CHAPTER 3. SUSTAINABILITY AND THE CIRCULAR ECONOMY

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Abstract

Sustainability is a triad including techno-economic efficiency, compatibility with the "Planetary Boundaries", and equity - enabling a decent quality of life for all. Circular Economy models often focus only on closing material flows in order to increase economic activity or market share. This overlooks the equity dimension. Here we focus on the Performance Economy, which extends the Circular Economy in ways that can enhance equity. The Performance Economy model concentrates on making best use of stocks in the economy, including labour which is a renewable resource. Extending product life through re-use, remanufacturing and reprocessing and shifting from non-renewable inputs (including energy) to renewable inputs (including labour) can improve resource efficiency and increase the supply of rewarding employment. The Performance Economy requires changes in business practices more than technological innovation, including a different view of the functions of value chains, and can be promoted by different approaches to taxation.

Keywords

Sustainability and sustainable development; Circular and performance economies; Re-use, remanufacturing and recycling; Resource efficiency; Extended Producer Responsibility; Social equity; Labour and employment; Product life; Stocks and flows; Global trade

1. Introduction

Of the Sustainable Development Goals discussed in the previous chapter (UN, 2015), this chapter is concerned mainly with no.12 – Responsible Consumption and Production. We explore how changes in infrastructure, business models and practices, supply systems and consumer expectations can all lead to a more sustainable economy.

1.1 A Brief History of Sustainability

Sustainability is an emergent property of a complex system, whereas *sustainable development* is a process of change towards a more sustainable state. These concepts were introduced by the Brundtland report (U.N., 1987), which conceived sustainable development as meeting "the needs of the present without compromising the ability of future generations to meet their needs" and built on the earlier Brandt Commission (Brandt, 1982, p. 23) which had pointed out firmly that:

> "One must avoid the persistent confusion of growth with development, and we strongly emphasise that the prime objective of development is to lead to self-

> fulfilment and creative partnership in the use of a nation's productive forces and its full human potential."

Amongst the literature exploring these concepts and the related question of how happiness and quality of life can best be promoted, Jackson (2010, p. 20) has provided one of the most succinct articulations of sustainability:

> "Sustainability is the art of living well, within the ecological limits of a finite planet.*"*

"Living well" means flourishing, with a decent level of material comfort, security and dignity, but also has a moral sense: not living at the expense of the well-being of others and thus feeling your life is good in ethical terms.

Recognition of limits is fundamental: if economic activity could be expanded without limits, sustainability of development would not be a concern. Sustainability is commonly represented as having three sets of limits: techno-economic; environmental or ecological; and social or societal (e.g. Clift, 1995; Mitchell *et al.*, 2004; Purvis *et al.*, 2019). The relationship between them is frequently represented as a Venn diagram (Figure 1) in which the three lobes represent decision spaces, bounded by "hard" or "soft" constraints[1]. Showing them overlapping represents our hope that a sustainable economy satisfying all three limits can be found. Sustainable development implies finding a path from current activities (point X in Figure 1) to sustainability; i.e. the region where all three sets of constraints are respected.

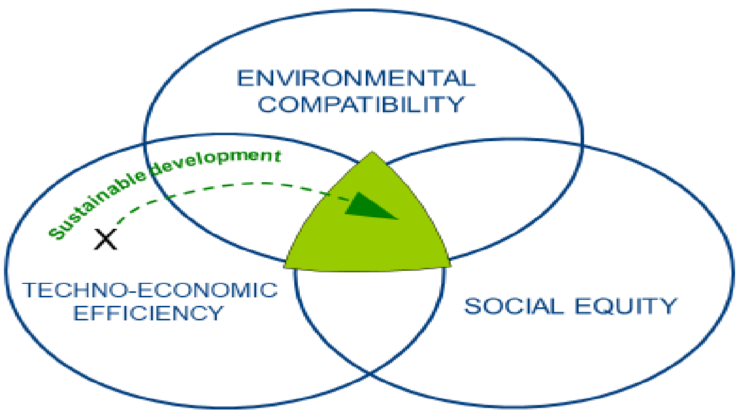

Figure 1 Sustainability and Sustainable Development (adapted from Clift (1995) and Clift et al. (2013))

"Techno-economic efficiency" represents the ranges of possible activities limited by technical skills and ingenuity, the laws of thermodynamics, and the need for efficiency as defined by

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[1] Authors who argue that the lobes should be concentric (e.g. Mitchell, 2000; Velenturf and Purnell, 2021) are illustrating a different metaphor in which they represent fields of interest or governance.

the prevailing economic system. It is important that the laws of thermodynamics are hard-wired into the universe whereas the "laws" of economics are human constructs and therefore mutable, for example by changes to the fiscal system. "Environmental compatibility" represents activities consistent with the resource and carrying capacity of the planet. Recent attempts to define these constraints and apply them in environmental management tools have focussed on the Planetary Boundaries approach (Rockström *et al.,* 2009; Steffen *et al.*, 2015; Clift *et al.*, 2017). "Social equity", emphasised in the Brandt report (1982), is an ethical principle at the heart of sustainable development. Dearing *et al.* (2014) and Raworth (2017), amongst others, have considered how to reconcile the social foundations of development with the Planetary Boundaries.

1.2 Circularity and Sustainability

Publications concerned with the idea of the circular economy have expanded ten-fold since 2015 (Velenturf and Purnell, 2021). The circular economy, with "closed loop" flows within the economy, is usually presented as an alternative to the "linear" use of resources that has prevailed since the industrial revolution. Figure 2 shows the distinction. Flows in the "linear" economy are shown as full lines. Production and post-consumer waste are inevitable - a "waste-free" economy is thermodynamically impossible (Georgescu-Roegen, 1971) - but waste can remain part of the economy even in a linear economy[2] because material is only truly lost when it is dispersed into the environment.

