Chapter 5
Approaches to the Circular Economy

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ABSTRACT

The concept of the circular economy, which looks to reduce the demand for raw material inputs and natural resources and to recover, reuse, and recycle those inputs and resources as an integral part of the production process, is attracting increasing attention from business corporations. A transition to a more circular economy will bring major changes for consumers, in patterns of consumption and in the consumption process. At the same time, there is growing interest in the concept of the circular economy and in its implications for consumption amongst academic researchers. This chapter outlines the concept and characteristics of the circular economy, offers a review of the nature and variety of academic research literature on the circular economy, and explores some of the challenges facing researchers who look to examine its operation within the business environment. While the focus of the chapter is firmly on the circular economy, it also raises a number of issues that have wider and deeper significance for consumer consumption.

INTRODUCTION

The concept of the circular economy which looks to reduce the demand for raw material inputs and natural resources and to recover, reuse and recycle those inputs and resources as an integral part of the production process, is gaining increasing momentum in political and business thinking about the transition to a more sustainable future (Jones and Comfort 2017). The European Commission (2015), for example, argued that "the transition to a more circular economy, where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste

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is minimised, is an essential contribution to the European Union's efforts to develop a sustainable, low carbon, resource efficient and competitive economy". The circular economy embraces all stages of the product life cycle from both the product design and the production process, through marketing and consumption to waste management, recycling and re-use. Accenture Strategy (2015), for example, suggested "transitioning to the circular economy may be the biggest revolution and opportunity for how we organize production and consumption in our global economy" and that "at its essence, the circular economy represents a new way of looking at the relationships between markets, customers and natural resources". PricewaterhouseCoopers (2017) argued "ultimately the circular economy is about rethinking everything, including business models themselves, so we can reduce consumption". In short, a transition to the circular economy will bring major changes for consumers, in patterns of consumption and in the consumption process.

While research work on incorporating pollution and waste in economics (e.g. Leontief 1970; Nakamura 1999; Duchin 1990) can be traced back over fifty years, more recently academic reseachers have taken an increasing interest in the circular economy across a wide range of business sectors. Jones and Comfort (2018a), for example, explored how Europe's leading retailers have publicly addressed circular economy approaches and offered some general reflections on the application of the concept within the retail sector of the economy. Girard and Norca (2017) proposed a circular economy model to make tourism more sustainable but recognised that circular tourism requires the development of appropriate tools and indicator data, to test the efficiency of this model. Leider et al. (2017) examined the possibilities of circular economy implementation in manufacturing systems using a multi-method simulation system approach to link design and business strategy. Lebre et al. (2017, p. 662) explored the role of the mining industry and suggested, "mines can make significant progress if they apply the circular economy principles at the mine site level" (p. 662). The transition to a circular economy has major implications for the consumption process and for consumers and it seems likely to attract growing research interest within the academy. With this in mind, this chapter outlines the concept and characteristics of the circular economy, offers a review of the nature and variety of academic research literature on the circular economy and, explores some of the challenges facing researchers who look to examine its operation within the business environment.

The Concept of the Circular Economy

While Murray et al. (2015, p. 10) suggested that the term circular economy has "been linked with a range of meanings and associations by different authors'"(p. 10) they argued that in its most basic form "a circular economy can be loosely defined as one which balances economic development with environmental and resource protection" (p. 10). The Ellen McArthur Foundation (2017a) which was established in 2010 with the aim of accelerating the transition to a circular economy, argued that "a circular economy is restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times" and that "the circular economy is a continuous, positive development cycle. It preserves and enhances natural capital, optimises resource yields, and minimises system risks by managing finite stocks and renewable flows" (webpage). In practice, circular economies are popularly seen to be built around a range of activities, which look to reduce the demand for raw material inputs and natural resources and to recover, recycle and re-use inputs and resources as an integral part of the production process. As such the concept of the circular economy is contrasted, by its proponents,

with the traditional linear economy which turns raw materials into waste in the production process and which is seen to lead to environmental pollution and the removal of natural capital from the environment.

Essentially the concept of the circular economy embraces all stages of the product life cycle from both the product design and the production process, through marketing and consumption to waste management, recycling and re-use. Within such an economy an initial focus on designing products that are more resource efficient throughout their life cycles can make products more durable, easier to repair and to recover constituent, and potentially still useful, materials from the products when their initial lifespan is over. As long as the majority of environmental costs are borne not by producers but more generally by a potentially wide range of stakeholders then there is limited incentive to introduce more innovative design thinking. The circular economy also demands greater efficiency in production processes and here the focus is on looking to reduce the environmental and social impact of production, for example, through more sustainable sourcing and the development and promotion of innovative industrial processes.

