning, licensed operative system, segregation of product flow, transportation requirements, warranty, certification and product label.

Semi-structured interviews with representatives from the governing organisations were conducted to generate further information regarding the initiatives. See more information on the interviews in section 2.5. The interviews with representatives from the governing organisations of the initiatives are listed in table 1 and will be referred to with the name of the initiative e.g. (ReVital).

Table 1. Interview respondents, European initiatives

The interview respondents of the interviews conducted to get a deeper understanding of the ongoing initiatives in Europe and the date on which the interview was performed.

Initiative	Organisation/Company	Name	Position	Date
PAS 141	Anonymous	Anonymous	Industry expert involved in the development and running of the scheme	22/3-2017
ReVital	Oberösterreich Landesabfallverband	Thomas Anderer	Chief Executive Officer	31/3-2017
Revolve	Zero Waste Scotland	Samantha Moir	Revolve manager	12/4-2017
Revisie	KOMOSIE	Hans Pauwels	Staff member, registration & reusable electrical devices	26/4-2017

2.4 Application to the Swedish Context

In the third and final part of the methodology the focus is on evaluating the initiatives in the Swedish context, aiming at making suggestions on how a more comprehensive certification scheme for electronics could be designed for a Swedish context. This is performed through semi-structured interviews with a strategic selection of Swedish stakeholders such as companies in the IT sector, public procurers and a governing organisation of an existing labelling scheme. The interviewed organisations and respondents are listed in table 2 below. The selection was based on a snowball sampling, a non-probability sampling method (Bryman, 2011) where a few potential interview subjects were selected and these in turn were used to identify additional respondents. This sampling method was motivated by the need to find respondents with specific knowledge of this field. The two municipalities with the largest population in Sweden were selected. See more information on the interviews in section 2.5. The interviews with Swedish stakeholders will be referred to with the name of the organisation they represent e.g. (INREGO).

Table 2. Interview respondents, Swedish context

The interview respondents of the interviews conducted to create a picture of the Swedish context and the date on which the interview was performed.

Organisation/company	Name	Position	Date
INREGO	Erik Pettersson	Sustainability manager	30/3-2017
TCO development	Niclas Rydell	Certification Director	6/4-2017
Atea Sverige Atea Logistics	Daniel Norlin, Joachim Aronsson	Project Manager, Atea Business Assurance Business Development	11/4-2017
Hewlett-Packard (HP)	Hans Wendschlag	Environmental Manager, European Environmental Program Manager	11/4 -2017
Stockholm läns landsting (SLL)	Anders Mannegard Christer Elbe	Unit Manager, Service and Process Development ¹ Management leader IT contracts ²	19/4 -2017
Stockholm Stad	Mia Svärd	Contracts Officer, City management Office, Department of Digital Development ³	27/4-2017
Göteborgs Stad	Johan Davidsson	Environmental specialist, Purchase and procurement ⁴	28/4-2017

2.5 Interviews

Semi-structured interviews with open questions were chosen as the initiatives studied are diverse and so are the Swedish stakeholders. This makes it preferable that the respondents are not restricted in answering the questions in order to generate relevant information (Bryman, 2011). Furthermore, it provides opportunities for the researcher to ask follow-up questions and include questions regarding specific characteristics of the respective initiatives or character of the stakeholders' engagement in re-use.

An interview guide with standard open questions was the basis of all interviews with different initiatives (Annex 1.). The questions asked included themes such as scope, organisation, certification process and linkages to public procurement.

In the interviews with Swedish stakeholders, individual interview guides were used as they are engaged in different parts of the re-use process (CF annex

¹ Enhetschef Tjänste- och processutveckling

² Förvaltningsledare IT-avtal

³ Avtalshandläggare, Stadsledningskontoret, Avdelningen för digital utveckling

⁴ Miljöspecialist, Inköp och upphandling

2-5). When interviewing public procurers, one general interview guide was used (annex 6). The questions asked aimed at obtaining their perceptions on the need, demand and possible organisation of a Swedish labelling initiative for re-use IT-products.

All interviews were made by telephone as the interviewees were geographically dispersed. Notes were taken during the conversations which also were audio recorded. All interviews were transcribed and key words were selected which were used to generate themes. The generated themes are listed below I, interviews with initiatives and II, interviews with Swedish stakeholders:

- I. 'Initiation and aim', 'Organisation', 'Included quality criteria', 'Link to other schemes' and 'Procurement'.
- II. 'The interviewed stakeholders and their engagement in re-use', 'Need and demand', 'Possibilities with existing labelling schemes', 'Scope and criteria of a new labelling scheme for re-use', 'Organisation of a new label' and 'Funding and contribution from the public sectors'

2.6 Limitations

This study was limited to analysing labelling schemes and standards addressing re-use, refurbishment and remanufacturing of electronic products with focus on IT-products. Thus, the conclusions are not intended to be generalised to other product categories. This study looked at the possibilities of these initiatives as applied to the current Swedish context and the conclusions drawn are thereby not necessarily valid in the context of another country or market situation. Only initiatives in Europe and North America are included in the study as the legal situations are more comparable to the Swedish.

2.7 Definitions of Re-use and Related Concepts

There are several closely related concepts regarding the prolonged lifespan of products relevant when discussing a more circular economy of products. The European commission defines 're-use' as '*...any operation by which products or components that are not waste are used again for the same purpose for which they were conceived*' (Dir 2008/98/EC). *Re-use* of products is the direct re-use of product without any modifications (APSRG, 2014).

The concept 'preparing for re-use' is defined by the European commission as follows '*...checking, cleaning or repairing recovery operations, by which products*

or components of products that have become waste are prepared so that they can be re-used without any other pre-processing' (Dir 2008/98/EC). This concept refers to several different operations. First, 'repairing' is the fixing of a fault of a product but it gives no guarantee on the functionality of the product as a whole (APSRG, 2014).

The concept of 'refurbishing' does generally refer to an aesthetic improvement of a product which might make it look like new but it has often undergone limited functionality improvements. 'Reconditioning' is an adjustment to components and bringing them back in working order (APSRG, 2014).

Finally, the most extensive way of prolonging the lifespan of a product is 'remanufacturing'. There is an existing academic definition of remanufacturing as follows "*A series of manufacturing steps acting on an end-of-life part or product in order to return it to like-new or better performance, with warranty to match.*" (Parker & Butler, 2007). Remanufacturing generally applied on complex products with embedded materials of economic interest or products that are energy or labour intensive to produce (Parker & Butler, 2007). By some, e.g. Abbey et al. (2017), remanufacturing is used in a more general way as a synonym to refurbished and reconditioned. In this study, the definitions above are used. The broad definition of re-use is used for the description of all preparing for re-use operations.

3. Results

3.1 Narrative Literature Review

This section provides a short overview of some relevant research areas related to re-use and remanufacturing of EEE as well as the use of environmental labelling as a policy instrument. The aim is to give the reader basic understanding of the specific aspects of re-use processes and product marketing.

3.1.1 Reverse Logistics

The research field of closed-loop supply chains and reverse logistics is growing, see Govindan et al. (2015) for a review of literature. Reverse logistics is the process of creating an efficient flow of materials and finish goods from the point of consumption to the point origin for the purpose of recapturing value or disposal see definition in (Rogers & Tibben-Lembke, 1998). Closed-loop supply chains, CLSC can be described as an integrated approach of both forward and reverse supply chains (Govindan & Soleimani, 2017). CLSC can be defined as:

'the design, control, and operation of a system to maximize value creation over the entire life cycle of a product with dynamic recovery of value from different types and volumes of returns over time' (Guide & Van Wassenhove, 2009).

There are some aspects of managing supply chains that are unique with re-used and remanufactured products. One such aspect is product acquisition management, which is the timing of returns of used products, i.e. getting the right amount, at the right time and to the right quality (Guide & van Wassenhove, 2001). 'Preparing for re-use' actions depend on the sales of new products as new products are the resource inflow in these operations. Guide and van Wassenhove (2001) discuss two systems of obtaining used products from end-users. The first, 'waste stream system' is making producers responsible for collection of their used products whereas in the second, 'market driven system' financial incentives are used by companies, specialised in re-use of a certain product, to motivate end-

users to return their products (Guide & van Wassenhove, 2001). Another important part of the reverse logistics is testing and sorting i.e. processes to select the proper management option, i.e. remanufacturing or recycling (Guide & van Wassenhove, 2001).

Marketing of products is also specific to this sector and will be discussed further in the next section. OEMs (Original Equipment Manufacturers) has long been resistant to remanufacturing due to the risk of cannibalization on the sales of new products (Atasu et al., 2010). Compared to selling to low-end quality products, which is a decision entirely made by the OEM, remanufacturing can also be done by a third party and thereby reduce the OEMs' sales of new products (Agrawal et al., 2015). Remanufacturing can be advantageous for economic reasons (Guide & van Wassenhove, 2001; Ovchinnikov et al., 2014).

3.1.2 Consumer Perceptions of Re-used and Remanufactured Products

In later years, the attitudes of the general public and consumers towards re-use, repair and remanufacturing of products has been the subject of several studies (Watson, 2008). Generally, the research implies that there is a resistance among consumers towards buying this type of products (Abbey, et al., 2015b; Hazen et al., 2016). Often consumers have the perception that these products have a lower quality than equivalent new equipment (Abbey et al., 2017; Guiot & Roux, 2010; Hazen et al., 2017).

Traditionally, the price discount was thought to make up for the perceived lower quality and increase the attractiveness of remanufactured products (Debo et al., 2005) and a substantial amount of research has been looking at optimal pricing of these products (Abbey et al. 2015a; Ovchinnikov, 2011). Regarding re-use of ICT especially mobile phones new features are often of importance to the consumer (Ylä-Mella, Keiski, & Pongrácz, 2015).

Consumer attitudes towards re-used, repaired and remanufactured products differentiate between consumer segments (Abbey et al., 2015a). Abbey et al. (2015a) identifies two separate consumer segments. The first group is relatively neutral towards new and remanufactured products and recognises price as an important factor in the decision between a new and a remanufactured product. The second segment prefer new products and are rather indifferent to the price difference between new and remanufactured products (Abbey et al., 2015a).

