

DEVELOPING CIRCULAR ECONOMY FOR THE RETAIL REFRIGERATION INDUSTRY: HOW FINANCIAL INCENTIVES COULD INFLUENCE REMANUFACTURING OF REFRIGERATED DISPLAY CABINETS IN THE UK

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Abstract

This paper examines how influential financial incentives could be in achieving a Circular Economy, with particular reference to the retail refrigeration industry. It underlines the potential monetary benefits for consumers who purchase remanufactured retail refrigeration equipment and highlights the potential financial incentives, which could help the producers of Refrigerated Display Cabinets (RDCs) to remanufacture.

The Circular Economy is an economic and industrial system where resources are kept in use for as long as possible. This system is an alternative to the linear “take-make-use-dispose” path, which is adopted in many industries. Remanufacturing uses less energy and resources than the traditional linear approach, whilst making products that are considered to be as good as new. Due to the economical and environmental benefits the impetus to remanufacture is growing. The growth of the remanufacturing industry in the UK in relation to RDCs, could help to create a more sustainable and competitive retail industry.

This paper evaluates the potential financial savings a supermarket could make from the purchase of remanufactured RDCs and proposes that financial incentives could help producers implement remanufacturing in their business models, in an attempt to encourage the industry to become more resource-efficient and circular.

Keywords

Circular Economy, Consumer Behaviour, Remanufacturing RDCs, Financial Incentives

1. INTRODUCTION

The Circular Economy (CE) is an economic and industrial system, in which resources are kept in use for as long as possible. The circularity of products is achieved by extending their functioning life, and by the regeneration of parts and material recovery at the end of their lifecycle. This system is an alternative to traditionally practiced linear economy, followed since the early days of the Industrial Revolution, where products were made, used and disposed of at the end on their lifecycle.

The manufacturing of retail refrigeration cabinets is typified by the extensive use of materials and energy, and the development of a Circular Economy (CE) is particularly

important. Businesses and Governments are now subject to environmental pressures and aware of potential shortages in resources, and they are beginning to recognise the economic, social and environmental benefits of a CE and consider its adaptation in practice. However, a number of behavioural barriers, which prevent the resource-efficient practice, stand in the way to its development.

Financial incentives can work to motivate desired behaviours. In this paper, financial incentives aim to increase remanufacturing activity in the UK retail refrigeration sector through the monetary benefits of remanufacturing. This study will also examine areas where incentives could help to drive adaptation of remanufacturing by this sector.

2. THE REMANUFACTURE OF REFRIGERATED DISPLAY CABINETS

Refrigerated Display Cabinets (RDCs) are used to stock and display chilled or frozen food and beverages in retail grocery stores. RDCs, included in the technical sector of the Circular Economy, have a proven capability to meet the principles of the concept. The prolonged life of RDCs, can be achieved with a correct approach to the initial design of the products and appropriate end-of-life treatment i.e. remanufacture and recycling, instead of disposal.

Remanufacturing is a manufacturing process, as a result of which an end-of-life product is returned to *as good as new* state, with an equivalent warranty. In line with the rules for design for longevity (namely use of durable parts, long life materials and simplified structure for easy disassembly at the end-of-life), RDCs can continue to cycle in service for longer than their current typical lifespan. They can be renewed 3 times before their absolute end-of-life (Bibalou et al, 2011), as opposed to being disposed of after 4-5 years from purchase, which is their average time in use.

RDCs and supermarkets began their inter-dependent existence in 1930s. Both, the design of the RDC and the self-service shopping system, has not changed for the past 80 years. In accordance with this pattern, unless new sustainable innovation in food refrigeration is introduced to stores or customers fully adopt some alternative methods of food shopping, the design and technology of RDCs is unlikely to change right away. However, to immediately develop the CE in this sector, manufacturers and consumers (grocery stores) could implement the circular business models - such as remanufacture - (Walsh et al, 2009), in their practice and encourage resource reuse, sustainable consumption and efficient manufacture. Remanufacturing of RDCs could instantly help to achieve the CE in this sector, until the new shopping culture and sustainable innovation in the retail refrigeration technologies arise.

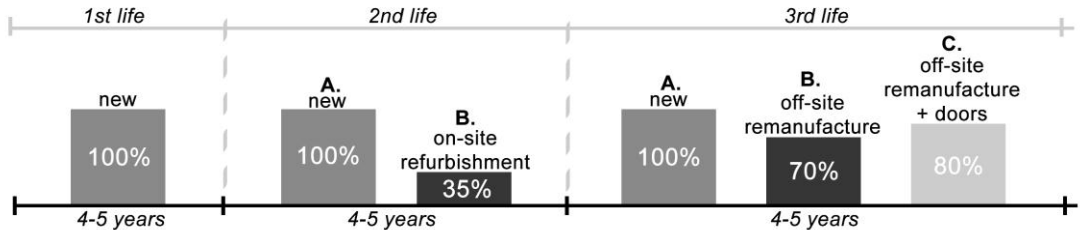


Figure 1: Prices of RDCs at different lifecycle scenarios

This assessment is built on the following industry lifecycle scenarios (Figure 1):

- **1st life:** Supermarket purchases 50 remote open-fronted 3.75m long RDCs, that are manufactured to bespoke specifications (size), and used for a period of 4-5 years.
- **2nd life:**