Consumers have a vital role to play if there is to be a transition to a more circular economy. In theory much will be expected of consumers, not least in that they need to be prepared to embrace what they may see as radical new buying behaviours and consumption practices. Some commentators have certainly suggested that the transition to a circular economy would demand dramatic changes in the ways in which consumers approach consumption. Korhonen et al. (2018a, p. 41), for example, foresaw the emergence of a "new consumption culture" with "user groups and communities sharing the use of the function, service and value of physical products" (p. 41). Here, a transition from the sale of products to a product service system, where companies offer a mix of products and services combined via leasing, hiring and sharing arrangements to fulfill consumers' needs, is seen to have an important role to play in the transition to a circular economy. While not all product service systems necessarily lead to a reduction in material consumption, they are widely seen to offer the potential to reduce usage of natural resources. Within a circular economy, waste management is no longer seen as a problem, but rather as an opportunity to return as much waste as possible back into productive use. The focus is on the prevention, reuse and recycling of waste materials rather than their disposal by landfill. Where waste cannot be prevented, reused or recycled then recovering its energy content is seen preferable to landfill and so-called waste to energy solutions are also seen to be integral to the circular economy. More generally, the circular economic model also looks to investigate and promote new markets for waste materials.

In some ways the circular economy is linked to the sharing economy and to what Hamari et al. (2015, p. 2041) described as "collaborative consumption" (p. 2047). While the European Commission (2016) suggested that there is no general consensus as to what comprises the sharing economy, and Martin (2016, p. 151) argued "it is extremely challenging to offer a definition of the "sharing economy which retains clarity whilst encompassing the variety of ways in which the term is used in practice" (p.151), a number of definitions can be identified. For PricewaterhouseCoopers (2014), for example, the sharing economy uses "the sharing economy uses digital platforms to allow customers to have access to, rather than ownership of, tangible goods and intangible assets" (webpage). This economises on scarce resources and often involves deeper social interactions than traditional market transactions (webpage). The Organisation for Economic and Cultural Co-operation (2016) described the sharing economy as "new marketplaces that allow services to be provided on a peer-to-peer or shared usage basis" (webpage). Kathan et al. (2016, p. 663) suggested the "so called sharing economy phenomenon is characterised by nonownership, temporary access, and redistribution of material goods or less tangible assets, such as money, space or time" (p.663). At the same time PricewaterhouseCoopers (2016) suggested that the "sharing economy reflects a shift in consumer patterns and in particular a demand for more accessible

goods and services" and "the sharing economy relates to innovation in creating new platforms that provide similar services to conventional business sectors but are more consumer friendly" (p. 2).

Hamari et al. (2015, p. 2047) defined collaborative consumption as "the peer-to-peer-based activity of obtaining, giving, or sharing the access to goods and services, coordinated through community-based online services" (p. 2047). The Altimeter Group (2013) suggested that "the collaborative economy is an economic model where ownership and access are shared between corporations, startups, and people and this this results in market efficiencies that bear new products, services, and business growth" (webpage). Tussyadiah (2014), for example, reported on an exploratory study into the drivers and deterrents of collaborative consumption in travel in the US. The findings revealed that the drivers included the social aspects of sustainability and community while lack of trust and lack of efficacy in relation to technology were amongst the deterrents. More generally the concept of collaborative consumption certainly challenges traditional ways of thinking, in that the value chain works differently, technology is mobilised differently, property rights in general and the concepts of ownership in particular are challenged, and the fundamental principles of monetisation are unclear. However, Hartl et al. (2016, p. 2756) cautioned that "new business models based on the concept of collaborative consumption comprise new challenges for the market place. In contrast to conventional businesses, collaborative consumption businesses are accused of not offering a standardized level of service and price and of lacking safeguards for customers" (p. 2756).

A number of factors help to explain the pressure for the transition to a more circular economy. On the one hand there are a number of resource and environmental factors, though some of these, specifically climate change, may come to assume greater relative importance. These factors include the continuing depletion of scarce natural resources, the supply problems associated with the increasingly volatile international political situation and the unpredictable events associated with climate change, and the potential price volatility associated with both these factors and the continuing environmental degradation and natural resource depletion associated with the current dominant traditional (capitalist) business model. On the other hand, a number of legislative, policy, corporate and consumer drivers have also assumed increasing importance in promoting the circular economy. These drivers include the increasing introduction of national and international statutory legislative regulation designed to reduce environmental problems, and investment in technological innovations which promote the more efficient use of natural resources. More generally, there are indications of the emergence of new strategic corporate thinking that recognises that the imperatives of business continuity will encourage the adoption of new and more resilient business models. Politically, both national and international governments and a range of international organisations such as the United Nations have also increased emphasised the importance of a transition to a more circular economic model. At the same time, a growing number of consumers are engaging with circular economic thinking and practices.