Consumers' willingness to pay for remanufactured products differentiate with regard to the supposed risk that the products are of lesser quality, either functionally or cosmetically (Abbey et al., 2017). Abbey et al. (2017) identify 'lifespan', 'features', 'performance' and 'serviceability' as important underlying factor of consumers perceived quality of remanufactured products. Hazen et al. (2012) finds a relationship between the consumer's 'tolerance for ambiguity', i.e.

their tolerance of the absence of information required to understand a situation, in this case the remanufacturing processes and product properties, and their willingness to pay for remanufactured products. It is also shown that the tolerance of ambiguity is related to perceived quality which in turn is related to the willingness to pay (Hazen et al., 2012).

Guiot and Roux (2010) finds that consumers perceive a particularly high risk when buying certain types of second hand products such as household appliances, computers, televisions and audio equipment. As one cause behind this, inconsistent claims from sellers are suggested. The writers' advocate for the need to provide more guarantees (i.e. warranties) and technical documentations (Guiot & Roux, 2010).

3.1.3 Environmental Labelling and Public Procurement

The use of environmental labelling of products and general environmental claims in marketing are standardised in the ISO 14020 series (ISO, 2012). According to this set of standards there are three main types of environmental labelling. Type I is the traditional type of environmental label where a mark or logo is awarded after third party auditing and fulfilment of criteria covering the entire life-cycle of a product (ISO, 1999). Type II (ISO, 2016) is self-declared environmental claims not necessarily controlled in any way. Type III (ISO, 2006) environmental declarations can be described as formalized set of environmental data describing the environmental aspects of a product.

Green public procurement, GPP, is a process whereby public authorities seek to procure goods and services with a reduced environmental impact (for a more detailed definition see COM(2008)400). Frankl et al. (2005) recommend eco-labelling to be used as a policy together with other policy instruments such as public procurement.

Public procurement in Sweden is regulated through the directive, 2014/24/EU. The use of labels in public procurement is regulated in article 43 (Dir 2014/24/EU). In the newly published *EU GPP Criteria for Computers and Monitors* (European Commission, 2016) section 4.2 concerns end of life management. In this section, the following is stated regarding the testing, servicing and upgrading of used products:

'Some Member States have developed standards and/or schemes that public authorities may wish to refer to in order to provide greater detail on how equipment shall be made suitable for reuse and resale' (European Commission, 2016)

3.1.4 Legislation

The management of waste of electrical and electronic equipment (WEEE) in Europe and Sweden is regulated in the WEEE Directive (Dir 2012/19/EU). It entered into force in February 2014 and aims at tackling the increasing waste stream of WEEE. It followed the first WEEE directive (Dir 2002/96/EC) that were introduced to, through the creation of collection schemes of WEEE through producer responsibility, increase the recycling and re-use of WEEE. The general waste management in EU is regulated in Dir 2008/98/EC (the Waste Framework Directive).

The producer responsibility rules can be a barrier as OEM sometimes choose to dispose and recycle equipment that could have been re-used (Ongondo et al., 2013). Intellectual property law is another area that can constitute a barrier for third party re-use organisations as information regarding disassembly of used products can be protected by patent law (Hartwell & Marco, 2016).

The Basel Convention (UNEP, 1989) is an important international regulation approved by the EU controlling transboundary movements and disposal of hazardous waste.

3.2 Initiatives Regarding Re-use and Remanufacturing of EEE

At the time being, there are a several quality certifications schemes, labels and brands available for re-use, remanufactured, refurbished and repaired electrical and electronic equipment in Europe and North America. An overview of the identified initiatives is presented in table 3. Thereafter, a short description of the main types of initiatives is presented below. There are similar initiatives in other parts of the world as well such as Korea and China (Kang et al., 2016). Some prior similar lists and comparisons of initiatives can be found in Chaplin (2012), Premm (2012) BIO Intelligence Service (2013) and Williams (2016) however, this list is significantly more extensive.

Table 3. Identified initiatives regarding re-use, repair and remanufacturing of electronic products

Identified initiatives aiming at increasing re-use, repair and remanufacturing of EEE.

Initiative	Application Area	Governing Organisation	Type of initiative	Scope	Overall Aim	Other comments	Reference
EN 50614 Preparing for re-use (will be launched during 2017)	Europe	CENELEC	Standard	Re-use of EEE	Implementation of the WEEE directive 2012/19/EU	Part of a set of European standards EN on WEEE	(in 't Groen, Stengs, & Zonneveld, 2017)
WEEELABEX	Europe	WEEE Forum	Standard (set of three standards)	All forms of WEEE (including re-use)	Implementation of the WEEE directive 2012/19/EU	Will be replaced by the EN set of standards (above)	(WEEE Forum, 2013a, 2013b)
PAS 141	UK	BIS	Process management specification	Re-use of EEE	Product quality and safety	Formerly also a certification scheme and label	(WRAP, 2016)
WRAP – product protocols	UK	WRAP	Guidelines on testing product quality	15 product categories of EEE	Product quality	Developed to be used in the PAS 141 framework	(WRAP, 2016)
Approved Re-use Centres – FRN enterprises	UK	FRN	Standard	All re-use products		Only non-profit organisations	(FRN, n.d.)
ICT Asset Recovery Standard	Int.	ADISA	Standard	Re-use IT-products	Data eradication, sanitation		(ADISA, 2017)
Code of good practice for the re-use of (W)EEE	Belgium, Flanders	OVAM	Guideline	8 product categories of EEE	Product quality, safety, environmental performance		(OVAM, 2012)
Revisie (Since 2017 “Devices with guarantee”)	Belgium Flanders	KOMOSIE	Product label	Re-use of EEE	Product quality and safety	Based on the the code of good practice for re-use of (W)EEE	(De Kringwinkel, n.d.-a, 2010 n.d.-b) (Pauwels, Revisie)
Reuse-Computer e.V.	Germany (Berlin area)	Re-use-Computer e.V.	Standard scheme and quality label	Re-use of ICT	Product quality		(ReUse-Computer e.V., 2004)
Revolve	Scotland	Zero Waste Scotland	Standard Shop label	All re-use products	Product quality, safety, customer service	Re-use quality standard for shops	(Zero Waste Scotland, n.d.-b, n.d.-c, n.d.-d)
Envie Garantie	France	Envie Roanne	Brand/label	Re-use EEE, mainly domestic appliances			(Envie Roanne, n.d.)

Initiative	Application Area	Governing Organisation	Type of initiative	Scope	Overall Aim	Other comments	Reference
ReVital	Austria (Upper part of the country)	OÖ Landesabfallverband	Brand/label	Several product group except cloths	Product quality, satfty. customer service	Only non-profit organisations	(OÖ Landesabfallverband, 2011)
Canadian Electronics Re-use and Refurbishing Standard (ERRS)	Canada	EPRA	Standard	Re-use Refurbishing of EEE	Product quality		(EPRA, 2016a, 2016b)
The e-Stewards Standard for Responsible Recycling and Re-use of Electronic Equipment	Int.	BAN	Standard	Recycling and re-use of electronic equipment.	Responsible recycling	Supported by and developed on initiative of the US EPA	(Basel Action Network, 2013)
The Responsible Recycling ("R2") Standard for Electronics Recyclers	Int.	SERI	Standard	Recycling and re-use of electronic equipment.	Responsible recycling		(SERI, 2013)
Guideline on Environmentally Sound Testing, Refurbishment & Re-pair of Used Computing Equipment	Int.	PACE Working Group	Guideline	Re-use of Computing equipment	Environmentally sound re-use	Supported by UNEP, BASEL	(PACE Working Group, 2011)

3.2.1 European Standards

In the WEEE directive (2012/19/EU) European Standardization Organisations are requested to develop European standards (ENs) for the collection, logistics and treatment, including recovery, recycling and preparing for re-use, of WEEE. The processes of developing these standards is currently undertaken by the European Committee for Electrotechnical Standardization CENELEC, a European standardization organisation (in 't Groen et al., 2017). These standards will replace the currently available WEEELABEX standards (described below) and is expected to become available during 2017(in 't Groen et al., 2017).

WEEELABEX is a project governed by the WEEE Forum, a European non-profit association with members from a large number of European WEEE collection and recovery organisations (WEEE Forum, 2013a). The project gains financial support of the LIFE programme of the European Community (WEEE Forum, 2013a). The standard consists of a set of three different standards on collection, logistics and treatment. The standard of most interest to this study is the one on treatment that includes a section on "preparing for re-use" (WEEE Forum, 2013b). These standards will be replaced by the European standards and are therefore not described in further detail.

There are also several national or regional standard initiatives going on around Europe. Several of these will be described in detail in the next chapter section 3.3.

3.2.2 Standards Specific for IT Equipment

The *ReUse-Computer eingetragener Verein (e.V.)* is a non-profit regional society based in Berlin, Germany, whose objective is to ‘...make it possible for the general public to use high-quality used computers and IT-technology at affordable prices and at the same time promote the ReUse idea.’ Among the 21 network participants there are three refurbishes and four retailers (Dietrich et al., 2014). It started in 2001 as a project founded the German Ministry of Education and Research (ReUse-Computer e.V., n.d.) but has also been a part of the EU founded ZeroWIN project between 2009-2014 (Dietrich et al., 2014). After a product had undergone the test and procedures based on the quality criteria it can be marked with the ReUse logo (ReUse-Computer e.V., 2004).

The ICT Asset Recovery Standard is owned by the Asset Disposal and Information Security Alliance (ADISA), and is focusing exclusively on IT equipment retirement (ADISA, 2017). The standard and certification scheme used to be available only in the UK but it has continued to grow and now the application area is international (ADISA, 2013, 2017). Today around 40 companies are certified, most of them based in Europe or more specifically in the UK (ADISA, n.d.). Data eradication, sanitation and security are the core elements of the standard but it includes sections on business credentials, logistics and waste management. Even special sections for on-site services, such as data eradication on-site at the clients, and leasing service (ADISA, 2017). There are criteria on that the products should be tested for functionality but no details on how the testing process should look like (ADISA, 2017). There is a strict certification process for all ADISA members and the audits performed by the ADISA audit review team. After the initial certification process all companies are audited at least two times per year. The members are issued their own certification logo that they can use on their website to market their compliance with the standard (ADISA, 2017).