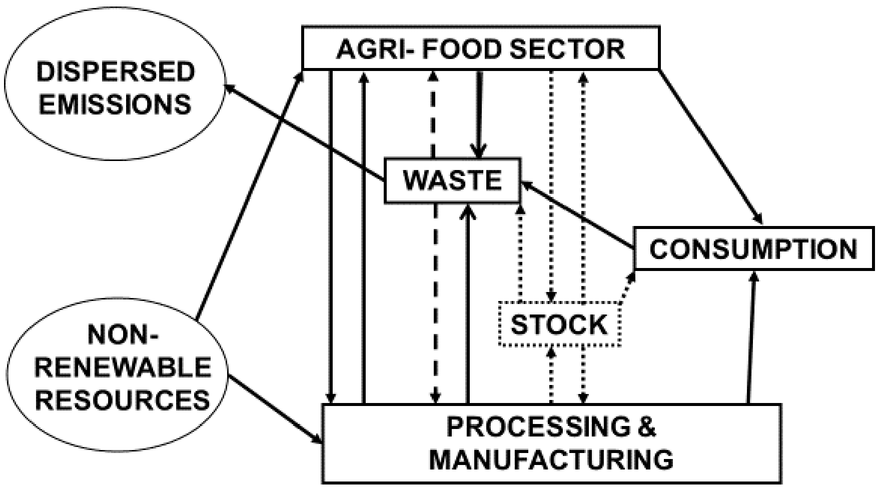

Figure 2 Linear, Circular and Performance Economies *(adapted from Clift, 2013)*

A commonly-cited definition (McKinsey, 2012, p. 14) states:

[2] E.g. old landfills are increasingly mined for their content of relatively scarce metals.

> "The circular economy refers to an industrial economy that is restorative by intention…and eradicates waste through careful design".

This interpretation emphasises immediate re-use and recycling of "waste" materials and used products: "circularity" refers to flows within the economy, shown by the broken lines in Figure 2. This improves resource efficiency by reducing demand for fresh products, waste from processing and manufacturing and resource extraction..

However, "circular economy" has a broad range of meanings. Kirchherr et al. (2017) reviewed 114 proposed definitions and concluded "the circular economy is most frequently depicted as a combination of reduce, reuse and recycle activities…(with)…few explicit linkages…to sustainable development." The usual focus is economic prosperity, sometimes with environmental quality, rarely including social or intergenerational equity, and even more rarely recognising systemic changes or the agents who might drive them.

Rather than introducing yet another definition, we use that given by the (UK) Waste and Resources Action Programme (WRAP, 2021):

> "A circular economy is an alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life."

This definition focusses on the stock of materials in use (infrastructure, buildings, plant, vehicles, appliances, etc.) and considers the resource flows and interactions indicated by the dotted arrows in Figure 2. Although the link to sustainability is not explicit, the need for systemic change is recognised, emphasising the longevity, utility and efficiency of the stock of products and materials in use.Thus economic restructuring for better resource efficiency goes beyond "circular" flows: "reduce, reuse and recycle activities" are secondary, one of several approaches to improving resource efficiency in building up, maintaining and using stock and infrastructure and in reducing the impacts of consumption. It includes the renewable stock of labour and so also enables the neglected social lobe to be included.

The focus on efficient use of stock rather than just "closing loops" in material flows is becoming more widely accepted. It is embodied in the Action Plan of the European Commission (2020). The Ellen MacArthur Foundation, long an advocate of the "circular flows" approach (Webster, 2015), has now (2021) articulated its policy goals as:

- Stimulate design for the circular economy;
- Manage resources to preserve value;
- Make the economics work;
- Invest in innovation, infrastructure and skills;
- Collaborate for system change.

Following Stahel (2010, 2019), we refer to the stock-centred model as the *Performance Economy*. The argument that living and interacting with high-quality stock, including the built environment, is at least as important as "consumption" flows in maintaining quality of life (Clift *et al.*, 2013; Jackson, 2017) further supports focussing on the most resource-efficient ways to use, maintain, and improve capital stock. However, even though thinking has moved away from circular material flows back to the emphasis on resource efficiency that is central to industrial ecology (Clift, 2013), the term "Circular Economy" has become so familiar that we retain it here as a general heading.

2. Material Resource Efficiency

2.1 Re-use, Remanufacturing and Recycling

"Stock" includes "manufactured capital": buildings, goods and infrastructure. Figure 3 shows the three "loops" that summarise the approach to reducing material intensity in the performance economy (King *et al.*, 2006; Stahel, 2010) with their geographical scales:
Re-use includes direct re-use such as refilling beverage containers or cleaning and refurbishing garments. It also includes cases where ownership changes, for example via a second-hand market or a mechanism such as eBay. These activities are usually carried out locally.
Remanufacturing (Loop 1) includes repair and remanufacture of used goods and "upgrading" to meet new performance standards or fashion. It is typically more labour intensive and less energy-intensive than recycling, and may be a small-scale local activity such as repairing appliances or vehicles (Stahel, 2010; Stahel and Clift, 2016). Complex items may be taken to regional service centres, but global movement of goods for remanufacturing is rare.
Recycling and reprocessing (Loop 2) refers to reprocessing or dismantling to recover materials or components. The recovered materials may be recycled into the same product system ("closed-loop recycling"), as shown in Figure 3, or may pass to Loop 2 of a different product system ("open-loop recycling"), often with lower performance requirements ("down-cycling"). Recycling is usually carried out at a larger scale than remanufacturing, in a regional or global product system. Production and use of both virgin and secondary materials are typically more energy-intensive than remanufacturing (Stahel, 2010; Allwood, 2014; Stahel and Clift, 2016).