A number of barriers have been identified as hampering the transition to a more circular economy. Kirchherr et al. (2017a, p. 3) have identified a two sets of barriers to the circular economy firstly "the cultural barriers of lacking consumer interest and awareness as well as a hesitant company culture" (p. 3) and secondly "market barriers…..particularly low virgin material prices and high upfront investment costs for circular business models" (p.3). In looking to address the first of these issues, for example, Borello et al. (2017, p. 1) suggested "little is known about consumers' willingness to participate in circular economy" and employed a structured questionnaire survey to assess the willingness of a sample of some 1, 200 Italian consumers to be actively involved in closed loops designed to reduce food waste. The findings revealed that consumers were willing to participate in closed loop initiatives but that consumers

reacted negatively to having to deliver their food waste regularly back to the retail outlets, preferring instead to have food waste collected from their homes.

More generally, the World Resources Institute (2018) suggested the creation of a truly circular economy must overcome five barriers namely, consumers' expectations for convenience; government regulations that can create waste; the lack of an efficient waste infrastructure; limited recycling technology; and the wrong business models. Ritzen and Sandstrom (2017) have identified a number of attitudinal, financial, structural, and technological barriers to a transition to a more circular economy in a study of large manufacturing companies. In attitudinal terms, for example, the findings revealed that risk aversion was a prohibitive factor in making what were seen as disruptive changes to adopt a circular business model. A shift towards a circular model was also perceived to require far reaching changes within companies and to influence all departments and activities. Such changes take both time and investment and where corporate financial systems are focused on rapid returns on investment and cost savings this currently was not seen to encourage long-term strategic change.

Nevertheless, a variety of potential environmental gains, energy generating opportunities and business benefits are claimed for a transition to a circular economy. These benefits include substantially reduced carbon dioxide emissions, greater use of renewable sources of energy, reduced pollution levels, the production of energy from waste materials and increased growth and profitability. The World Economic Forum (2014, p. 13) estimated that globally the circular economy is a "trillion dollar opportunity with huge potential for innovation, job creation and economic growth". Further McKinsey and Company (2015) argued that a circular economy "would allow Europe to grow resource productivity by up to 3% annually" (webpage) and that it could generate a net economic benefit of 1.8 trillion Euros by 2030. More specifically EY (2015, p.10) suggested that "the circular economy helps to contain risks" (p. 10) for example, in managing raw material supply in competitive markets, and in providing opportunities to "extend and strengthen customer relationships", "tap into new markets", "become more efficient" and "yield extra income" (p. 10). The European Environment Agency (2016) claimed "the benefits of a transition towards a circular economy in Europe could be considerable, reducing environmental pressures in Europe and beyond and minimising the continent's high and increasing dependence on imports" and that "circular economy strategies could also result in considerable cost savings, increasing the competitiveness of Europe's industry while delivering net benefits in terms of job opportunities" (webpage).

Academic Literature and Institutional Research Programmes

A growing volume of individual research work and organisational research initiatives and programmes on the circular economy can be identified. While it is not the aim of this chapter to provide a comprehensive review of the emerging literature a few illustrative examples offer a flavour of the nature, variety and direction of this work. Much of the initial published research on the circular economy has been undertaken in China, "where the perspective on the circular economy is broad, incorporating pollution and other issues alongside waste and resource concerns, and it is framed as a response to the environmental challenges created by rapid growth and industrialization" (McDowall et al. 2017, p. 651). Wang et al. (2018, p. 885), for example, devised "a new comprehensive indicator system" (p. 885) to examine China's urban circular economy development based. The indicator was calculated for 40 cities, which are part of China's pilot circular economy cities programme over the five year period 2012-2016. The authors concluded that China's urban circular economy development had been significantly supported by national policies and that the annual growth rate in the 40 cities was higher than historic rates and that circular

economy development was becoming more and more prevalent in society and especially in urban areas. Yang et al. (2011) analysed the circular economy in a number of provinces in West China. The authors concluded that the development of the circular economy was geographically uneven and recommended the introduction of a series of measures to strengthen the construction of a circular economy system.

Research has also been undertaken on the circular economy within the tourism and hospitality sector within China. Ming and Shu (2007), for example, argued that developing the circular economy of tourism can help to achieve the more sustainable use of natural resources, to enhance the efficiency of the tourism industry and to enable tourism to contribute more effectively to sustainable development. At the same time, Ming and Shu (2007) also recognised that developing a circular economy approach within the tourist industry is complex and requires the implementation of appropriate legislative and policy and greater advocacy of green consumption. Zhang and Dong (2015) identified a number of problems in seeking to develop a circular economy model for the Mount Emei Scenic Area in Sichuan Province in China. These problems included a lack of understanding of the concept of the circular economy in tourism, excessive tourist pressure on specific sites within the scenic area, and low resource recycling rates and the poor quality of employees. In looking to address these problems Zhang and Dong (2015) drew up a tourism circular economy model built around greater government involvement in the tourist economy, encouraging both accommodation and catering companies to develop green procurement of raw materials, waste management and energy saving initiatives and designing tour routes using environmentally friendly vehicles.