Guideline on Environmentally Sound Testing, Refurbishment & Re-pair of Used Computing Equipment was developed with support from UNEP and BASEL (PACE Working Group, 2011). The aim is to promote re-use of computing equipment through environmentally sound re-use processes and management of discarded equipment. This guideline does specify some functionality tests that should be performed on certain components of computing equipment (PACE Working Group, 2011).

3.2.3 North American Standards

The Canadian *Electronics Reuse and Refurbishing Standard*, ERRS (EPRA, 2016b), is one part of the *Electronics Re-use and Refurbishing Program*, ERRP (EPRA, 2016a). The program and the standard is approved by the Canadian government and governed by the non-profit industry-led organisation Electronic Products Recycling Association, EPRA). The standard contains basic requirements on product functionality, a 30-day warranty and verified destruction of data (EPRA, 2016b). Audits are performed by the Recycler Qualification Office which operates under EPRA (2016a). There is no label to be use by organisations to promote being approved under the standard (EPRA, 2016a).

The *e-Stewards Standard for Responsible Recycling and Re-use of Electronic Equipment* (hereafter the e-Stewards Standard) was launched in 2009 by the Basel Action Network, BAN (2013). The standard is to be used in an accredited third party audited certification program and fully incorporates the requirements of the environmental management systems standard ISO 14001(Basel Action Network, 2013). The standard has specific requirements on the organisations management of: occupational health and safety, fair labour practises, Data security, environmental criteria and conformity with international laws (Basel Action Network, 2013). Currently around 1500 organisations are certified internationally with a majority located in the US. Only around 80 of these are engaged in refurbishing (e-Stewards, n.d.).

The *Responsible Recycling ("R2") Standard for Electronics Recyclers* (SERI, 2013) is another third party certification scheme with similarities to the e-Stewards Standard. Today around 700 recyclers are certified internationally and a majority of these are located in North America (SERI, n.d.).

3.3 Detailed Description of Four Initiatives

This section provides the result from the detailed study of four selected initiatives. The analysis of the criteria on product quality included in the different initiatives are presented in table 4. All initiatives require a visual inspection, electrical safety test and functionality test. Only two initiatives, Revolve and PAS 141 have specifications of test for different product categories, such as functionality testing of certain components. Most initiatives require data eradication, warranty and a licensed operative system. After the table follows a description of each selected initiative based on document analysis and interviews.

Table 4. Product quality criteria included in the initiatives

The main quality criteria for EEE included in the initiatives. Green areas = criteria are included and Orange areas = not included.

Initiative	Visual inspection	Electrical safety test	Data eradication	Full functionality	Specific product category tests	Cleaning	Licensed operative system	Transport requirements	Segregation of product flows	Product label	Warranty	Certification/audit process	References
PAS 141											28 days	3 rd party	(BSI, 2011)
Revisie/ devices with guarantee											12 months	2 nd party	(OVAM, 2012)
Revolve												3 rd /2 nd party	(Zero Waste Scotland, n.d.-b, n.d.-c)
ReVital											6 months	2 nd party	(KERP, 2009)

3.3.1 PAS 141

PAS 141, is still available as a process management specification for operations in the sector of re-use of WEEE (BSI, 2011). The former certification scheme was launched in 2013 and ceased to exist in 2016 (WRAP, 2016; PAS 141). The standard was initiated in 2011 after being developed on commission by the Department for Business, Innovation and skills (BIS, former UK governmental department) together with industry and the government under BIS (BSI, 2011). The industry wanted a standard by which re-use operators could differentiate themselves from less legitimate operators and to make consumers confident that they buy a re-used item that is repaired to a good standard (PAS 141). An industry expert argues that the specification is making sure that all the right systems are in place e. g. traceability of items and data eradication (PAS 141). For more details on included criteria see table 4. WRAP’s Re-use Protocols for Electrical Products were intended for use within the PAS 141 framework (WRAP, 2016). WRAP provide protocols for 15 product categories such as Desktop and Laptops, ICT

Equipment, Mobile phones, tablet computers and Televisions. All protocols set out the minimum tests for the EEE to be considered fit for re-use (WRAP, 2016).

The PAS 141 certification scheme was a third-party certification scheme and the certification bodies, the companies who wanted to audit re-use companies to PAS 141, had to be accredited by UKAS, United Kingdom Accreditation Service (WRAP, 2016). The way in which the scheme was organised made it very onerous for the re-use companies to get certified (PAS 141). As the certification bodies had to undergo a quite time-consuming and costly process to get accredited PAS 141 certifiers this cost had to be passed on to the re-use companies to which the certification bodies sold their services (PAS 141). According to the anonymous industry expert, this made the cost of getting certified quite prohibitive for many companies and only a few did get certified. As the scheme was voluntary there were no legislation to push the companies to get certified and as it never got a wide recognition they did not experience having any business advantages by the commitment (PAS 141).

When PAS 141 were set up there were discussions on making the re-use organisations pay for a badge that they were going to put on every item they sell and then they would pay a small amount for each label (PAS 141).

To create a wider recognition of the PAS 141 the steering group and the administration tried to engage with public procurement. Presentations were made at several events to encourage local authorities to request PAS 141 when procuring re-used items. Unfortunately, this did not generate the desired effect, probably due to the agencies' priorities and the fact that re-use equipment in general is such a small part of the overall procurement; therefore, procuring agencies has other priorities (PAS 141). The industry expert think that procurement is one of the key mechanisms for the success of a similar scheme elsewhere (PAS 141).

3.3.2 Code of Good Practice for the Re-use of (W)EEE / Revisie

The Code of good practice for re-use of (W)EEE (OVAM, 2012) is since 2017 a regional legislation in Flanders, Belgium (Pauwels, Revisie). All organisations preparing electronic and electrical products for re-use now must conform with the Code of good practice (Revisie). OVAM, responsible for the initiative, is the public waste agency of Flanders.

The former label Revisie, started in 1999, were only used in a project governed by KOMOSIE (a network organisation for environmental entrepreneurs in the social economy) at a few of the 'De Kringwinkel' shops. De Kringwinkel (n.d.-b) is a non-profit organisation in the social labour market with more than 100 second hand shops in Flanders. The overall quality management approach is based on the European foundation for quality management (EFQM) model

(Premm, 2012). The product quality criteria used in the Revisie project (De Kringwinkel, n.d.-a) are now incorporated in the Code of good practice (OVAM, 2012) and a new label called ‘devices with guarantee’ has replaced the old label (Revisie). A sticker is placed on the products and some information material is also given to the buyer when larger EEE items are bought. The label is targeting private consumers.

The project was initiated as the members of KOMOSIE needed a larger inflow of products and Recupel (partner responsible for collection), governed by OVAM, gave them access to products collected at recycling centres under the permission that they provided a quality label on electrical devices (Revisie).

The ‘De Kringwinkel’ shops sell almost no IT due to expensive software licenses (a requirement in the Code of good practice) and the lack of skills required to do the repairs among the workers, as they are part of the social labour market (Revisie). Audits at ‘De Kringwinkel’ are performed by KOMOSIE and by the government, OVAM, every fourth year. Exactly how the audits of all re-use organisations are going to be structured, after the legal obligation entered force, is not yet decided (Revisie).

3.3.3 Revolve

Revolve is a Scottish national re-use quality standard available for shops in Scotland who sell second hand goods (Zero Waste Scotland, n.d.-d). The standard was developed by Zero Waste Scotland together with the Community Recycling Network Scotland, a membership body for community organisations managing waste resources at a local level (Scottish Government, 2016). The standard is in the last two years governed by the organisation Zero Waste Scotland, earlier governance was done by the Community Recycling Network Scotland (Revolve). Zero Waste Scotland is funded by the Scottish government and the EU Regional Development Fund (Zero Waste Scotland, n.d.-e). All organisations engaged in re-use based in Scotland can be accepted for accreditation. Earlier only community based third-sector organisations were accepted but now also bigger charities and the private sector organisations are accepted (Revolve). Currently 96 organisations are certified (Zero Waste Scotland, n.d.-a).

The main market need to be addressed by the standard was to give confidence to consumers to buy second hand both to general public and to local authorities doing procurement (Revolve).

The standard is designed to be a sign of quality, reliability and professionalism. Apart from criteria on how to prepare goods, the shops are tested on customer care and shop layout (Zero Waste Scotland, n.d.-b). The accreditation process consists of two main stages, (the total process consists of four stages), the ‘Entry stage’ and ‘Quality Improvement stage’ (Zero Waste

Scotland, n.d.-c). The 'entry stage' aims to check that the organisations are legally compliant and have assessed all risks. It consists of 64 standards including trading, health and safety, product safety, employment, and waste management (Revolve). The assessment is done by support officers within the Revolve team (Revolve).

The 'quality improvement stage' aims at creating a culture of professionalism and continuous improvement and takes about six months. To achieve the Revolve accreditation an organisation must achieve the EFQM 'Committed to Excellence' award and participate in the Revolve retail programme, including passing the revolve retail audit (Zero Waste Scotland, n.d.-c). The EFQM is externally validated by Quality Scotland and is a third-party certification. The retail program and audit is also provided by an external contractor (Revolve).

The revolve project has developed their own 'preparing for re-use' standard, which is based on trading standards. This include organisations meeting the legal obligations in terms of trading standards such as all goods must be checked, safe, and set for purpose. For electronic equipment, the WRAP product protocols (WRAP, 2016) are used as baseline with some of their own supplements (Revolve).

Inspiration were taken from the Revisie project (section 3.3.2) in Flanders and Zero Waste Scotland are putting a lot of work into marketing the standard to get a wide recognition, something done efficiently in Flanders (Revolve). Another current development of the standard a 'code of good practise' for the collection of goods (Revolve). Revolve currently receive a lot of questions regarding the system from states and organisations around Europe (Revolve).