- A. Supermarket buys the same 50 new cabinets at 100% price to be used for another 4-5 years, this sometimes occurs due to changes in floor layout or new design requirements.
- B. Supermarket refurbishes all 50 RDCs on-site at 35% of the price of new RDCs, which extends their life in use for another 4-5 years. *Refurbishment* of RDCs on-site is a cosmetic modification, which is commonly performed due its financial benefits and convenience.
- **3rd life:**
 - A. Supermarket buys the same 50 new cabinets at 100% price to be used for another 4-5 years, this commonly occurs.
 - B. Supermarket remanufactures the previously refurbished 50 cabinets at 70% price of new RDCs, and extends their life by another 4-5 years. *Remanufacturing* of RDCs off-site is performed on the *end-of-life* units that need cosmetic and additional technical modifications in order to be brought to *as good as new* condition. Remanufacturing of RDCs rarely occurs.
 - C. Supermarket remanufactures the 50 previously refurbished open-fronted cabinets, extends their life by 4-5 years, but installs doors at an additional 10% price. Even with an additional component, remanufactured RDCs can cost less than new ones without doors on them.

3. RESULTS

The potential financial savings are calculated across the 3 lifecycles of 50 typical 3.75 m long remote open-fronted RDCs at a price of £3,800 per 1 new unit. The estimates are based on 4 different scenarios occurring over a period of 12-15 years (3 lifecycles), when a supermarket buys:

- 1. 50 new RDCs every 4-5 years (in all 3 lifecycles)
- 2. 50 new (1st life), refurbishes RDCs on-site (2nd life), buys new 50 RDCs again (3rd life)
- 3. 50 new (1st life), refurbishes RDCs on-site (2nd life), remanufactures all 50 (3rd life)
- 4. 50 new (1st life), refurbishes RDCs on-site (2nd life), remanufactures and adds door on all 50 units (3rd life)

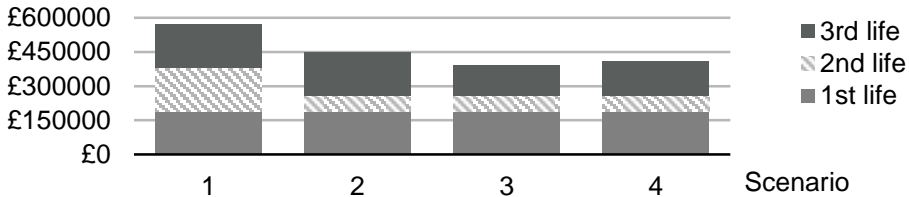


Figure 2: Prices of 50 RDCs at different lifecycle scenarios

The most cost efficient purchase of 50 RDCs over the period of 3 lifecycles (Figure 2) is set in Scenario 3, when at the 3rd lifecycle, a supermarket decides to remanufacture their units. This is giving the retailer a substantial saving estimated at £180,500, which could fund a purchase of 47 new RDCs (priced at £3,800 per unit) to almost completely furnish their store again in 4-5 years.

4. DISCUSSION

In a purchasing environment where price is a key factor influencing the choice of a product, a visible financial discount could be a driver for buying remanufactured RDCs. However, the substantial financial savings that the retailers could gain from remanufacturing their RDCs, are not preventing their disposal. According to the Centre for Remanufacturing

and Reuse (CRR) it was forecasted that in 2015, 80,980 RDCs would be at their *end-of-life*, of which only 12,147 were assumed to be remanufactured (Walsh, 2009). This leaves around of 68,000 units, which could be remanufactured and furnish over 1,300 supermarkets at 30% less cost, instead of disposal.

The most common pattern of purchasing behaviour across the 3 lifecycles, is shown in Scenario 2, when a supermarket orders a set of customised new cabinets (1st life), refurbishes them after 4-5 years (2nd life), disposes them after another 4-5 years preventing the 3rd lifecycle, by buying new ones. This behaviour shows that there is an interest in extending cabinets' life through refurbishment, due to its convenience and economic benefits. However this stops at the 3rd lifecycle, when units need remanufacturing.

Remanufacturing is relying on the availability of cores (*end-of-life* units). It is an inconvenient process, which requires transportation of 50 cabinets from a supermarket to a factory, where units are remanufactured, leaving the store empty for a period of approximately 6 weeks. To buy remanufactured cabinets straight away and avoid any disruption, the same store would require a ready *end-of-life* stock of cores of the same specifications (size in particular), that after being remanufactured, could be put back on the shop floor replacing the old ones.

The assumptions are, that due to the complexity of the remanufacturing process, retailers choose to or are forced to go for a 'hassle-free' purchase of new RDCs, sacrificing the probable 30% savings. However, a number of additional financial incentives, could change this behaviour:

- **Incentivised cores return** - despite the clear availability of core RDCs, manufacturers are still having difficulties locating them. Therefore a guaranteed take-back arrangement, where retailers are encouraged to return their *end-of-life* RDCs to a remanufacturer by being given a discount on their next remanufacturing order, would provide producers with stock of cores, maintain their business and promote remanufacturing across the sector.
- **Incentivised purchase** - inclusion of remanufactured products in the Enhanced Capital Allowance scheme (which already supports purchase of the energy efficient RDCs in the UK), could increase the potential savings even more and encourage retailers to remanufacture (Walsh, 2009).

5. CONCLUSION

This study highlights the socio-economic barriers to achieving a Circular Economy in the retail refrigeration industry. Refurbishment tends to be favoured by supermarkets, because of the direct financial savings it brings. However, the benefits of remanufacturing are offset by its complex process, despite the considerable financial savings it brings. The incentivised return of cores and additional tax savings from the ECA scheme, could support remanufacturing and change the purchasing behaviour in this sector and this will be investigated in the future.

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