More generally, Ghisellini et al. (2016, p. 12) summarised and evaluated the literature on Chinese circular economy implementation experiences and compared them experiences in other parts of the world, principally Europe and Japan in an attempt "to understand to what extent circular economy could be a solution to the need for reducing the environmental impacts of business-as-usual economic systems" (p. 12). Ghisellini et al. 2016, p. 27) concluded that although the implementation worldwide was still at an early stage, "the circular economy provides a reliable framework towards radically improving the present business model towards preventative and regenerative eco-industrial development as well as increased wellbeing based on recovered environmental integrity" (p.27). At the same time the authors recognised that "only a limited number of countries have taken preliminary actions towards circular economy and stronger commitment is still required" and that the circular economy is not "an appropriate tool for growth oriented economic systems" and that it "cannot be claimed to support further economic growth" (Ghisellini et al. 2016, p. 27).

In taking a much wider perspective Haas et al. (2015) looked to make "a rough assessment of the degree of circularity of the global economy at the turn of the century" (webpage). At that time the authors estimated that "roughly one third of global waste flows were recycled or downcycled, and the remainder was disposed to the environment directly or after treatment in waste plants and left the socioeconomic system as gaseous, liquid or solid outputs" (webpage). Further Haas et al. (2015) estimated that "the degree of circularity measured as the share of recycled material in total processed materials was very low at only 6%" and concluded "the circular economy is not in sight at present" (webpage). While the data underpinning this conclusion is now slightly dated, more recently, Circle Economy (2018) estimated "our world economy is only 9.1% circular, leaving a massive circularity gap" and argued that bridging this gap "requires intervention across the full breath of society and action in sectors, supply chains and cities" (webpage).

For the majority of consumers living in advanced capitalist economies, retail outlets are currently the major sites of consumption, and large retailers, who currently account for the majority share of consumer

spending, might be seen to be in the front line in a transition to a more circular economy. Jones and Comfort (2018a) provided some illustrations of how Europe's leading retailers are publicly addressing circular economy approaches and offered some general reflections on the application of the concept within the retail sector of the economy. At the macro level EuroCommerce and the European Retail Round Table (2015, p. 1) claimed that "retailers are a large contributor to the European Union economy' and as "responsible economic operators", they "are keen to take a front seat in shaping a circular economy in Europe" (p. 1). Further, Adela Torres Calatayud, Environment Committee Chair of EuroCommerce suggested "retailers have a key role to play in sharing the benefits of the circular economy as millions of European consumers buy their products in our stores every single day" (European Retail Round Table 2017, p.1). Jones and Comfort (2018) revealed that Europe's leading retailers articulated their commitment to the concept of the circular economy in a variety of ways and that a number of interlinked themes could be identified.

Some of the selected European retailers emphasised their strategic corporate commitment to promoting the principles of the circular economy. H&M (2017, p. 9), for example, reported its commitment to "lead the change to 100% circular and renewable fashion", which will involve "building circularity into every stage of our value chain, including the products we make and the materials we use in our operations" (H&M, 2017, p. 40). There was a focus on looking to eliminate waste and recycling, and reuse were the most common element in the selected retailers' approach to the circular economy. Kingfisher (2017, p. 21) reported "we want to play our part in the transition to a circular economy – enabling resources to be continually reused and recycled. We integrate circular economy principles into our products– designing them to use recycled materials, to be durable and long-lasting and recyclable at the end of their useful life. This is good for customers because products last longer and are easier to recycle, good for our business because it helps us reduce costs and creates opportunities for innovation, and good for the environment". Further Kingfisher (2017, p. 180), reported on how it was "exploring new services which can be an alternative to product sales, and drawing on the benefits of the circular and sharing economies" (p. 180). Kingfisher cited a number of specific examples to illustrate its approach. The retailer's Castorama chain in France have worked in partnership with Le Relais, a recycling social enterprise, in a scheme which enables customers to dispose of old clothes and linens in containers outside some of the companies' stores. In a similar vein, Kingfisher reported that Screwfix UK was extracting valuable parts, as well as plastics and metals from used and damaged power tools collected in store. These tools are broken down into ten different streams and each stream is sold to specific companies who repurpose the parts or materials.