The initiative is linked to public procurement as a few local authorities are asking for revolve certification or 'an equivalent standard' when buying re-use furniture for social housing (Revolve).

3.3.4 ReVital

The ReVital project is a regional network, product label and retail shop label. The network consists of drop off centres, processing plant and outlets (OÖ Landesabfallverband, 2011). The label is owned by the waste management association of Upper Austria, (OÖ Landesabfallverband) who is also responsible for the project management (ReVital). The project was initiated in 2009 after visiting the Revisie project (see description in section 3.3.2). Apart from electrical appliances also furniture as well as sports and leisure equipment are collected and sold under the label (ReVital) License to operate under the ReVital label is given to the shops and repair partners who must comply with certain quality standards and pay a license fee of 4 € cents per kilogram of products. The intention with the

project was to create a network but there are two additional main aims to the project, the first one is to avoid waste generation and the second is job creation for long time unemployed.

The products sold under the label must meet certain simple quality standards such as being 'attractive in appearance' and 'complete and undamaged' (OÖ Landesabfallverband, 2011). Electrical appliances are also tested for functionality and electrical safety based on the guidelines on re-use of EEE from KERP (2009) (OÖ Landesabfallverband, 2011). No standardised audits are performed although the OÖ Landesabfallverband can visit the shops and repair partners and control them whenever they want. So-called 'ReVital reviews', meetings exchange of information and discussions around development with all network partners (ReVital).

The label is an important instrument to create a demand for re-used products because it guarantees the products' quality (ReVital). The label is not used in procurement and it is primarily aiming at targeting private customers (ReVital).

When the project started in 2009 there were only six shops and ten waste collection centres and today there are 19 shops and 104 waste collection centres. The partners report amounts, kilograms, of sold products. In 2009, it was around 40 tons and in 2016 around 980 tons (ReVital).

3.4 Possible Organisation of a Certification Scheme for Re-use of IT in Sweden

This section includes the results generated from interviews with Swedish stakeholders in the IT-sector. As mentioned above interviews with Swedish stakeholders were conducted to obtain their views on how a more comprehensive certification scheme for electronics might be designed to be suitable for this specific context and to get a picture of their attitudes towards re-use. The interviews were transcribed and key words were selected. The key words were clustered under the same themes as the interview results below. The selected themes are; 'The interviewed stakeholders and their engagement in re-use', 'Need and demand', 'Possibilities with existing labelling schemes', 'Scope and criteria of a new labelling scheme for re-use', 'Organisation of a new label' and 'Funding and contribution from the public sectors'.

3.4.1 The Interviewed Stakeholders and Their Current Engagement in Re-use

INREGO is Sweden's largest company engaged in selling re-used IT equipment. INREGO buy used ICT from organisations and businesses as these are of higher quality than used products from private consumers. The products are sorted and reconditioned at INREGO's facility. Products not suitable for re-use are recycled by an external partner. IT-products are primarily sold via their online-store. INREGO also perform data eradication and hard-ware services and sell their products with a warranty (INREGO).

TCO development is the owner and governing organisation of the international IT-product sustainability labelling scheme TCO Certified. TCO is a Swedish organisation. TCO development call the label a sustainability certification as it covers environmental, social and economic aspects in the entire lifecycle, production, use phase and the end of life management. It is an ISO type I certification that currently only certifies new products (TCO development).

Atea is Northern Europe's leading provider of IT-infrastructure. Atea has a concept called 'goitloop' which today consist of them taking back used products from their customers in locked cabinets, performing data eradication and selling them on to other companies (e.g. INREGO) that the prepare them for re-use and sell them to a new customer or recycle the material.

HP is a multinational OEM of IT products. HP engages in the re-use sector with their own refurbish and re-use centre in Scotland. In the centre, former leasing products and to some extent also other products are refurbished and a large majority of them are sold to new users. The products are predominantly laptops, desktops and servers. The second-hand market for printers is on the other hand less developed (HP). On the Swedish market the company also cooperate with INREGO when customers are requesting re-use of their former items within the country borders (HP). The company has a specialised truck in which data eradication can be performed on-site at the customers (HP).

The public procurers are Stockholm läns landsting (SLL), a Swedish regional authority and two local municipalities Stockholm city and Gothenburg city. The next and following sections summarises the stakeholders' perceptions of the 'need and demand' of a more comprehensive sustainability labelling scheme for EEE with focus on IT.

3.4.2 Need and Demand

Eco-labelling and sustainability labelling of new IT-products

Hewlett-Packard (HP) is, as a global OEM of IT-equipment, exposed by around 70 different eco-labels and apply for about 20 of those labels. They experience

this situation as cost-inefficient as they sometimes apply for three to four labels for a single product due to the special demand of different labelling schemes in different countries. In Europe HP monitor four eco-labelling schemes EU ecolabel, German blue angel, Nordic swan and TCO Certified. HP states that the success of the labels changes over time. Currently, HP experience that for printers the Blue Angel is market leading. The Nordic Swan are only certifying a few printers but no computers. The EU ecolabel has, according to HP no licenses, due to their strict chemical restrictions. The company used to participate in the discussions, regarding the labelling scheme at EU level, but experience it as an onerous decision making process where the input from industry is not properly considered. The label TCO Certified is since many years market leading on certifications of displays and since a few years also computers, primarily laptops. *'TCO currently has the toughest environmental criteria, primarily because they include both social requirements and conflict minerals'* [HP]. Harmonising of these eco-labels has, according to HP, been on the agenda for a long time but have not been put into practice to the extent he would prefer. In some cases, the certification process has been somewhat simplified but the companies still must pay the full license fee for all labels (HP). TCO development have decided to continue to market their label, TCO Certified, as a sustainability label covering all three aspect of sustainability and explain that:

'It is a challenge to cover all the core aspects of sustainability (environmental, social and economic) but that is necessary to be able to say that you have made a more sustainable procurement.' [TCO development]

The biggest challenge has been to incorporate in the label is the social conditions in the production. Even so, TCO development is confident that *'The broad aspect of sustainability is something that we will keep in the future'* adding *'One important target for us in the future is to reduce recycling and increase re-use.'* [TCO development].

TCO development describe that it is primarily business products that is certified and the price of the certified products are often in the same range as the non-certified product of the same quality. TCO development would prefer more purchasers requiring certified products as it gives them the opportunity to push the brands harder to make preferable changes in design and management. TCO development states that there are several explanations to why purchasers do not require a certification:

‘Some purchasers are worried to set tough requirements as they may then get less products to choose between. Other purchasers have decided that they want a certain product and if it is not certified then they don’t want to require that [i.e. certification].’ [TCO development]

HP experience an increasing number of procurements are requiring eco-labelled products, or equivalent standards, since the launch of the new procurement directive. A move towards procurement criteria on the supply chain is also apparent:

‘Social requirements, working conditions, account for audit results and such matters are discussed more often with mainly larger customers. Both the public sector but also the private sector’ [HP]

Furthermore, HP add: *‘What we also see and what we actually try to make customers demand is that the products have increased durability’ [HP]*; this partly includes criteria in the American military standard MIL810G. (HP). A description of the stakeholders’ perception of the future of re-used products will now follow.

Future of Re-use

There is a consensus among the stakeholders in the private sector that the market for re-use of IT-products is on a developing stage and that the future is looking bright. HP emphasise that even though some people believe that leasing is a new concept of the circular economy it has been used within the sector for over 30 years. Regarding the possibility of the future of re-use of IT-products in Sweden and the companies own involvement HP state;

‘There is no doubt that when society changes and customers’ demand changes, it is obvious that we provide and will provide it [re-used products]. It will increase in the future, I’m very sure about it.’ [HP]

Atea express that due to the success of their service goitloop they are considering the possibilities of further development of this service and possibly also regarding selling re-used equipment themselves (Atea). *‘We monitor this area (trade with re-used and remanufactured equipment) with interest because we want to see where this is going, and we believe that this can be quite big’ [Atea]*. Atea think that shortly they themselves and other similar companies will be requested to offer delivery of both new second-hand IT-equipment from the same company (Atea).

TCO development think that in the future it will be important is to reduce recycling of materials in IT-products and increase re-use. At the same time the organisation experience that very few customers realise that buying re-used IT is

an option (TCO development). This is verified by INREGO as most of their customers are surprised that buying re-used items can be an option worth consideration.

Consumer Attitudes Towards Re-use

HP highlight the importance of behavioural science when looking at possible ways to increase re-use of products. HP argue that perceptions, attitudes and behavioural change is the biggest challenge. Customers do not consider buying a re-used mobile phone as the marketing of new goods are very efficient with new features and functions. Therefore, according to HP, behavioural science is important as the fundamental question is around the change of perceptions and attitudes. INREGO argues that:

‘there is an embedded attitude towards re-used products, that they are of lesser quality, even though we can, with our tests show that not true we have a huge problem communicating that’ [INREGO]

On the other hand, the company have never been asked by any purchaser for a label of quality (INREGO). The general reaction from INREGO’s customers is instead that they are surprised about the possibility to buy reconditioned IT.

The public procurers all recognise the environmental benefit of buying re-used items although none of them currently procure re-used IT. On the other hand, they do all request the suppliers of new equipment to provide collection of their used products for re-use or material recycling (SLL; Stockholm; Gothenburg). Stockholm are in the middle of a large procurement of IT and will begin leasing their products and all the collection arrangements of used products will be handled by the supplier (Stockholm). Both Stockholm and SLL highlights that the big volumes of IT equipment used within their organisations as a barrier for them to procure reconditioned IT. Another related problem is that large quantities of equipment needs to be supplied by the contractor within short notice (Stockholm).

Gothenburg argues that when considering procurement of re-used products in general it is more difficult to ensure traceability of products, energy consumption and labelling. This can create some conflicts within the agreement and it must be considered what is most beneficial. Therefore, it would be difficult to procure both re-used and new products in the same agreement. One possibility might be to do separate procurements of new and reconditioned IT-equipment (Gothenburg). This might actualise another problem as *‘...people are inclined to really want a brand-new product in their hand’ [Gothenburg]*. Continuing:

‘In the end, what we most often struggle with is that those who order products know what they want and if this is not available, they get dissatisfied. So, we must have clear directions from the municipality that we only should have a certain type of product’ [Gothenburg]

SLL emphasises two characteristics of re-used IT as the most important. Firstly, the age of the products and secondly, the uniqueness of the products. According to SLL, their enterprise platform requires strictly controlled components and identical products. SLL believes other that larges organisations and platforms has similar requirements.