To both reduce non-renewable resources use and generate employment, re-use and remanufacturing (Loop1) are usually preferable to reprocessing (Loop2), with primary production the least desirable (Stahel, 2010 and 2019). More detailed analysis (Stahel and Clift, 2016) shows that the priority order for changing design and practice is:

1. Extend service life, to reduce material throughput;
2. Intensify use of stock, to reduce stock needed;
3. Increase the proportion of post-use products remanufactured;
4. Increase the proportion of post-use products and materials reprocessed.

These priorities underpin the structural changes needed. Product longevity is specifically emphasised in the policies of the European Union (EC, 2020), although making it a legal requirement is problematic (Tonner and Malcolm, 2017).

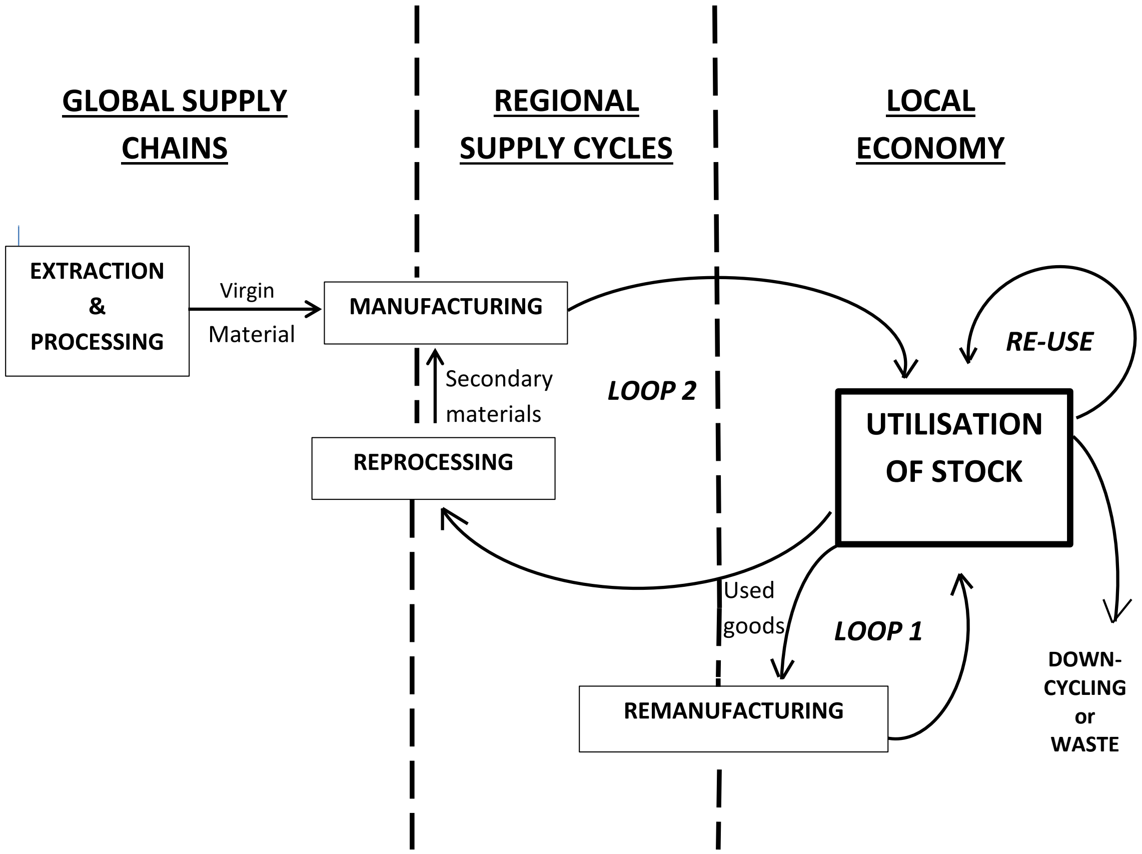

Figure 3 Material loops in the performance economy *(adapted from Stahel and Clift, 2016)*

2.2 Material Reprocessing and Energy Recovery

Figure 4 shows an idealised system to obtain maximum value from a material as it passes through the economy, through a ***cascade of uses*** with successively lower requirements on purity and material properties. It is complementary to Figure 3, which refers to a manufactured product.

Following primary production, the material is processed for use 1. It may be re-used several times in this form, and also reprocessed for the same use. Eventually, because of contamination or degradation, the material must leave the first use loop. It may then be ***downcycled*** to a second use with lower performance specifications; re-used and reprocessed several times in this use, before being downcycled again; and so on. As a specific example, aluminium may be used in beverage containers, then passed to use in mechanical components (e.g. in vehicles), and then structural items (e.g. building components). A system for plastics is outlined in the Text Box, to illustrate that multiple re-use and recycling is more complex than merely closing material loops.

Ultimately, the material must become so contaminated or degraded that there is no demand for it or the resource input or cost to reprocess it become larger than for virgin material. End-of-life waste is inevitable even in a fully-developed circular economy so that waste management will always be needed. Plastic packaging illustrates the need for energy recovery from waste is necessary even in a circular economy (see Text Box).

