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Constraints and opportunities for integrating preparation for reuse in the Danish WEEE management system

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ABSTRACT

In Denmark, the targets of the WEEE Directive are primarily met through recycling, even though waste electronic and electrical equipment (WEEE) could be prepared for reuse with increased environmental, economic and social benefits. In this study, we investigate the WEEE management system as a socio-technical system. Through interviews with 23 stakeholders, we identify conflicts of interest and technological, organisational and institutional constraints for integrating preparation for reuse as a management option within the current system. Based on this, we identify four main prerequisites for a future integration of preparation for reuse. These are: a) extended tendering periods to incentivise technological investments; b) the introduction of measures to incentivise municipal waste authorities to organise value-conserving logistics; c) the introduction of standards and/or guidelines to ensure the quality and safety of preparation operations and data management; and d) measures to avoid transboundary sales of used EEE. Based on transition management theory, we suggest pilot testing and the development of niche projects to test new constellations of collaboration between actors in the system.

1. Introduction

The concept of the circular economy (CE) is an umbrella concept for new ways to organise reuse and recycling (Blomsma and Brennan, 2017). One of the principles of the CE is that the lifetime of products should be as long as possible before materials are recovered from waste products through recycling (Macarthur, 2013; Bocken et al., 2016). Prolonging the lifetime of discarded products can be enabled through preparation for reuse activities. Preparation for reuse can be defined as "…checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be reused without any other pre-processing" (EU 2008). This definition implies that preparation for reuse (PfR) can be conducted by actors other than the original owner.

Since the publication of the Circular Economy Action plan in 2015, the European Commission has put CE on the political agenda in Europe (European Commission, 2015). Several directives and regulations are already in place to support a transition towards a CE. Electrical and Electronic Equipment (EEE) is covered by a range of policy instruments with the potential to support CE, including the Waste Electrical and Electronic Equipment (WEEE) Directive, the Restriction of Hazardous Substance (RoHS) Directive, the Ecodesign Directive and the EU Ecolabels (Bundgaard, 2016). In particular, the Ecodesign Directive has the potential to set product design requirements to a comprehensive set of circular aspects that can improve the durability of products and make them easier to repair, reuse and recycle. However, so far the Ecodesign Directive has mainly focused on energy efficiency aspects (Bundgaard et al., 2017). The importance of the Ecodesign Directive in the transition towards CE is also enhanced in the Circular Economy Action Plan (European Commission, 2015) and the Ecodesign Working planning from 2016 to 2019 (European Commission, 2016).

The WEEE Directive is also a key policy instrument to support the transition to a CE. The WEEE Directive was developed to incentivise take-backs and prevention and improve recovery and recycling of WEEE. Furthermore, the WEEE Directive introduced the producer responsibility, making the producers financially responsibility for the collection and treatment of WEEE. In practice, however, individual producer responsibility and product take-back is a rarity, and the vast majority of WEEE is collected by waste managers and treated for recycling (Grunow and Gobbi, 2009). One of the consequences of this approach is that almost no PfR takes place in the current waste management system, despite the fact that there is a significant accessed potential for reuse of household WEEE (Bovea et al., 2016; Parajuly and Wenzel, 2017).

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Efficient resource management of WEEE is of high priority due to its increasing volume, high value and hazardous contents (Achillas et al., 2010). There are well-documented environmental benefits from recycling (Bigum et al., 2012; Hischier et al., 2005; Wäger and Hischier, 2015), but the environmental benefits from the reuse of WEEE have been investigated to a much lesser extent. A few studies on specific products document the benefits of a prolonged lifetime (Lu et al., 2014, 2015, Prakach et al., 2012; Truttmann and Rechberger, 2006; WRAP, 2011; Zanghelini et al., 2014). However, the reuse of end-of-life products may also have other types of benefits: economic potential is documented by Parajuly and Wenzel (2017) and WRAP (2011), and in particular, the social benefits seem to justify the increased reuse of waste products. Social benefits include employment opportunities, training for low-skilled labour and providing less-advantaged people in the local community with the opportunity to acquire products to increase their standard of living (Curran and Williams, 2010).

In order to achieve a CE and reap environmental, economic and social benefits, it is essential that different end-of-life treatment solutions coexist (Achillas et al., 2010). In the WEEE management system, this implies that reuse should be able to coexist with recycling, incineration and safe disposal (Achillas et al., 2010). However, in Europe, only 2% of the collected WEEE in the WEEE management system is prepared for reuse, whereas 68% is recycled (Parajuly and Wenzel, 2017). In Denmark, the situation is very similar. In 2015, only 0.2% of the collected WEEE was reused, whereas 83.9% of the collected WEEE was recycled (Eurostat, 2018). This indicates that PfR is not sufficiently supported in the current WEEE management system and that there is a large, unutilised potential for reuse of WEEE delivered at the household waste recycling centres both in Denmark and in the rest of Europe. The aim of this study, therefore, is to identify and analyse constraints, prerequisites and opportunities for the integration of preparation for reuse in the current WEEE management system in Denmark.