Stakeholder Attitudes Towards Developing a Label

INREGO experience that organisations often needs to buy from them before they realise that the products are as good as new and this is where a quality label would be useful and make the communication easier (INREGO). INREGO argues that:

‘The labelling is needed primarily to ensure buyers of the quality of used products; that the product will work properly, i.e. it is ‘inspected’ [INREGO]

Further, INREGO highlights the importance of an independent standard as the foundation of the label in difference to them making a self-claim. TCO development also argues that currently the problem is the many customers don’t know that buying re-use is an option. Thus, TCO development concludes that there is no demand for a re-use quality label or eco-label.

Atea also believes the market of re-used IT would benefit from an independent standard or label. One reason is that the Swedish procurement agency (Upphandlingsmyndigheten) 2015 encouraged all Swedish authorities to start to partly procure re-used IT equipment but a barrier is that there are no criteria or labels to use in the procurement (Atea).

HP does not see any risks of harming the consumers’ confidence in HP as a brand due to other companies selling re-used items of low quality originally manufactured by HP. According to HP, the companies refurbishing or reconditioning the products have secured processes and gives warranty on the quality to the new customer. At the same time, HP adds, there is always a risk that certain companies are unserious. Furthermore, HP, is very sceptical to creating a new label for re-used IT equipment as the company believes that the industry does not want another label because they are already exposed to many (HP). HP admits that this question can be important to HP as an OEM when regarding product safety. Should there be an electrical error in a product, and someone would get harmed, the initial contact would probably be made to de OEM and not the re-use

organisation. The risk of this is still low as there are electrical safety standards and the re-use companies are currently primarily doing low Wast improvements which are less risky (HP).

The public procurers are all positive towards introducing a quality label of re-used IT equipment. The representative from Stockholm answering if she is experiencing a need for such a label:

'... even if it does not help us in my workplace, because we need so many computers and mobiles, I would as a private person appreciate a quality label on used IT equipment.' [Stockholm]

SLL argues that this must be of interest to smaller organisations and enterprises. Gothenburg says that a label would make it easier to procure re-used products as the label can be used as something to refer to in the procurement criteria.

3.4.3 Possibilities with Existing Labelling Schemes

According to TCO development there are two ways to encourage re-use through eco-labelling. The first way is to try to develop criteria that make the product work as well as possible from the start, such as a battery with long lifespan and the ergonomics of the product. It is a way to work with the problem that products are replaced so often. The second way is to include criteria to make sure that when we want to replace the products they can be re-used by someone else. TCO development describe that they have been working mostly with the first approach; though they have also adopted elements of the second approach as their certification require manufacturers to provide spare parts and warranties on the products.

HP encourage labelling schemes to include criteria from the military standard on durability, MIL810G. At the same time, HP believes one disadvantage of environmental labelling schemes are that as soon as they sit on the product, few customers are engaged enough to find out what requirements are included and therefore governing organisations of labelling schemes should better communicate the included requirements.

TCO development can put criteria in their certification on solutions that are available on the market and thus encourage more companies to use them. The aim is that 30 % of the industry shall be able to comply with the criteria in TCO Certified.

‘Regarding re-use there are a lot of good ideas of how it would be possible to create circularity for IT-products but a lot of those ideas are not being used. These ideas have never been tested in reality, and then we cannot require them in our certification.’ [TCO development]

TCO development have done investigations on whether it is possible to include requirements in their existing certification that would facilitate and encourage re-use. They also looked at whether it is possible to quality assure different recycling flows so that, for example, the products do not end up in landfill in other parts of the world after re-use and are still covered by the WEEE-directive. The conclusions according to TCO development:

‘Our conclusion was that it is possible to develop a quality assurance for the sourcing of reused IT-products but that it is difficult to find a way to finance it. Instead we focus on creating incitements for reuse within our existing certification: TCO Certified.’ [TCO development]

However, there are other possibilities with their existing label *‘...many of the products that are being re-used could be TCO Certified. If the product has not been modified but only repaired it could still keep its certification.’* [TCO development]. Although INREGO describes that a long time ago they could tell their customers that a screen was TCO-certified and that explained something. Today, almost all screens are certified and therefore it is not important to their business process nor to their customers (INREGO).

TCO development include quality criteria in their current certification. Especially on displays i.e. visual ergonomics such as resolution, luminance and contrast. This do not cover the entire quality of a computer or phone although an important part (TCO development).

Remanufactured products could, if put together by components from different used products into an entirely new product, according to TCO development, be certified with the existing TCO Certified. Although this require marketing them as new model under a new name.

3.4.4 Scope and Criteria of a New Labelling Scheme for Re-use

Different Parts of the Reverse Logistics

INREGO consider a quality label to be most efficient on the sales of their products. At the same time, INREGO explains that their biggest challenge concerns the steady supply of used products to recondition:

‘We have staff employed to promote us buying things from them [i.e. potential client organisations] and this is our biggest challenge...all similar companies have the same product supply problems’ [INREGO]

Even so, INREGO doesn’t comprehend how a quality label would help solving this problem. Atea is currently only engaged in the business of collecting used IT equipment, on the other hand see a relevance in including also the collection aspects in a labelling scheme. Today the collection aspects are usually regulated in the in the agreement with the customer organisation but Atea believes that some certification on handling of items, including both those fit for re-use as well as those destructed and recycled, could simplify for customers as well as the companies. Atea are reflecting on if the different parts of the process can be included in one label or if it would be favourable to divide them. As Atea engages in the collection of items and data eradication their main interest is in these parts, while other stakeholders are engaged in the sales of re-used IT. Even so, a label might consider all these different parts (Atea).

SLL believes that there might be benefits from a standard or labelling scheme targeting the management of the collection of items. Currently, they have developed a ‘code of conduct for supplier’, including requirements on human rights and labour law, which they use in all procurements. Although, they conclude, a label is often making the procurement process easier.

Quality, Environmental and Social Aspects

Both representatives from Atea agrees that a labelling scheme for re-use IT would benefit from including criteria regarding quality aspects but also environmental and social aspects. Atea highlights the environmental and social aspects as very important as these are aspects their customers ask for. Atea emphasises that quality aspects are of particular interest when discussing remanufactured products and not just reconditioned or refurbished products as the former involves putting in entirely new components. Atea believes that by including environmental and social aspects the labelling scheme gains more credibility *‘One disadvantage could be that the labelling becomes more complex to handle, more complex to put together and more complex to follow up’* [Atea].

INREGO does not experience a need to include criteria aiming at stopping environmentally hazardous products from the market as the company argue that mobile phones and computers are such standardised products. INREGO experience a need to better communicate the environmental benefits of the re-used product. Even so this need was more acute a few years back when the knowledge among the public was limited. Now INREGO experiences that this knowledge has improved. *‘So maybe it’s not as important today to [eco-]label used products as [environmentally] better because people are aware of that’* [INREGO]. INREGO has previously been in contact with the Nordic Swan

regarding certifying their product with that eco-label, but they found it very difficult to certify a re-used product with regard to environmental performance.

Social aspects, on the other hand, when regarding IT in general often includes production in different parts of the world and conditions for the workers which, concludes INREGO, is far from their business. TCO development says that if social aspects were to be considered in a labelling scheme for re-used items an important question to is whether to look at the original production or the preparation for re-use process or maybe both. Conflict minerals is also a social question very difficult for INREGO to engage in as it's almost impossible for OEMs to keep track on (INREGO). INREGO explains that questions on the export of electrical waste are of interest to the customers that sells their equipment to them but not for the customers buying re-used items. SLL is of a different opinion:

'...the most important thing for us when we sell, and this should also apply to the buyer, is that this supplier has a responsible handling system for the equipment at all stages, even for things being discarded' [SLL]

Detailed Criteria

If considering remanufactured products, the components and the performance of components are important parts of a label according to Atea. As remanufactured products often consist of a new memory, hard drive or battery. Atea, emphasizes that these new components need to be quality checked and information must be given to the customers so that they confident in what they are buying. SLL also highlights the importance of information on components to customers.

Atea further argues that cosmetic aspects of products are of importance even though it's a challenge were to set the standards, i.e. how many scratches can be accepted. Another important dimension is the social aspect such as working conditions at the facilities were the products are remanufactured, especially if this is done in other parts of the world (Atea).

INREGO would prefer a label including criteria on: all vital parts should be tested for functionality, warranty, offering of service on the hardware and licensed operative system. The data eradication is only interesting to the seller and not to the buyer. *'The data eradication is not really interesting to the buyer, rather it (i.e. the product) shall just be ready to use'* [INREGO]. Gothenburg) highlights the importance of re-use companies selling IT to provide warranty on their products.

3.4.5 Organisation of a New Label

Product, Process or Company

Atea think that the label or standard should be specific for the IT-market to be able to generate a desired effect. To have a solution for all WEEE products they regard too general. INREGO agrees on that the label must be specific and include criteria on which processes the products need to undergo. At the same time, he argues that the label needs to cover as many products as possible as consideration should be taken to the dispersal and recognition of the label. The representatives from both companies would prefer a product labelling scheme for products rather than a certification scheme for companies (INREGO; Atea). However, INREGO is certain that such a scheme would be too ambitious as this would require a standard for each product or product category. Therefore, INREGO argues that a scheme on company level should be considered. Though certifying the test processes at the company a label can be placed on the individual products.

‘So realistically, it would be preferable that this company use this specified test process on their product, and thus you could put some kind of label on a computer’ [INREGO].

Atea describes another possible solution ‘*I can see that there may be different criteria for different product groups, but the requirement specification needs to be quite detailed*’ [ATEA].