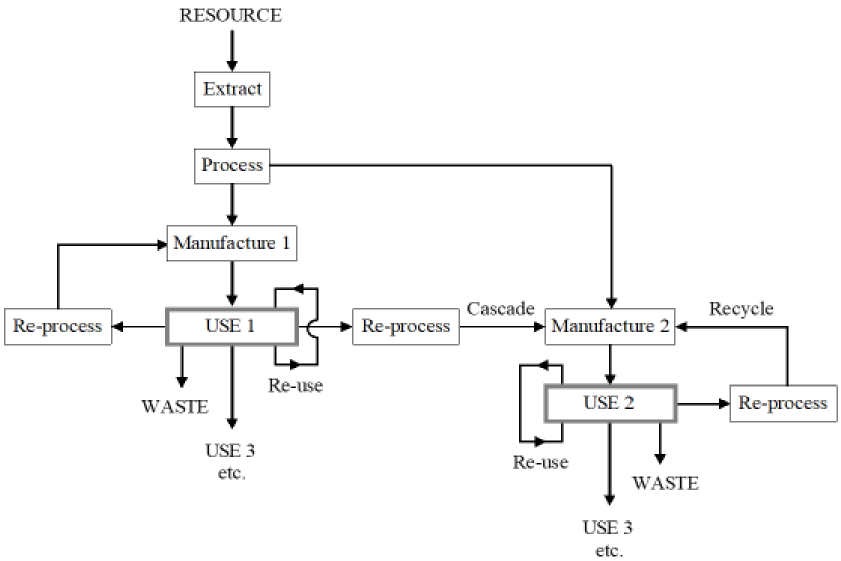

Figure 4: Re-use, reprocessing and cascaded use of a material (Clift, 2013)

Text Box : Circular Economy for Plastics

Figure 5 maps the industrial ecology of plastic produced from fossil hydrocarbons; i.e. it shows the principle flows and uses of plastics in the economy.

Starting at the top left, the raw material is extracted and processed to produce the monomer (e.g. ethylene) which is polymerised to make the polymer (e.g. polyethylene). Before forming into a plastic product, additives including plasticisers, fillers and pigments must be added to give the required material properties. Thus plastics put to different uses are already differentiated at this point.

Possible routes for re-use, reprocessing and recycling start at the top right of Figure 5. Plastic formed into a durable product, such as a toner cartridge for a printer, may be re-used. However, these items eventually become damaged or contaminated so that they must be remanufactured or reprocessed. Provided the plastic is not contaminated or mingled with different materials, it may be possible to re-form it into a replacement or a similar product (closed-loop "mechanical recycling" in Figure 5). The demand for items made from mixed waste plastic is small, so open-loop mechanical recycling is not shown. Some plastics may be "depolymerised" back to the monomer, which can be recycled to polymerisation. More commonly, mixed waste plastic must be recycled chemically; i.e. converted thermally into a chemical product which is reprocessed or used as a fuel. Failing this, the waste can be used directly in energy-from-waste plants, or else landfilled.

The further the loops are from the corner in Figure 5, the less environmentally beneficial they are. Keeping material in the inner loops requires it to be kept clean and not mixed with plastics containing different polymers or additives. This option is not available for single-use plastic, including most packaging. Thus use as an energy source is a necessary part of any truly closed-loop system for plastics. The alternative is landfilling to sequester carbon, but energy recovery is usually preferable on environmental grounds (Evangelisti *et al.*, 2015; Gear *et al.*, 2018).

Figure 5 also shows the principal points in the industrial ecology where plastics can "leak" from the economy into the environment to contribute to the problem of plastic pollution. Once released, a plastic item is carried by environmental flows to end up in the ocean. Ocean plastic is so mixed and contaminated that it cannot realistically be recycled and may not even be usable as a fuel (Clift *et al.*, 2019): it is a legacy that must be collected and landfilled, and also a source of social inequity because the impacts affect people other than those who used the plastic. To limit future plastic pollution, it is essential to avoid "leakage" by ensuring that all the loops in Figure 5 are in place, including energy recovery.

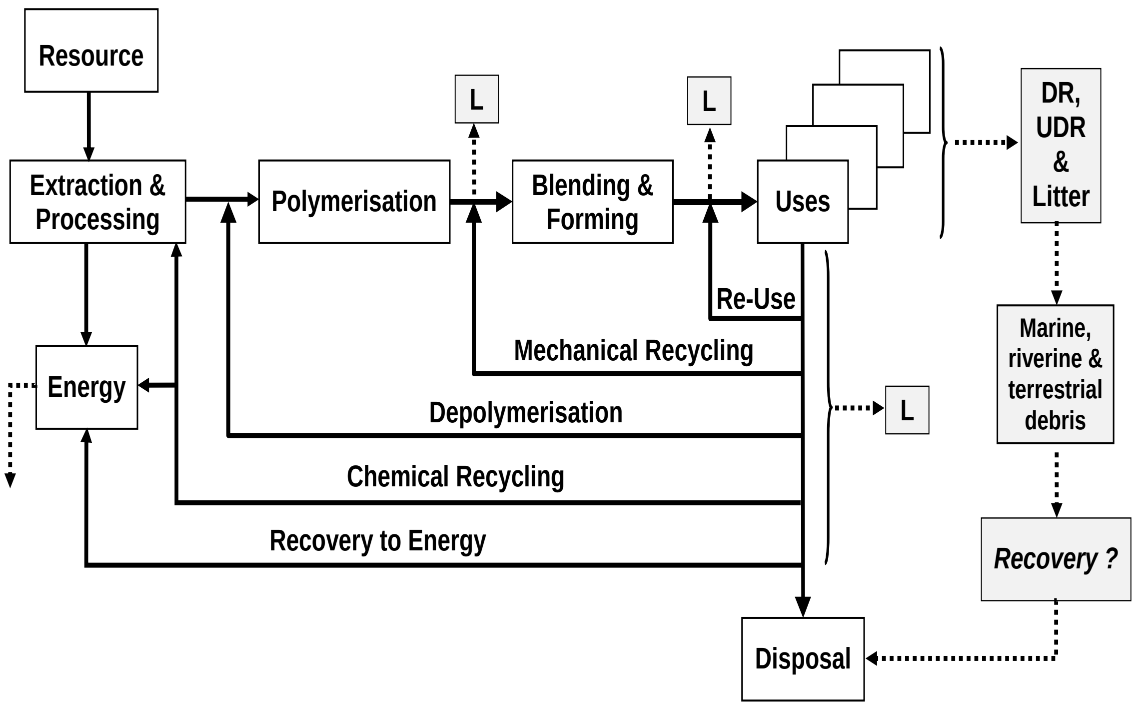

Figure 5: The Industrial Ecology of Plastics; adapted from Clift (1997) and Clift et al. (2019)

