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# Circular Economy Ownership Models: A view from South Africa Industry

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**Abstract**

The world is neither globally successful in remanufacturing and re-use of products nor recycling of waste materials. This requires a combination of circular economy management systems, business models and novel technologies. There are contrasting views in literature regarding models for a circular economy. The main views are built on extended producer responsibility and on the role of end users. This paper is based on a study of the South African industry's view of circular economy models, drivers and sustainers, with particular focus on composite waste. Cost reduction was found to be the strongest driver and sustainer for recycling of composites. Thus, maximizing opportunities to reduce cost is a key factor in encouraging South African companies to embrace the circular economy. This is important in developing appropriate national models for managing the transition to a circular economy.


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*Keywords:* Circular economy ownership models; composites; recycling; South Africa; drivers and sustainers

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## 1. Introduction

In a circular economy resources are kept in use for as long as possible, extracting the maximum value and then recovering and regenerating products and materials at the end of each service life. Unfortunately, the opportunities of such a green economy and the potential to develop low carbon products, remanufacture retired products and recover valuable materials, are not being fully utilized on a global level. For 2015, it was estimated that the European Union (EU) produced over 300,000 tonnes of composite waste, of which around 250,000 was end-of-life (EOL) waste [1]. It is estimated that 98% of the composite waste is disposed to landfill. These volumes illustrate the challenge faced by industry in tackling the waste problem. There are also major opportunities because carbon fibre reinforced composite materials are high value materials and re-using or recycling these would enable cascading of value within the supply chain. The high volume of glass-fiber reinforced plastic (GFRP), which is typically 98% of composites volume, imply that there is a bigger environmental challenge and advantage for re-using and recycling GFRP. The energy content of new carbon fibre and glass fibre are is relatively high and around 183 to 286 MJ/kg and 13 to 32 MJ/kg respectively [2]. It was also reported that the energy required to recycle carbon fibre is only about 5% to 10% of the production energy of virgin fibre [3]. In recent studies it was established that the energy demand for mechanical recycling of GFRP is only 0.17 MJ/kg at a recycling rate of 150 kg/hour [4]. Thus, the use of composites in a circular economy is also a good strategy to avoid or reduce the high energy demand associated with virgin material production. EU legislation is forcing companies to consider recycling of composites. It is therefore timely and proactive for the South African companies to consider end–of-life options for composite waste in line with international trends.

### *1.1. Ownership Models for a Circular Economy*

There are examples of transition to circular economy for other products outside the composite industry. For end-of-life vehicles (ELVs), Sweden implemented the Extended Producer Responsibility (EPR) scheme, which incorporates environmental costs throughout the product lifecycle, into the market price of the product [5]. This additional money goes into the Car Scrapping Fund, funding the dismantling of the product. It makes the manufacturer responsible for the waste they produce, using financial incentives, either combined with a reuse, buy-back or recycling initiative. Third parties, also known as Producer Responsibility Organizations (PRO), can be paid by the producer to deal with the waste management. Proponents argue that EPR takes the financial burden of waste management from local government and gives incentive to manufacturers to reduce the amount of primary resources, to improve product design, to use secondary materials and reduce waste [6]. In Japan, the end-of-life vehicles (ELV) system includes a recycling fee collected by the Japan Automobile Recycling Promotion Centre [7]. Japan already achieves 95% recovery of automotive shredder residues. For the four streams targeted by specific EU Directives (packaging, batteries, ELVs and WEEE), an EPR scheme has been systematically implemented in EU Member States [8].

Sachs [9], in his paper “Planning the Funeral at the Birth..”, argues that the end-of-life responsibility should be borne by the end user who turned the product into waste and not the manufacturers who are creating beneficial products. While, Scheijgrond [10], suggests that that government should take charge entirely. Thus, there is no consensus on a universal ownership system for dealing with end-of life waste. It is timely to consider the views of industry across different countries and understand the drivers and sustainers for transition to a circular economy.

### *1.2. Drivers and Sustainers for Sustainable Manufacturing*

Bey et al [11], in a study of international companies, reported that the main barriers for implementation of environmental strategies in companies were a lack of information on environmental impacts, a lack of expert knowledge and a lack of allocated resources (manpower and time). In terms of sustainers, they reported two main factors, namely customer demand and competitive edge.