INREGO and Atea also mention that ISO-certifications such as 14001 and 9001 do not cover the same need as a labelling scheme would. INREGO explains that these are standards of management systems with criteria too general to be a guarantee of the products. Furthermore, only large companies and authorities consider these in their procurement, no small companies or private consumers (INREGO). Atea also states: ‘*I believe that it is difficult to find a labelling that is too general, i.e. that can be applicable to all types of product groups*’. The products they consider as in scope are high-end quality products (Atea).

The biggest challenge with certifying re-use products, according to TCO development, is that it impossible to guarantee that all products are identical. When certifying new products, TCO development can take a random sample of a batch of products a test the sample and conclude whether it comply with the standards in their certification. In a batch of re-used equipment, regardless of the refurbishing or reconditioning process its undergone, every item will always have been used in a different way making it unique (TCO development).

Governing Organisation and Certification Process

It’s important that the governing organisation of a labelling scheme of re-used products is well recognised and has experience of certification processes, TCO

development might be a possibility according to INREGO. TCO development are not excluding that possibility however, emphasise that there must be a demand from customers. Atea states that some organisation consisting of both private and public organisations would be preferable. They emphasise the need of industry and procurers to be able to part of the development of the standard or label (Atea).

The representatives from Atea have limited knowledge about certification processes but believe that whether a third-party certification is needed to create sufficient credibility, will depend on how the governing organisation is set up. INREGO suggests that the label should be based on a standard and audits shall take place maybe once a year. This is important he argues for the credibility of the label.

‘It is difficult enough to capture what is currently good quality but it would also be interesting to find a possibility to raise the requirements over time. Both regarding each individual certified company, and regarding the actual standard’ [INREGO]

3.4.6 Funding and Contribution from the Public Sector

It should be considered if the cost of getting this certification shall be based on the size of the certified company or the number of products it sells to avoid small companies having to pay large initial costs (INREGO). If considering the re-use sector of IT-products in Sweden the number of companies possibly interested in a certification are limited to about five companies, too few to finance the scheme themselves. Thus, INREGO concludes that:

‘The public system needs to finance the certification scheme, or at least subsidize it. The recycling industry today consists of many small organisations with limited financial resources and cannot themselves finance such a system, as is usually in the case of e.g. the ISO- or TCO-certifications.’ [INREGO]

Atea argues that the industry and the public sector needs to engage in this together and thereby creating a demand for the label. When launched, a strong marketing of the label both towards the re-use companies and the customers is crucial according to INREGO. Atea list funding, coordination, active participation in the governing organization and procurement as important aspects for the public sector.

The first important step for public authorities, according to TCO development, is to engage in the collection of items for re-use rather than

recycling and making sure that recycling is done in an environmentally and socially acceptable way.

Regarding the Swedish Government Official Report (SOU 2017:22) INREGO regards it as positive that it's a suggestion among many others although he would have liked to know more about the details on how they would like it should be designed.

Discussion

The aim of this study is to evaluate if a more comprehensive sustainability certification scheme for electronic products - development of current certification schemes or establishment of new schemes, could be a way to better communicate the benefits of re-used electronic products. The focus is on the re-use of IT-equipment in a Swedish context. This section will start with a short discussion on the existing initiatives, research question one and two, then a more extensive discussion will follow regarding the application to the Swedish context, research question number three.

4.1 Identification of initiatives

The first part of this study, after the initial literature review, was aiming to identify existing initiatives intending to increase re-use of products such as standards or certification schemes. The generated information was used to select initiatives subject to a more detailed analysis in the subsequent part of the study.

Several existing initiatives aiming at increasing the re-use, repair and remanufacturing of electronic products in Europe and North America were identified. The initiatives differ greatly regarding several aspects. The first aspect is the type of initiative; some initiatives are standards, guidelines (e.g. PACE Working Group (2011)) and others are re-use networks (e.g. ReUse-Computer e.V. (2012)).

The second aspect is scope; some are specific for re-use of IT (e.g. The ICT Asset Recovery Standard (ADISA, 2017)), others cover re-use of EEE (e.g. ERRS (EPRA, 2016b)) or general re-use of many product types (e.g. Revolve). Some initiatives are focusing on responsible recycling of WEEE, e. g. e-Stewards and R2, rather than 'preparing for re-use' operations. Additional aspects of difference are geographical application area (e.g. compare e-steward, international, and Reuse-Computer e.V., Berlin area) and recognition (from just a few companies to several hundred or over a thousand). Trading standards and legislation such as WEEE-directive (e.g. WEEELABEX, EN 50614 Preparing for re-use) and the Basel convention are often the basis (e-stewards). Some integrate (e-stewards) or require environmental management systems (R2).

4.2 Lessons from a selection of initiatives

One first lesson, highlighted in all analysed initiatives is the importance of marketing. Wide recognition of a label or brand among customers is crucial to generate an increased demand for re-use. The 'De Kringwinkel' shops using the Revisie label and ReVital are especially good examples of this as emphasised by the interviewees. Both ReVital and Revolve used the 'De Kringwinkel' shops, as a source of inspiration in marketing management. Regarding PAS 141, the anonymous industry expert state that both marketing towards customers buying re-used EEE and the re-use organisations applying for the certification are of importance to the success of similar initiatives.

A second lesson, closely linked to marketing, is the importance of networks. Dietrich et al. (2014) discuss the importance of re-use network to increase re-use of ICT for example in marketing practices and by developing quality control schemes and product labels. Premm (2012) also discuss marketing as an important aspect of the success of re-use networks. A credible network supporting a label, including public authorities and re-use organisations is a possible way to avoid expansive verification processes. This is apparent in the Revolve and Revisie projects both providing credibility although not being third-party certification schemes. Additionally, a network might increase the demand from consumers under the condition that public and private procurers are consulted during development and provided with information about the scheme. Thus, public procurement can become a driver of demand of the label (Frankl et al., 2005). This possibility is highlighted by the PAS 141 and the Revolve. The importance of networks is also stated for obtaining products both in the ReVital and Revisie initiatives. However, the management of supply of products difference significantly between these initiatives, which are based on supply from end-users giving their products to re-use for charity, and the situation in the Swedish re-use of IT sector. The latter being based on a market-driven system, where financial incentives are used to obtain products from organisations (Guide & van Wassenhove, 2001).

Third lesson is that a label or standard must be specific for IT to provide a proper quality assurance of IT-products. A general labelling scheme, e.g. ReVital certifying retailers all re-use products do not sufficiently cover all aspect important to quality of IT. A standard and labelling covering EEE, such as PAS 141 and The Code of good practice for re-use of (W)EEE/Revisie is more specific and covers more aspects. One possibility is to use different criteria for different product groups and the use of the WRAP (2016) product protocols used by Revolve and by PAS 141. Simultaneously to having specific criteria Revolve is very general and cover many aspects less relevant to the sector of IT re-use.

The initiatives also give insights on relevant criteria that may be relevant to include in an initiative established elsewhere; visual inspection, electrical safety test, data eradication, functionality, specific product category tests, cleaning, licensed operative system, segregation of product flow, transportation requirements and warranty. These criteria do to large extent represent the same criteria as those discussed by the Swedish stakeholders. One additional criteria included in the initiatives is the importance of segregation of different product flows (PAS 141).

A final lesson is that funding of a labelling scheme of re-used EEE or specifically IT, is a challenge. All initiatives except PAS 141 are to large extent funded by the different states. The problem with the expensive organisation of the former third-party certification scheme of PAS 141 and thus limited possibilities of generating a wide recognition was recognised already soon after it was launched (Quariguasi-Frota-Neto et al., 2014). A need for a certification can also be created legally, as exemplified by OVAM and The Code of good practice for re-use of (W)EEE/Revisie.

4.3 Application to the Swedish Context

First, if we start by considering the demand for sustainability labelled IT-products in general, there is a demand, according to Atea and HP, especially among private and public procurers. All public procurers in this study request environmental certifications, such as Nordic swan or TCO Certified. After the adoption of the current EU procurement directive public procurers are, according to HP, requesting Eco-labels more often than earlier. Social aspects and conflict minerals are important aspects of eco-labelling on IT-products, according to both Atea and HP and is supposedly an important cause behind the success of TCO Certified.

Secondly, to create a new label or develop existing labelling schemes to cover re-use products, there must be a demand for such an initiative among customers and/or an experienced need among the re-use organisations. Starting with the overall demand for re-used IT equipment in Sweden, there is a consensus among the interviewed Swedish stakeholders in the private sector that the market for re-use of IT-products is in a developing stage. The companies, INREGO, Atea and HP, are all to some extent engaged in reverse logistics aiming at putting re-used goods back on the market. OEMs, such as HP, have long been resistant to re-use due to the risk of cannibalization on the sales of new products and risk of third-party competition (Atasu et al., 2010; Guide & Van Wassenhove, 2009). HP is currently not experiencing remanufacturing as any major competition to the sales of the company's new products and argue that '*when society changes and customers' demand changes*' they will provide remanufactured products on the

Swedish market. Although currently the remanufacturing market of IT-products in Sweden is largely consisting of third party organisations, with INREGO being the primer example. This is often the case with remanufacturing of consumer electronics (Guide & van Wassenhove, 2001) Atea believe that shortly companies like them will be requested to offer delivery of both new and re-used IT-equipment from the same company.

Today one re-use organisation in the Swedish IT sector, INREGO, clearly experiences a need to better communicate the quality of their products. *'The labelling is needed primarily to ensure buyers of the quality of used products'* [INREGO]. Although another company, selling to private consumers, do not experience the same need of a label to communicate the quality of their products (Dalhammar & Milios, 2016). Atea state that the need of a label will increase when the re-use industry of IT develops and more remanufacturing are taking place, which includes replacing vital parts such as batteries. HP on the other hand does not see any need to introduce new labels as there are so many existing labels and the risk of brand damage due to unreliable third party remanufacturers is minor.