3. Structural Changes

Pursuing sustainability entails restructuring to achieve a more resource-efficient and equitable economy. Developing the approaches in Section 2 is only part of this restructuring: circularity is not an end in itself. We now consider other factors determining the performance of an economy.

3.1 Redeployment: Labour in the Performance Economy

To understand the structural changes needed to move to a more sustainable performance economy, "stock" must be extended to include the "five capitals": manufactured, social, human, financial, and natural (Porritt, 2005; Forum for the Future, 2014). In addition to "natural capital" (i.e. renewable and non-renewable natural resources), we focus on "social capital" (i.e. the formal and informal structures and relationships on which a society depends) and "human capital" (i.e. the knowledge, skills and experience of individuals and groups in the society) which we conflate as "labour". Natural capital relates to the "Environmental Compatibility" lobe of Figure 1 while labour relates mainly to Social Equity. Restructuring involves more than changes in processes to maintain physical stock: the performance economy implies an integrative framework that links the life cycles of materials to their social webs (Laurenti *et al.*, 2018), realigning social relationships and improving human skills.

Labour has both stock and flow dimensions. Labour as non-material stock represents the available resource of social and human capital. Labour also denotes the use of this stock in economic and social activities: i.e. a flow into these activities. The stock is not depleted when labour is used; therefore it is a renewable resource, in contrast with non-renewable stocks of materials and fossil energy.

Non-renewable resources, primarily deposits of minerals and fossil energy, are key parts of natural capital. Unemployment and low wages are features of socioeconomic inequality. Therefore, substituting non-renewable resource use by renewable labour addresses both the "Environmental Compatibility" and "Social Equity" dimensions of sustainability (Figure 1). In aiming for higher employment and therefore lower labour efficiency, the performance economy represents a reversal of the structural economic changes during and following the industrial revolution. Seeing employment as a social good represents a reversal of conventional economic thinking, which sees labour as a cost and labour efficiency as an indicator of desirable social outcomes such as wages and leisure time.[3]

Stahel's (2010, 2019) concept of the Performance Economy also addresses policy measures to promote the shift from energy use to labour: taxing use of non-renewable resources, rather than renewable resources like labour, provides a practical application of the idea that the economic part of "Techno-economic Efficiency" (Figure 1) can be changed by fiscal measures. However, achieving meaningful shifts of taxation from labour to materials is complex and politically difficult; see Section 4.2.

[3]See Isham et al. (2021) for a discussion of this tension.

3.2 Socialising Business Practices: Beyond the Profit Motive

The economics laureate Milton Friedman (1970) famously declared "the social responsibility of business is to increase its profits" to maximize short-term shareholder value. However, obsession with short-term profit is incompatible with the environmental and equity goals inherent in sustainability. COVID-19's social problems have intensified critiques of the Friedman paradigm, making it "sound emptier than ever" (Ward, 2020: 1) and amplifying expectations that business should provide societal benefits as well as profits.

The idea of ***Corporate Social Responsibility*** **(CSR)** developed from the 1980s as a move to engage external *stake*holders who are outside a business but affected by its actions (customers, suppliers, creditors, the local community, society, government) in addition to the internal *share*holders (employees, owners, investors) recognised by Friedman (Freeman and Reed, 1983). Attempts to measure CSR performance have achieved limited success (Korhonen, 2003). More transparent ***Environmental, Social, and Governance*** **(ESG)** ratings have evolved to provide investors with data for assessing the performance of corporations in these domains (e.g. Sustainalytics, 2021). However, they are still intended to measure economic risks rather than sustainability. Although current CSR and ESG initiatives embody a move away from Friedman's exclusive focus on profit, they do not fully address the social and environmental components of sustainability.

Socializing business practices involves a more radical approach. It was noted in Section 1 that the circular economy approach focuses on material flows, while the performance economy approach recognises both social and physical stocks. Labour as social stock is an underappreciated factor for promoting sustainability in the circular economy: "reconsidering labor is essential to tackling the large share of dissipated material and energy flows that cannot be recovered economically" (Moreau *et al.*, 2017, p. 497). Circular economy transitions are generally predicted to increase employment (Wijkman and Skanders, 2015; Wiebe *et al.*, 2019) and hence reduce the structural socioeconomic disparities that have a negative effect on quality of life for all (Wilkinson and Pickett, 2010).

The more radical approach requires a different conception of ***value chains.*** The term conventionally refers to the activities and functions within businesses to deliver products and services and provide competitive economic advantages. The concept is a development of the Friedman business model: it maximizes shareholder profit (Porter, 1985) but has been updated to incorporate CSR (Porter and Kramer, 2011). By contrast, the Performance Economy model challenges businesses to develop the labour component of their value chains as a goal in itself, thereby helping to fulfil their neglected social remit; a value chain is seen as a set of relationships that delivers benefits in both directions along the chain (Clift *et al.*, 2013; Makower, 2021). The social benefit of providing employment can lead to the environmental benefit of reducing non-renewable inputs. Under an appropriate fiscal system (see Section 4.2), this can translate into economic advantages.