Some of the selected retailers stressed the importance of moving towards a life cycle approach as part of their commitment to the circular economy. Ikea (2016) for example, in reporting on "transitioning to a circular economy" outlined its focus on both "products and services" and "buildings and transport" (p. 23). In addressing products and services, the company argued "that it all starts here" and more specifically that "products must be designed to last as long as they are needed……. make the most efficient use of resources….use materials that are recyclable, recycled or renewable" and "be easy to care for, repair, adapt, disassemble and reassemble and recycle" (p. 23). A number of the selected retailers looked to explicitly include a customer focus within their commitment to the circular economy. Ikea (2016), for example, reported "we will support our customers to prolong the life of their products and find new uses for the things they no longer need" (p. 23). More generally, Metro (2017) reported "developing a customer guidance system for products which can be recommended in terms of sustainability in order to support conscious purchase decisions" (p. 48). That said, Jones and Comfort (2018a) suggested that

If Europe's leading retailers' public commitments to a more circular economy are to become a reality then they will not only need to effect a radical change in their current business models but that this will need to be accompanied by radical changes in consumers consumption behaviour.

Lieder and Rashid (2016) looked to explore circular economy implementation in the context of manufacturing industry and concluded circular economy research had focused principally on waste generation, resource use and environmental impact, to the neglect of business and economic perspectives. Looking to the future, the authors also concluded that a attempts to implement a successful circular economy strategy must embrace the interests of a range of stakeholders, including policy makers, government bodies and manufacturing industries and the prioritising either environmental or economic benefits at the expense of the other should be avoided. Genovese et al. (2017) employed case studies from the chemical and food processing industries to explore the integration of circular economy principles within sustainable supply chain management. The authors concluded that "integrating the core principles of the circular economy within green supply chain management can provide clear advantages from an environmental point of view" but that "the implementation of circular supply chains may be challenging from an economic point of view" (Genovese et al., 2017, p. 355). Further Genovese et al. (2017) suggested that government support might be one way of addressing such challenges.

Tukker (2015) suggested that product service systems have been increasingly seen "as one of the most important instruments for moving society towards a resource-efficient circular economy'" (p. 76) and reviewed the literature on such systems. However, he concluded that product service systems are not a "sustainability panacea" (p. 88) and that "it will never be easy for a product service system provider to overcome the perception that he is putting his consumer in a relatively dependent position or influencing, or even prescribing, how his consumer should behave" (p. 88). More specifically, Bridgens et al. (2017) explored the development of a product service system that "facilitates the recovery of valuable functional components and metals from mobile phone circuit boards" (webpage). While Bridgens et al. (2017) discussed some of the technological challenges associated with development of product service system mobile phone they also emphasised the importance of understanding the interaction between consumer and the circular economy to ensure the willing participation in the introduction of product service systems. As such, the authors proposed a product service system "which facilitates e-waste recovery by engaging the consumer with the product they own and interact with, rather than by financial coercion" (Bridgens et al. 2017, webpage).

At an organisational level, the Pioneer Universities initiative, for example, is an international network of higher education institutions, established under the auspices of the Ellen Macarthur Foundation, which are developing "pioneering and innovative circular economy-orientated research or teaching programmes" (Ellen Macarthur Foundation 2017b, webpage). University College London, for example, through its Institute for Sustainable Resources, Institute of Making and its Centre for Resource Efficiency and the Environment looks to embed circular economy principles into its taught courses and its research activities across a range of disciplines. The University's Circular Economy Lab, founded in 2015, looks "to develop the scientific and socio-economic understanding and technological basis for design and implementation of systems, processes and policy that will support the transition to a Circular Economy" (University of Central London 2018, webpage). The Circular Economy Lab's founding prospectus statement emphasised the need for circular economy research and technology development to be "driven by the needs of the industrial/business community. We envision support of, and guidance by, an industrial ecosystem composed of one or two compatible large companies and several well-matched

small/medium-sized enterprises (SMEs), each with its own symbiotic ecological niche" (University of Central London 2018, webpage).

Teresa Domenech, a member of the Circular Economy Lab's core team co-authored work on the *"Transition to a Resource Efficient Circular Economy in Europe"* (Domenech and Bahn-Walkowiak in press, webpage). Here the authors drew on a range of policy documents and empirical surveys from the European Union and Member States to provide an review of current policy frameworks and to provide some insights into the elements shaping the policy making process. In the conclusions to this review the authors argued that the European Union's circular economy package is limited in scope and weak in terms of instrumentation in that it has no binding objectives and in that it relies on existing instruments rather introducing new economic instruments. At the same time the authors recognised current progress in recycling and reusing raw materials should increase circularity, but argued that such measures will be insufficient if they simply supplement rather than substitute the consumption of primary materials.