TCO development, argues that the consumers do not yet experience a need to be reassured of the quality of re-used IT-products as they do not even consider a re-use as an option, something also discussed in literature (van Weelden et al., 2016). However, the interviewed public procurers communicate interest in re-used equipment and development of a quality label. Gothenburg argues that a label would make it easier to procure re-used products as the label can be used as something to refer to in the procurement criteria. Although, the procurers experience some barriers toward procuring re-used IT-equipment that cannot be solved by a label e. g. large required volumes (Stockholm; SLL) and specific requirements on equipment as it is used in enterprise platforms (SLL). Several stakeholders (SLL; Gothenburg; HP) confirm the notion that that consumers and purchasers often prefer or request new products. New features are important to many consumers (Gothenburg, HP) as confirmed by literature (Abbey et al., 2015a; Ylä-Mella et al., 2015). This raises the question on whether a labelling scheme or certification can change behaviour of consumers? To change consumers' behaviour regarding buying new or remanufactured products, changing their attitudes are of importance (Hazen et al., 2017).

There is partly a need and demand for a reassurance of sustainable collection of and handling with used goods. The collection of used equipment is the most developed part of the reversed logistics of IT in Sweden with all interviewed companies engaged (INREGO, HP and Atea). All public procurers (Gothenburg, SLL, Stockholm) request collection of used equipment from suppliers and SLL states that a labelling scheme might be useful to control this although SLL already has their own 'code of conduct'.

There are possibilities with developing and using existing environmental and sustainability labels for IT, at least according to the certification studied here, TCO certified. TCO Certified is a sustainability label already covering some interesting aspects such as social aspects, warranty, supply of repair parts and product quality. HP has a positive attitude towards including more product durability aspects, something discussed within the EU and academia (Maitre-Ekern & Dalhammar, 2016). The most apparent limitation is that it only solutions already used by, in TCO Certified's case, a third of the manufacturers can be requested. A re-used product can keep its TCO Certification if it has only undergone reconditioning (TCO development). However, INREGO experience that they do not benefit from keeping the old labelling on equipment. If re-used components instead are put together into an entirely new product it can apply for a new TCO Certified licence but it needs to be sold under a new name and brand (TCO development) although this is not the current procedure of remanufacturing IT-equipment in Sweden. TCO development conclude that it is possible to develop a quality assurance for the sourcing of reused IT-products but that it is difficult to find a way to finance it. Such initiatives do already partly exist, e.g. E-steward and R2 (Basel Action Network, 2013; SERI, 2013).

INREGO experience less need, although still a need, to communicate the environmental benefits of re-use and remanufacturing today compared to a few years back. Atea on the other hand states that environmental benefits are of great importance in a label. Studies (Michaud & Llerena, 2011; Wang et al., 2016) suggest that providing consumers with information regarding the environmental benefits increase their willingness to pay for remanufactured products. Certain consumer segments are willing to pay more for eco-label products (Laroche et al., 2001) also refurbished products (Harms & Linton, 2016).

Data eradication and security is of great importance especially to the seller of used equipment but also to the buyer (SLL) although INREGO regards it as important to the buyer. However, I would argue that a buyer regard this important as no one want equipment containing data from a prior owner. All initiatives selected for a detailed analysis include data eradication as a criterion. Specifying the included components are an important criterion according to SLL and Atea, although it is not included in any of the analysed initiatives.

It is argued by the Atea and INREGO that the label should be specific for re-use of IT-products. INREGO and Atea state that ISO-certifications such as 14001 and 9001 do not address the same need as a labelling scheme for re-used IT would. The criteria in these certifications regarding management systems and do not cover product quality aspects. Furthermore, only large organisations consider these in their procurement, no small companies or private consumers (INREGO). The consumer concerns about quality of product is often due to the perceived risk (Abbey et al., 2017) A certification scheme of re-used EEE and IT is likely to be more important than a scheme of re-used products in general. Consumers perceive

many risks with re-used and remanufactured EEE and IT products (Guiot & Roux, 2010) due to a large uncertainty about the remanufacturing processes and product properties (Hazen et al., 2012). The Swedish Official Report (Utredningen cirkulär ekonomi, 2017) highlights EEE as the most important area to analyse regarding label.

One important question concerning the potential organisation of a new label for re-use of EEE is whether to certify a product, process or company? The stakeholders INREGO and Atea argue that a product label certification system would be preferable, however INREGO is certain this is not realistic. TCO development argues that the biggest challenge, regardless of if a re-use product should be labelled through an existing or new product certification scheme, is that every re-use item is unique. It is impossible to be sure of what happened to this product in its former life-cycle. Likewise, one procurer, SLL, is also anxious about the uniqueness of each product. This raises the question: If, a process or company shall be certified rather than a product, is there any guarantee on the quality of the end-product? i.e., is there a link between the process and the end-product? This is an issue discussed by Quariguasi-Frota-Neto et al. (2014) regarding PAS 141.

Atea and INREGO argue that the state need to support and partly finance a labelling scheme, as the re-use of IT sector consists of small organisations. Although TCO development, advocate for the importance of third-party certification schemes they have their downsides, predominantly that they are expensive. Other ways of funding were discussed in the PAS 141 development and are suggested by INREGO, i.e. fees based on the number of products sold. If one where to implement a scheme for the re-use sector of IT-products in Sweden, the number of companies possibly interested in a certification are limited to maybe five companies, too few to finance the scheme themselves (INREGO) but also possibly too few to argue that the state should fund such a scheme. If considering a national solution, it must have a wider scope a least covering all EEE supplemented with protocols for different product categories, as in Revolve and PAS 141. Therefore, there might also be limits to how many aspects that can be covered in the standard being the basis of a scheme. Covering all social aspects, as argued by ATEA and SLL, are for example expensive and by INREGO stated as not very important. The question is still how to generate enough recognition? One possible driver of demand and opportunity for the public to support a labelling scheme is, as previously discussed, though public procurement. The use of such a standard or labelling scheme in public procurement is, as discussed earlier, supported by the European Commission (2016).

4.4 Future Research

The selection of interview respondents regarding the initiatives have given their personal views of the important aspects of the success and lack of success of different initiatives. This only provide us with a glimpse of the supposedly most important aspects. Furthermore, this study is limited in the number of stakeholders interviewed. It would be interesting to further analyse the consumer attitudes towards labelling of re-used IT; especially the attitudes among procurers in smaller municipalities but also private consumers. Additionally, it would be interesting to cover a larger number of stakeholders involved in re-use of consumer IT.

In future research, it would be interesting to consider the development of the new European standard for ‘preparing for re-use’ of EEE and what this will bring. Could it be used in the Swedish context of re-use of IT-equipment? Or is it possible to start other types of collaborations and networks between smaller number of countries, such as the ongoing project with a Nordic textile certification (Palm et al., 2015)? Another aspect that to evaluate is the possibilities of a Nordic or European system specified at re-use and remanufacturing of IT.

The link between a certification scheme of process or a company and the actual quality of the end-products is, as previously discussed, an interesting area of research.

4. Conclusion

A more comprehensive sustainability certification scheme for electronic products has the potential to be a useful policy instrument to increase re-use of products. There are several existing initiatives aiming at increasing the re-use and remanufacturing of electronic products. The main lessons to be learned from a selection of initiatives are;

- marketing towards private customers, procurers and companies are of importance to generate enough certified products or companies to generate a wide recognition of a label,
- networks are beneficial during the development of an initiative and to create a link to public procurement,
- EEE and IT-products require specific criteria to give assurance of quality,
- funding is an important aspect to consider as the industry cannot pay for such a system like traditionally when implementing eco-certifications.

Exactly how a certification scheme for should be designed to be suitable for communicating the benefits of re-use and remanufacturing of electronic products is difficult to specify. Apart from the insight from the lessons listed above the main aspect to consider regarding the application to the Swedish IT re-use sector is that there is a trade-off between information communicated in the labelling scheme and the expenses to cover and verify these aspects. Furthermore, certifying a process or company is easier than certifying a product and the criteria needs to be specific to IT and possibly also to specific product categories. Finally, funding and recognition are key aspects to consider during the possible development of a scheme. A credible network supporting a label, including public authorities and re-use organisations, is a possible way to avoid expansive verification processes. Additionally, recognition can be stimulated through public procurement.

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Annex 1. Interview guide Initiatives

Background information

What are your position and major responsibilities at XX?

- How long have you been working at XX and with XX?

- Can you give me a short description of XX?

Part 1. Organisation of the scheme

- How is the *project* organised?
 - Which is the governing organisation?
 - Who is responsible for the auditing? Or is there any kind of auditing?
 - How is it funded?

Part 2. Initiation of the scheme

- Why was *this project* initiated?
 - How?
 - By whom?

- What was the perceived market needs that were addressed?

- Where inspiration taken from other European schemes/projects during the development and review of this scheme? How?

Part 3. Including criteria?

- Which criteria are included when the products are quality checked?

Part 4. Current situation

- Have the scheme/label/standard/specification generated the desired effect?
 - Have any kind of evaluation been conducted?
 - What are the key reasons behind the success/or lack of success of the scheme?

- How many companies are currently certified, started the certification process or use the scheme/label/standard/specification?
- Which kind of organisations and companies can be accepted for certification?

Part 5. Link to other schemes

- What are the current relation to other similar projects (*labelling schemes/standards*)?
 - o Is there any cooperation with other schemes/projects?
 - o Are there many synergies with other schemes/projects?
 - o Or will there be more in the future?

Part 6. Procurement and future of the scheme

- What is the link to public and private procurement?
 - o Is the label/standard used as a criteria in procurement?
- What do you think of the future development and possibilities of this scheme and other similar schemes?
- Within the research program we have indications that public procurers are interested in pushing increased product durability through public procurement. Do you have similar discussions?

Do you have any questions or do you feel like you would like to add something?