Education serves as an illustration. Social benefits accrue from individuals acquiring new craft and digital skills (Tilak, 2008). Businesses generally rely on outside institutions to provide workers with the required knowledge and skills to provide the necessary input; i.e. to build up and maintain the stock of labour. Furthermore, educational programs provide occupations for their staffs and teachers. This illustrates the way in which the performance economy recognises and benefits from its social embeddedness: education and training to maintain the labour stock are amongst the two-way benefits of value chains. As Laurenti et al. (2018) put it: “this important feedback loop needs to be explicitly taken into account in circular economy initiatives”.

In the current circular economy discourse, little attention is paid to the wider structural framework of social systems within which all economies operate, but social sustainability requires the broader perspective (Ede, 2017). ***Social enterprises*** provide opportunities to integrate the economic, environmental, and social domains of sustainability and sustainable development (Sahakian, 2016). A social enterprise is a business with monetary return but without profit maximization. The intent is to address social or environmental problems, using business practices to support this purpose(Vickers *et al.*, 2017; Gomez, 2016). Social enterprises have been emerging around the world, involving major bridging institutions: markets, civil organizations, states, and international aid programs (Kerlin, 2010). The model is rooted in a value proposition that “embeds” business activity in social and environmental performance (Stratan, 2017). Social enterprises can link social causes with environmental performance and include both in accounts along with financial performance. Profits are retained for expansion and improvement. Investors receive back what they put in but there are no dividends.

3.3 Dematerialisation and Employment

The focus on stock in the Performance Economy model leads to the priorities identified in Section 2.1 to better align economic profitability with sustainability by decreasing material throughput and non-renewable resource use and increasing the use of renewable labour. Remanufacturing to extend the service lives of products is generally more labour-intensive than primary extraction and processing, as well as less intensive in use of physical inputs and the associated environmental impacts (Schau *et al.*, 2012; Jensen *et al.*, 2019). It is less routine and repetitive than primary manufacture, and therefore less open to automation. The European Commission (2020) estimates that job-intensive reforms in circular economies could generate about 700,000 jobs in the EU by 2030. Servicing and remanufacturing require humans with flexible skills, not programmed robots, countering the possibility that a new wave of automation could displace workers, particularly in “blue-collar” craft occupations (WEF, 2020). Automobiles are a prime example: while virgin models are made on large centralised assembly lines, their lives are extended by local enterprises employing human labour (Stahel, 2019). Businesses based on quality goods, produced and serviced by highly-skilled labourers, can similarly improve quality of life for both consumers and workers (Clift *et al.*, 2013). The associated shifts in labour and social relations meet the MacArthur Foundation policy goal to invest in technical innovation, infrastructure, and human skill (see Section 1.2).

Dematerialisation is associated with a broader change: ***servicisation*** – i.e. moving away from material products to service provision (Stahel, 2013; 2019). Stahel (2016) sees this as “a new relationship with our goods and materials”. Service provision as a business model has been growing since the 1980s (Vandermerwe and Rada, 1988), illustrated by leasing of equipment like photocopiers. The value chain for a servicised business can lead to greater resource efficiency and increased employment (Heiskanen and Jalas, 2000) by promoting the changes identified in Section 2.1. However, servicisation has not yet produced a widespread sustainability-driven paradigm shift in business practices; rather, as in the interpretation of "circularity" discussed in Section 1.2, it has been seen as a way to make continuing profits beyond product sales. Servicisation is most likely to succeed commercially if a product has high use value relative to production and disposal costs (Örsdemir *et al.*, 2018); it has resulted in profit growth particularly for producers of complex high-value products, such as aircraft, automobiles, and ICT equipment, whose use is accompanied by service contracts (Stahel and Clift, 2016; Lightfoot, 2021). However, reluctance to shift from product sales to service is widespread: "most companies either don't know how or don't care to provide after-sales services" (Cohen *et al.*, 2006).

Extended Producer Responsibility (EPR) is a complementary approach in which the producer retains liability for material products at the end of their service life but does not usually retain ownership or liability in use. EPR is sometimes seen as a driver for stock preservation similar to servicisation (Stahel, 2010; Malcolm, 2019), requiring manufacturers to incorporate end-of-life remanufacturing and reprocessing and longevity in product design. A few companies have adopted EPR for commercial reasons, particularly where their business is part service so that the return system already exists; the Xerox Asset Recovery Operation is a notable early example (Clift, 2013). However, EPR is rarely economically attractive (Clift and Wright, 2000): only in a few instances are the prices of scarce materials (notably some rare earths) high enough to promote recovery, and technological change often removes the possibility of re-using components in "new" products. Environmental taxes have not generally been effective in promoting re-use or recycling because, with the exception of disposal charges for some hazardous materials, they are not high enough to offset the expense of recovery and disassembly. In the absence of economic incentives aligned with environmental benefits, EPR has developed mainly as a regulatory approach rather than a voluntary business strategy: companies are mandated to "take back" their products at end-of-life.

EPR legislation has two complementary objectives: ensuring that substances presenting risks to human and environmental health are recycled or at least managed , and inducing manufacturers to design their products to facilitate re-use of components and recovery of materials. The latter objective requires legislation to be framed so that items are returned to the original manufacturer, to build-in the link between take-back and product design (Lindhqvist and Lifset, 2003). However, due to a combination of confused legislative processes and industry push-back, implementation of EPR has generally been cumbersome (Castell *et al.*, 2008; Mayers *et al.*, 2011). Mayers (2016) concluded:

> "While EPR was developed with good motives, in practice its implementation is both administratively and logistically complex, and to date the main purpose to incentivise design is largely unfulfilled."