Different studies have examined the Danish WEEE management system. These studies have focused on flows, qualities, characteristic and management of WEEE in the Danish system (Bigum et al., 2013; Parajuly and Wenzel, 2017; Parajuly et al., 2017), the design of WEEE networks (Grunow and Gobbi, 2009) and the sustainable transition of the Danish WEEE management system (Lauridsen and Jørgensen, 2010). Unlike these previous studies, this article takes a socio-technical perspective on the WEEE management system in order to identify constraints and opportunities for PfR within the interaction between human practices and infrastructures and technology. The article focuses on the relationship between physical waste infrastructures, actor constellations in the current waste governance and the incentives for reuse of WEEE. Mapping and analysing this can point to opportunities to integrate PfR into the system. Socio-technical systems are developed and optimised with regard to their societal function. The societal function of the existing WEEE management system is, as formally stated in the WEEE Directive:

…to contribute to a sustainable production and consumption by, as a first priority, the prevention of WEEE, and, in addition, by the reuse, recycling and other forms of recovery of such wastes…" (EU 2012).

However, in practice, this order of priority (reuse over recycling) does not appear to be the guiding principle. In practice, the aim of the current system is to collect and manage WEEE for recycling.

2. Background knowledge

This section introduces the background knowledge on socio-technical systems and PfR providing the framework for this study.

2.1. Socio-technical systems

Socio-technical systems can become so well established that they hinder the emergence of alternative, more sustainable solutions (Kemp et al., 1998). Technological development follows a path influenced by a number of factors, such as the existing market, the institutional and regulatory framework, economic rules and contracts and the expectations of the users of the technology (David, 1985, Foxon, 2002, Kemp et al., 1998). Social factors can also become constraints, for instance through adaptation of preferences and expectations, codes of behaviour and social conventions (Unruh, 2002). These factors tend to favour existing technologies over new ones. Path dependencies already exist in the current waste management regime, as documented by Wilts (2012) and Corvellec et al. (2013). The existing treatment of waste has minimised the direct environmental impacts from waste, and this has reduced the pressure to implement more sustainable solutions, such as PfR, as there does not seen to be a urgent need for this.

Path dependencies favour one solution over others due to a self-reinforcing feedback that relates to the technological, organisational, institutional and social systems. This can lead to constraints that limit the capability of change. The concept of path dependency frames how constraints due to choices in the past influence present decisions (Unruh 2002).

Changing systems, such as integrating PfR into the WEEE management system, may thus involve changes in technology, infrastructure, governance and institutions, as well as business and social dynamics and culture and knowledge (Geels, 2011). Moreover, a change requires a systematic promotion of alternatives – a social or political recognition of the need for intervention (Corvellec et al., 2013).

2.2. Prepare for reuse

Different European studies have shown that about 20–30% of the discarded EEE is fit for extended use when delivered at the household waste and recycling centres (Agamuthu et al., 2012). More specifically, a study from Spain showed that from a sample of small household WEEE 31% of the product was fit for recycling, 68% had potential for reuse and 2% of the product could be reused directly (Bovea et al., 2016). A British study has found that 49% of the WEEE were still functioning when they ended up at the household waste recycling centres, and 23% had a reuse potential (Pocock et al., 2011). In Denmark, a sample of WEEE collected from a Danish household waste recycling centre showed that 22% of the small appliances and 7% of the monitors were fully functional (Parajuly and Wenzel, 2017). Furthermore, the consumer to consumer resale and reuse of EEE in Denmark is also well developed, as illustrated by numbers on resale of white goods and electronics from the Danish version of eBay in Table 1. The sale numbers showed an estimated resale value of 14 million Euros for white goods and 370 million Euros for electronics. This estimate is probably higher than the actual resales value, as the price often is reduced in connection with a sale. However, this still indicates that there is a large potential for both preparation for reuse and reuse of WEEE from Danish household waste recycling centres and that there also is a large Danish market for the sales of reused EEE.

Table 1
Value and numbers of reused white goods and electronics on sale at the Danish version of eBay in 2013. The estimated number of products sold and the estimated resale value is based on a 86% success rate of sales when posting an advertisement on eBay Denmark. Numbers are provided by eBay Denmark (Ebay, 2014).

	White goods	Electronics
Value of the products on sale	16 million Euros	430 million Euros
Numbers of advertisements	80,624	1,381,000
Estimated resale value (86% of the products on sale are sold)	14 million Euros	370 million Euros
Estimated number of sold products (86% of the products on sale are sold)	69,337	1,187,660