Cranfield University (Ellen MacArthur Foundation 2017c) has stressed its commitment to "developing a truly integrated industry-driven approach circular economy research and teaching agenda" (webpage). Within the "Circuit" research programme, for example, the University is focusing on "reverse logistics in the circular economy" and on "maximising the retained value of servitised products" (Ellen MacArthur Foundation 2017c, webpage). In addition the "Digital Intelligence to Enable a Circular Economy" research programme is looking to provide "digital intelligence to shape decisions about the manufacture and utilisation of automotive components for accelerating the implementation of more circular approaches in UK manufacturing" (Ellen MacArthur Foundation 2017c, webpage). "Sustainability and the Circular Economy" is one of four research clusters within the Business School at Exeter University. Here the focus is on an interdisciplinary approach which brings together political economists, supply chain experts, biologists, business administrators, mathematical modelers and social scientists "to explore, interrogate and challenge a wide variety of ideas relating to how we can make life on this planet more sustainable, circular and resilient" (University of Exeter Business School 2018, webpage).

Challenges for Researchers

As the focus on the concept of the circular economy continues to gain momentum within political and policymaking arenas, so researchers may wish to explore its workings in a variety of business settings. At the same time Urbinati et al. (2017) suggested that "within the strategic management field politicians, practitioners and scholars particularly, are still struggling with a lack of a framework explaining how companies willing to become circular adapt their existing business model or create new one" (p. 487). Researchers may thus also wish to develop theoretical frameworks of the circular economy in order to help to conceptualise its operation, to guide future work on the concept and to integrate it within wider conceptual and theoretical thinking on sustainability. Early work on the workings of the circular economy is already underway as exemplified in the introduction but research on the circular economy faces a number of challenges and issues, which merit reflective discussion.

Defintions and Meanings

There are issues about definition and the term circular economy can hold different meanings for different audiences. In looking to provide a rationale for their investigation of the "current understandings of the circular economy concept among scholars and practitioners" Kirchherr et al. (2017b) argued "a

concept with various understandings way ultimately collapse or remain in a deadlock due to permanent conceptual contention" (p.221). Arguably more critically, Gregson et al. (2015) suggested the idea of the circular economy is "more often celebrated than critically interrogated" and that "its actual enactment is limited and fragile" (p. 218). Korhonen et al. (2018b) argued that the circular economy was "an essentially contested concept" (p. 544) which is "loosely based on a fragmented collection of ideas derived from a variety of scientific disciplines and semi-scientific concepts" (p. 545). At the same time Korhonen et al. (2018a) claimed "the concept of circular economy and its practice have almost exclusively been developed and led by practitioners, i.e. policy-makers, businesses, business consultants, business associations, business foundations etc." while "the scientific research content of circular economy remains largely unexplored" (p. 37). Kirchherr et al. (2017b) argued that "most authors see circular economy as an avenue for economic prosperity, whereas previous scholars conducting narrative reviews of the circular economy literature had argued that circular economy would be mostly concerned with environmental aims" (p. 229).

An extensive literature review undertaken by Prieto-Sandoval et al. (2018) showed "few explicit definitions of circular economy" (p. 608) and remarkably, when Kirchherr et al. (2017b) gathered definitions published in peer reviewed journals and policy papers and reports, their sample of 114 definitions featured "95 different definitions" (p. 226). In a similar vein, Korhonen's (2018a) literature review of papers on the circular economy identified 11 definitions of the term circular economy and, arguably more worryingly, this review revealed that 13 papers "had neither a definition nor a description of what circular economy was supposed to mean in their studies" (p. 546). In recognising that the concept of the circular economy "has a multitude of different definitions'" Korhonen et al. (2018a) suggested that "a single universal definition of borders the impossible and should not be attempted because it will always exclude some interests and because it is dynamic and evolving" (p. 548). More positively, Korhonen et al. (2018a) concluded, "however this should not be used as an excuse to not develop the concept, its methodologies and practices, its policies and strategies" (p. 548).

Nevertheless, Korhonen et al. (2018b) proposed "a working definition of the concept of circular economy" (p. 547) as "viewed from the production and consumption system perspective" (p.547). As such the "circular economy is a sustainable development initiative with the objective of reducing the societal production-consumption systems' linear material and energy throughput flows by applying materials cycles, renewable and cascade-type energy flows to the linear system. Circular economy promoted high value material cycles alongside more traditional recycling and develops systems approaches to the cooperation of producers, consumers and other social actors in sustainable development work" (Korhonen 2018b, p. 547). In concluding their search for "a consensus on the circular economy" Prieto-Sandoval et al. (2018) argued that four main components should be included in the definition of the circular economy. Namely "the recirculation of resources and energy, the minimization of resources demand and the recovery of value from waste"; "a multilevel approach"; "its importance as a path to achieve sustainable development"; and "its close relationship with the way society innovates" (Prieto-Sandoval 2018, p. 610).