EPR is not a driver for some of the other benefits of servicisation, and specifically does not promote longevity. Tonner and Malcolm (2017) suggested statutory lifespan guarantees for specific groups of products. However, this would be resisted as a move towards a command-and-control approach. Furthermore, it would be difficult to frame legislation that recognised that optimal service life differs between different products.

3.4 Localisation of Activities: “Small is Beautiful”

Formal and informal ***co-operative associations*** at the local level provide frameworks for socializing the circular economy. Remanufacturing - “Loop 1” in Figure 3 – is typically carried out in small-scale local sites or even in the home, and is labour intensive. This makes remanufacturing less subject than capital-intensive activities to “economies of scale”. Efficiencies result from loops that are more proximate (Stahel and Clift, 2016). Local enterprises can benefit from cooperation in developing and deploying the human capital required for remanufacturing. This, in turn, encourages local networks to grow into stand-alone regional enterprises (Stahel and Clift, 2016). A social economy incorporating these elements can become one of the agents transforming the biophysical-based economy (North, 1999; Sahakian, 2016).

Mending and restoring goods as they wear and break-down is essential to extend product life, but can also be an antidote to globalised mass production of low cost throwaway goods. Local businesses, as well as individual consumers, can contribute to the necessary development of repair shops. For example, there are more than a thousand Repair Cafe volunteer organizations in Western Europe, helping people to fix broken goods (Charter, 2018). The emergence of a “right-to-repair” movement, embodying the principle of “keeping resources in use for as long as possible” (WRAP, 2021), indicates the growing public demand for product life extension (Duvall *et al.*, 2016). It challenges control of the repair function by manufacturers that can increase the lifetime cost (Stahel, 2019) and limit independent repair shops by denying access to spare parts, specialized tools, and technical manuals.

Industrial symbiosis (IS) is a different type of co-operative association, linking productive activities through flows of physical by-products, especially flows that would otherwise be wastes. IS provides an opportunity to focus on labour stocks as well as material flows because labour is involved in connecting material flows and the repair and re-use of necessary equipment. IS depends on close relationships between the participants (Chertow and Park, 2016). Proximity favours both the development of these relationships and the physical exchanges.

3.5 Implications for Global Trade

Global trade is one of the characteristics of the linear economy. In the decades before the 2008 financial crisis, global supply chains became progressively more complex (Los *et al.*, 2014). The pace of globalisation has subsequently slowed, with trade as a percentage of GDP remaining roughly constant at 60% of world GDP (Wang and Sun, 2020). Primary resources are an important part of this trade: in 2019, accounting for around 25% of international trade by value (UNCTAD, n.d.).

Transition to a performance economy, with local reuse and remanufacturing, would reduce production and trade of primary resources (OECD, 2018). The consequences would differ between the “Global North” and the “Global South”. Wiebe et al. (2019) modelled a range of circular economy policies and concluded that, where circularity can be implemented by shrinking primary production and growing secondary sectors within the same nation, distributional impacts on employment and wages would be minimal: reducing production and trade of primary materials by around 10% would increase in global employment by less than 5%, primarily driven by increases in remanufacturing. The impact is small because sectors producing secondary resources (e.g. metals from scrap) do not currently have systematically higher employment intensities. This highlights the importance of understanding the performance economy in terms of an economy-wide shift away from resource-intensive processes towards labour-intensive processes, rather than a scaling up of some sectors as others recede.

However, circular economy policies, such as those in the EU, focus on changing the global distribution of primary and secondary production (Gregson *et al.*, 2015). If economies in the North reduce material intensity, fewer imports will be needed from low-income countries and will remove the livelihoods of workers in the global South dependent on primary production and exports, for example from their agricultural and textile sectors (e.g. cotton and cloth) (Schröder *et al.*, 2019). Other rebound effects are also likely, such as consumers using monetary savings to purchase more goods and so expand output. A meta-analysis of 300 CE scenarios to 2050 (Aguilar-Hernandez *et al.*, 2021) found that they pay insufficient attention to potential rebounds.

Delivering a global economy that reduces unsustainability for both the “North” and “South” is the subject of a nascent literature highlighting the power relationships inherent in the linear economy (dominated by the global North) and how they influence circular economy practice and thinking (Schröder *et al.*, 2019). However, there is a possibility to shift these power relations. Measures to curtail export of waste plastic to the “South” illustrate the shift (Clift *et al*., 2019). The concept of a sustainable value chain as a set of relationships that delivers benefits in both directions along the chain (see Section 3.2) is essential here, exemplified by movements like ***Fair Trade*** that promote ethical consumer choices (Reed, 2009) and link sustainable consumption to sustainable production (Clift et al., 2013; Sahakian, 2016).

The dependence of many workers in the global South on primary resource exports is a feature of the vertical specialisation increasingly evident in global trade from around 1970 (Pahl and Timmer, 2019; Timmer *et al.*, 2019): countries become specialised in particular stages of the supply chain. A performance economy, maintaining stocks as close to the point of use as possible, favours a more resilient system in which countries have a broad basis in multiple stages of production. Relocalisation can promote more equitable distribution of social benefits by avoiding trapping countries in the parts of the supply chain with low economic value and disproportionately high environmental impact (Clift and Wright, 2000): it does not merely mean returning blue collar industrial jobs to the North; it can also generate white collar jobs in the global South.