Annex 2. Interview guide INREGO

1. Varför är ni intresserade av kvalitetsmärkning av återtillverkade produkter?
2. Vad är det som främst behöver kommuniceras i en sådan märkning?
3. Vad är det för behov ni upplever finns inom branschen återtillverkare av IT i Sverige?
4. Vilket behov finns bland de som efterfrågar återtillverkad IT?
5. Vad tänker ni att det är som ska märkas?
 - Produkterna? Vilka produkter? Bara återtillverkade/reparerade?
 - På företagsnivå?
6. Vad tänker ni att en sådan märkning ska innefatta?
 - enbart kvalitet? vilka aspekter av kvalitet skulle innefattas? Funktionalitet? Säkerhet? Integritetssäkring/radering av data på enheterna?
 - Miljöaspekter? (Inkluderas i exempelvis den belgiska ”code of practice for reuse”)
 - Sociala aspekter? (Vissa av de märkningar/varumärken som finns, exempelvis ReVital i Österrike, tar även in sociala aspekter såsom arbetsmarknadsåtgärder, löner. Andra inkluderar export av avfall etc. Hur tänker ni kring detta?
7. Vilka är för- respektive nackdelarna med en märkning som inte bara tar in produktkvaliteten utan även andra aspekter?
8. Vissa av de märkningssystem och standarder som jag har identifierat inkluderas såväl produkterna som butikerna där de säljs och hur säljare bemöter kunder. Så är exempelvis fallet med det skotska Revolve-systemet. Ser ni ett behov av det i en svensk kontext?
9. Andra system fokuserar mer på att system för kvalitetshantering ska finnas på plats. Ytterligare andra inkluderar certifiering enligt ett

miljöledningssystem, ex ISO 14001 i samma standard. Exempelvis E-stewards systemet i USA. Hur tänker ni kring detta?

10. Hur tänker ni att ett märkningssystem ska initieras och organiseras?
 - Av vem?
 - Vilken typ av certifieringsprocess tänker ni skulle krävas för att märkningen ska bli trovärdig?
11. Ett problem med vissa av de standarder/märkningar jag har tittat på, exempelvis PAS 141 i Storbritannien, är att det krävs att ett ganska stort antal företag och/eller produkter märks för att systemet ska få genomslag och det ska bli lönsamt för ett företag att bekosta en märkning. Hur tänker ni att det skulle kunna åstadkommas i Sverige?
12. Vad tänker ni att det krävs för typ av stöd från offentliga aktörer för att ett sådant system ska kunna fungera?
 - Finansiering, subventionering?
 - Information, praktiskt stöd? I Revolve-systemet handlar det mycket om att den statliga organisationen bakom standarden ger stöd till företagen under genomförandet
13. Att implementera denna typ av system kan vara ganska kostsamt administrativt både för enskilda företag och för de som organiserar systemet. På vilket sätt tänker ni att ni inom branschen kan bidra?
14. Finns det ett behov av samordning och nätverk mellan företagen i branschen i Sverige?
15. Hur ser ni på det som diskuterades kring en märkning av återanvända produkter bland förslagen i den nyligen publicerade statliga utredning om Cirkulär ekonomi?
16. Hur ser ni på behovet av framtida utveckling av märkning av it generellt för att gynna en mer cirkulär ekonomi? kan ni utnyttja ursprungsmärkningar av produkter?
17. Har du något som du känner att du skulle vilja tillägga?

Annex 3. Interview guide TCO development

Bakgrund

1. Vem är du vilken är din position och dina arbetsuppgifter på TCO development?

Allmänt angående TCO Certified och hållbarhetsmärkningar av IT

2. Hur ser ni på den framtida utvecklingen för miljö-/hållbarhetsmärkningar av elektronikprodukter?
3. Hur ser ni på möjligheterna till kriterier också för design för återanvändning i TCO certifiering av nya produkter?

Märkning för återanvändning och återtillverkning av IT

4. Hur ser ni på möjligheterna att introducera en kvalitetsmärkning/standard för reconditionerad/återtillverkad IT i Sverige?
5. Vad är det som främst behöver kommuniceras i en sådan märkning?

Förhållandet till TCO certified

6. Hur ser ni på möjligheterna till att ni skulle kunna vara delaktiga i att introducera och organisera en märkning i Sverige?
7. Hur ser ni på möjligheten att märkning av denna typ av produkter skulle kunna ske med er nuvarande märkning?
8. Skulle det kunna vara en helt egen märkning som ett komplement till er nuvarande märkning?
9. Vad tänker ni att det är som ska märkas?
 - Produkter?

- Företagsnivå?

Finansiering/lönsamhet

10. Vad tänker ni att det krävs för typ av stöd från offentliga aktörer för att ett sådant system ska kunna fungera?

Upphandling och TCO-märkning

11. Hur används era kriterier i offentlig och privat upphandling idag?
12. Hur vill ni att era kriterier ska användas i upphandling?

Annex 4. Interview guide Atea

Bakgrund

1. Vem är du vilken är din position och dina arbetsuppgifter på Atea?

Efterfrågan

2. Upplever ni att det finns en efterfrågan på miljö-/hållbarhetsmärkt IT bland era kunder?
3. Hur ser efterfrågan ut bland era kunder för återtillverkad/återanvänd IT-utrustning?
4. Hur sker inköp/omhändertagande av använd IT-utrustning?

Kvalitetsmärkning behov

5. Hur ser ni på behovet av en kvalitetsmärkning/standard för återtillverkad/återanvänd IT?
6. Vad är det som främst behöver kommuniceras i en sådan märkning?
7. Finns ett behov av en kvalitetsmärkning bland de som efterfrågar återtillverkad IT?
 - Vilket behov?
8. Finns ett behov av en kvalitetsmärkning/standarder bland de som säljer/återlämnar använd IT?
 - Vilket behov?

Innehåll i märkningen

9. Vad tänker ni att det är som lämpligen ska märkas?
 - Produkterna?
 - På företagsnivå?

10. Vad tänker ni att en sådan märkning ska innefatta?
- enbart kvalitet? vilka aspekter av kvalitet skulle innefattas? Funktionalitet? Säkerhet? Integritetssäkring/radering av data på enheterna?
 - Miljöaspekter? (Inkluderas i exempelvis den belgiska ”code of practice for reuse”)
 - Sociala aspekter? (Vissa av de märkningar/varumärken som finns, exempelvis ReVital i Österrike, tar även in sociala aspekter såsom arbetsmarknadsåtgärder, löner. Andra inkluderar export av avfall etc. Hur tänker ni kring detta?
11. Vilka är för- respektive nackdelarna med en märkning som inte bara tar in produktkvaliteten utan även andra aspekter?

Organisation, finansiering och stöd

12. Hur tänker ni att ett märkningssystem ska initieras och organiseras?
- Av vem?
 - Vilken typ av certifieringsprocess tänker ni skulle krävas för att märkningen ska bli trovärdig?
13. Ett problem med vissa av de standarder/märkningar jag har tittat på, exempelvis PAS 141 i Storbritannien, är att det krävs att ett ganska stort antal företag och/eller produkter märks för att systemet ska få genomslag och det ska bli lönsamt för ett företag att bekosta en märkning. Har ni några tankar kring hur det skulle kunna åstadkommas i Sverige?
14. Vad tänker ni att det krävs för typ av stöd från offentliga aktörer för att ett sådant system ska kunna fungera?
- Finansiering, subventionering?
 - Information, praktiskt stöd? I revolve-systemet handlar det mycket om att den statliga organisationen bakom standarden ger stöd till företagen under genomförandet
15. Att implementera denna typ av system kan vara ganska kostsamt administrativt både för enskilda företag och för de som organiserar systemet. På vilket sätt tänker ni att ni inom branschen kan bidra?
16. Finns det ett behov av samordning och nätverk mellan företagen i branschen i Sverige?

Annex 5. Interview guide HP

Bakgrund

1. Vem är du vilken är din position och dina arbetsuppgifter på HP?

Allmänt angående miljö- och hållbarhetsmärkningar

2. Upplever ni att det finns en efterfrågan på miljö-/hållbarhetsmärkt IT bland era kunder?
 - Efterfrågan vid offentlig och privat upphandling?
3. Hur ser ni på den framtida utvecklingen för miljö-/hållbarhetsmärkningar av elektronikprodukter?
4. Vi ser en del diskussioner kring krav på längre hållbarhet på IT-produkter bland annat inom EU, hur ser ni på det?

Återtillverkad/rekonditionerad IT

5. Hur ställer ni er generellt till försäljning av återtillverkade/rekonditionerade exemplar av era produkter?
 - Hur ser ni på risken för ökade konkurrens när dessa företag växer?
 - Risken för att kunderna tappar förtroende för era produkter genom att företag säljer återtillverkade produkter av dålig kvalitet?
6. Hur ser ni på att användandet av återtagssystem och dessutom försäljning av återtillverkade/rekonditionerade ökar bland offentliga upphandlare?

Kvalitetsmärkning behov

7. Hur ser ni på behovet av en kvalitetsmärkning/standard för återtillverkad/återanvänd IT?
 - Finns ett behov av att säkerställa kvaliteten på processerna produkterna går igenom på företagen eller på de färdiga produkterna

- Skulle det gynna er/minska riskerna för att dessa produkter ger ert märke dåligt rykte?

Annex 6. Interview guide Public procurers

Bakgrund

1. Vem är du vilken är din position på organisation X?

Upphandling IT generellt

2. Ställer ni hållbarhetskrav vid upphandling av IT?
 - Vilken typ av krav? Socialt? Miljö?

Dagens situation, upphandling av återtillverkad/återanvänd IT

3. Upphandlar ni återtillverkad/återanvänd IT?
 - a. Om ja
 - Vilka produkter?
 - Varför?
 - b. Om nej
 - Varför inte?
 - Ställer ni vanligtvis kravet att utrustningen ska vara fabriksny vid IT-upphandlingar?
4. Har ni någon återtagstjänst för era uttjänta produkter så att dessa säljs för att sedan, om möjligt, kunna återanvändas?

Kvalitetsmärkning och garanti

5. Skulle någon typ av försäkran om prestanda/kvalitet, såsom en kvalitetsmärkning för återtillverkad/återanvänd IT bidra till att ni började upphandla (alt. i större utsträckning upphandlade) återtillverkad/återanvänd IT-utrustning?

6. Ofta ger leverantörer av återtillverkade/återanvända IT produkter garanti motsvarande den som ges från de företag som säljer nyproducerade är detta i sig tillräckligt för att garantera produkternas kvalitet?

Syn på miljöpåverkan

7. Hur ser ni på miljöpåverkan från återtillverkad/återanvänd IT i förhållande till nyproducerade produkter?



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