MEASUREMENT

Measuring circularity also presents a major challenge, but in looking to move towards a more circular economy, a number of approaches to measurement have been developed. The Ellen McArthur Founda-

tion, Granta Material Intelligence and Life (2015a), for example, has developed a Circularity Indicators Project which looks to measure "the circularity of products" (p.4). Here the "Material Circularity Indicator for a product measures the extent to which linear flow has been minimised and restorative flow maximised for its component materials, and how long and intensively it is used compared to a similar industry-average product" (Ellen McArthur Foundation, Granta Material Intelligence and Life (2015b, p.19). Essentially, the Material Circularity Indicator which looks to measure not only "how restorative the material flows of a product or company are" but also "complementary indicators that additional impacts and risks to be taken into account" (p. 30.). The index is presented as a value between 0 and 1, with circularity increasing as the value approaches 1.

While recognising that "measuring the circularity of a product or service can be a challenge due to the complexity and variety of actions, activities and projects that could be called circular", the US Chamber of Commerce Foundation (2018a, webpage) has developed a Circular Economy Toolbox, which includes a number of metrics to measure impact. The proposed circular economy metrics include the carbon footprint, estimated cost savings when leasing rather than buying, estimated resource and emission offsets and the percentage of a product that can be recycled or repaired at the end of its useful life. At the same time the US Chamber of Commerce Foundation (2018b) asserted, "there is currently no single accepted framework to enable organizations to assess and report on their progress in moving towards circularity" and argued that the lack of such a "framework represents one of the greatest needs, and greatest opportunities, in the circular economy" (webpage). In a similar vein, Saidani et al. (2017) suggested, "current tools neither consider the whole complexity of the circular economy paradigm, nor provide operational guidance for engineers, designers or managers to improve their products in the context of circular economy" (webpage).

Empirical Research

There are issues in undertaking empirical research into the workings of the circular economy. The majority of the academic literature on the circular economy to date falls into one of two groups. On the one hand, the focus has been on reviewing the concept of the circular economy or providing prescriptions for its implementation. On the other hand, empirical work has focused on the analysis of published sources of data and/or policy documentation with little or no attempt to collect primary information and data. This might be seen to highlight the challenges involved in framing research projects designed to explore how companies approach the circular economy, on how they go about framing and implementing strategies designed to achieve a more circular business approach and on how they identify and look to overcome perceived barriers to the adoption of circular business models. At the same time, there are also challenges in undertaking research designed to explore consumers' attitudes to the circular economy and to product service systems and to examine if and how such attitudes influence consumer buying behaviour.

At the corporate level, each proposed research project will have its own specific set of aims and an appropriate methodological approach designed to achieve those aims. That said, research projects may have the challenge of getting access to organisations, to their strategy documentation and to company decision makers, at a variety of levels, who are responsible for designing, driving and implementing circular approaches to the company's business operations and its relations with other companies in its supply chain. Karjalainen et al. (2015) argued, "the question of research access is fundamental to much empirical research. Yet it is still often neglected in the analysis and reporting of research" (p. 274). Researchers may face a number of difficulties in looking to gain/negotiate access to companies, which are

introducing circular economy approaches and producer service systems. Companies may be reluctant or unwilling to allow access to corporate data and/or decision makers for a number of reasons, including the protection of intellectual property, concerns that data may be misinterpreted, a reluctance to discuss emerging and unproven technologies with people outside the company and commercial confidentiality. This last issue may be a particularly sensitive issue where companies believe they are developing cutting edge innovations to develop more circular approaches that may give them a vital competitive advantage in what is a dynamic marketplace.

While access to consumers designed to explore their attitudes to the circular economy and into attendant consumer buying behaviour may initially seem more straightforward, here too there are challenges. The traditional approach to consumption is based on the individual consumer as the basic unit of analysis. Here consumers are seen to be empowered individuals making decisions for themselves, or their households, and voluntarily exercising their freedom of choice, in their buying behaviour. As such conventional survey research methods might be seen to appropriate in revealing consumers' attitudes and buying behaviour but this ignores what Welch and Wardle (2015) described as "the attitude behaviour gap", namely "the phenomenon of the discrepancy between reported pro-environmental values and obdurately unsustainable behaviour" (p. 88). On the one hand this suggests the need for a more ethnographic research approach as a way of understanding consumers' attitudes and behaviours. On the other hand, Hobson (2016) has suggested that emerging work in the social sciences on 'theories of practice' (p. 15) where "practices, instead of individuals, become the units of analysis that matter most" (Spaargaren 2011, p. 815) may prove fruitful. As such Hobson (2016) argued that "making practices more sustainable requires questioning how and why current needs are met, and about thinking creatively about other ways to meet needs" (p.15). Here qualitative studies, based for example, around semi-structured interviews, designed to gain greater understanding of consumers' thoughts and feeling about the circular economy might offer an appropriate research approach.

Socio-Economic Issues

There are a set of more fundamental socio-economic issues which can be seen to have implications for the nature and direction of research into the circular economy. While the circular economy has a strong environmental focus much less attention has been paid to the social dimension. Murray et al. (2015), for example, argued that the circular economy "is virtually silent on the social dimension, concentrating on the redesign of manufacturing and service systems to benefit the biosphere" (p. 22). A number of issues may be important here. While the transition to a circular economy will bring socio-economic benefits, for example in terms of the creation of new employment opportunities associated with the establishment of new waste management and recycling facilities, issues may arise in terms of the quality of such opportunities, the reward levels associated with them and the geographical distribution of such benefits at regional, national and international levels. As such, any attempt to evaluate the impact of the introduction of circular economy approaches at company or national levels will need to be alert to the wider potential social implications in other geographical realms.

Arguably more contentiously, there are concerns rooted in political economy which merit attention in a comprehensive approach to research on the circular economy. Hobson (2016), for example, suggested that current "academic, policy and business-led analyses frame transformations towards the circular economy as predominantly issues of innovation, technical systems, fiscal and business incentives and reformulated business models" while "little has been said about the socio-political implications and

possibilities for shifting current production-consumption-use- waste practices" (p. 3). Further Hobson (2016) poses the question "is the circular economy yet another iteration of capitalist crisis, reproduction and survival or does it productively merge disparate discourses and actors to garner much-needed action around the manifold issues of global sustainability" (p. 3).

At the same time there are related issues about how the concept of the circular economy might be being captured by corporate interests, and more specifically by corporate capitalism, to justify continuing economic growth despite concerns about the overconsumption of natural resources and the damaging environmental effects of such growth. Valenzuela and Bohm (2017), for example, argued that the terms circular economy and sustainability were effectively being "captured by politic-economic elites claiming that rapid economic growth can be achieved in a way that manages to remain responsible to environment and society" (p. 27). In their conclusions, Valenzuela and Bohm (2017) pessimistically suggested that "the closer we get to the ideal of a fully circular economy, the more we are allowed to consume without taking an ethico-political stance" (p. 50). It is important that researchers look to recognise the embedded values in the current mainstream approaches to the circular economy, which can be seen to enhance some economic and social values, for, while at the same time minimizing threats to other values, such as continuing economic growth.

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

Interest in the concept of the circular economy is gathering momentum amongst policy makers and within the business world. That said, at the present time it remains to be seen whether or not the circular economy can become a workable and realistic business model. More specifically, if the circular economy is to become a reality then winning the hearts and minds of consumers may prove to be its most testing challenge. At the same time, the concept and the workings of the circular economy have attracted increasing attention from researchers and within the academic literature. Whiles ome of the initial published research on the circular economy was undertaken at a broad level within regional and urban economies in China, work now covers a range of specific economic sectors and geographical areas. Looking to the future, research into the workings of the circular economy seems likely to grow, but researchers seem to face a number of challenges including problems of definition, measurement, pursuing empirical avenues of enquiry and wider socio-economic issues, which reflect underlying values.

That said, a number of future research directions can be identified. Firstly, consumers' perceptions of, and enthusiasms for, the changes a transition to a more circular economy will demand, will provide valuable insights into what may be a radically changing consumption process. In exploring such consumer perceptions, questionnaire surveys, semi structured interviews and focus groups might provide valuable methods of empirical enquiry. Secondly, given that for the majority of consumers living in advanced capitalist economies, retail outlets are currently the major sites of consumption, potentially fruitful research may be conducted into how a variety of retailers are engaging with the circular economy. More specifically, such work might profitably explore how such circular economy strategies and business models are being driven, and/or being resisted, by retailers, not only within their own organisations, but also within their supply chains. At the same time, researchers might investigate the challenges and barriers that retailers are facing in looking to pursue a circular economy strategy and explore the ways in which both retailers and suppliers are looking to address and overcome such challenges and barriers. Here, researchers will need to negotiate executive level access within retail companies and within their suppliers in order to

explore strategic decision making. Thirdly, researchers might explore how technological developments are underpinning, and driving, circular economy initiatives. Fourthly, research is required to devise, and test, indicators that can provide a measure of the extent to which companies are moving towards a more circular economy model. Finally, research enquiries might focus on the extent to which global recycling networks are contributing to the emergence and development of circular economies.

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