4. Drivers for a Sustainable Economy

A sustainable economy must respect all three constraints in Figure 1:

1. Techno-economic efficiency: the scientific laws and economic constraints that shape the ways we provide for ourselves and seek to improve our societies. Whereas scientific laws are immutable, the "laws" defining economic efficiency are not: "economic efficiency" is a construct that can be modified, for example through changes to the fiscal system.
2. Environmental compatibility: the environmental and resource constraints that bound a 'safe operating space' for humanity.
3. Social equity: the ethical constraints that ensure we do not place our wellbeing ahead of the wellbeing of others (including future generations).

The performance economy aims to provide enhanced quality of life while recognising these three sets of constraints.

Linear economies define efficiency in terms of the monetary value associated with the flows of goods and services produced and consumed. The performance economy approach shifts the focus to maximising the value obtained from stock in use. This perspective shifts the view of the economic system to overlap with environmental and social concerns: a focus on stock preservation helps harness technological efficiency to satisfy environmental and equity constraints. For example, the stock of natural capital provides value by preserving environmental conditions in which human societies flourish. Likewise, the stock of skilled labour can provide value by providing meaningful and well rewarded employment. Earlier sections of this chapter introduced the idea that a focus on stock preservation leads to a greater focus on the role of skilled labour in producing value, recognising that labour is a renewable resource. However, shifting to a labour-based economy requires major structural shifts. We therefore consider measures that would promote such shifts.

It was noted in Section 1.2 that much of the literature on the circular economy emphasises its potential as a profit generating activity rather than a route to improving sustainability. However, studies of barriers to the implementation of circular economy strategies highlight that they are not always immediately profitable (Govindan and Hasanagic, 2018; Kirchherr *et al.*, 2018). This is to be expected: the circular economy constrains economic goals to meet environmental and equity goals. Therefore, promoting the performance economy may require changes to the techno-economic domain. Government actions are generally more effective than "softer" private or behavioural pressure (Mols *et al.*, 2015; Lehner *et al.*, 2016); i.e. the state must play an active role. In addition to regulation, the state can intervene by ***fiscal measures***, which are the principal means by which governments can reshape the techno-economic domain of Figure 1.

Ecological taxes on use of non-renewable stocks represent fiscal measures to promote resource efficiency by replacing non-renewable inputs by renewables (Lawn, 2000; Stahel, 2013). Ecological tax reforms are an important part of the circular economy policy landscape, particularly in Europe where tax reform is a key pillar of the resource efficiency roadmap

(Domenech and Bahn-Walkowiak, 2019). The latest European circular economy action plan (European Commission, 2020), includes provisions for member states to use variable tax rates to incentivise consumers to use repair services. However, such strategies appear to have had limited impacts, in part because consumers may believe that some goods are not worth repairing even if it is cheap to do so (Milios, 2021). Domenech and Bahn-Walkowiak (2019) point also to the political context, arguing that taxes are used as elements of economic competition between states who resist substantive taxes on resources as they do not wish to harm their competitiveness. We return to this point below. Social equity can be promoted by ***personal taxation*** with a progressive rate structure that reduces income taxes for the lower paid. However, taxation policy is politically determined so that, in practice, there are limits on the extent to which personal taxation can be redistributive. Combining personal taxation with ecological taxes offers a potentially more "acceptable" approach, improving both resource efficiency and equity.

The central idea of using taxes to increase the prices of non-renewable resources and decrease costs of renewables includes the shift from non-renewables to labour in the performance economy (Stahel, 2013, 2019; Stahel and Clift, 2016). Opposition to ecological taxes can be muted if the changes are presented as ***revenue-neutral***; i.e. as a shift in the tax base, not an additional tax. Taxes or levies on emissions of greenhouse gases - so-called "carbon taxes" – are a specific form of ecological tax[4]. The Canadian province of British Columbia illustrates this approach: carbon taxes are already high by global standards (CDN$45 per tCO_2e*)* but are being increased even further without widespread opposition. Some of the revenue is returned to lower-paid individuals and families as a "carbon tax rebate", emphasising that carbon taxes represent redistribution rather than additional taxation. There are signs that this fiscal approach is driving restructuring towards greater resource efficiency (Murray and Rivers, 2015; Smart Prosperity Institute, 2021).

One of the concerns around fiscal measures is that increasing material or emission costs in one region will shift the associated activities elsewhere. This has been discussed primarily in terms of "carbon leakage" (Cosbey *et al.*, 2019; Keen and Kotsogiannis, 2014; Ward *et al.*, 2015) – i.e. migration of industries emitting greenhouse gases to regions other than those where their products are consumed - but the principles apply more widely. Taxes on emissions or resource use make it more expensive to make a product than in regions where there is no such tax. Production, investment and employment may then migrate to a lower tax region, from where the product will be imported into the region with the ecological taxes. ***Boundary or border taxes*** on imported goods are intended to negate the perverse competitive advantage of goods from a low-tax region by imposing tariffs equal to the ecological taxes. However, World Trade Organisation rules raise questions over such taxes, and carbon border tax proposals in the US and Europe have been rejected by the relevant legislative bodies (Mehling *et al.*, 2019; Truby, 2010).

[4] The efficacy of direct taxes and levies relative to an indirect system for "pricing" emissions is not a topic we have space to discuss. We refer here to taxes or levies because that relates more directly to our analysis and because we believe such direct measures have proven more effective in practice.

5. Conclusions

Following Brandt (1982), sustainable development implies enhancing quality of life and well-being for current and future generations, rather than increasing consumption. Sustainability has economic, social, and environmental dimensions; quality of life does not equate to spending power; ethical imperatives override financial gain; and the well-being of the planet overrides everything. However, most interpretations of the circular economy promote it as a way to expand economic activity and corporate profits. Shifting to a more sustainable "performance economy", respecting all three dimensions, requires major changes in business focus, away from material flows toward managing stocks of goods and labour. The circular economy approach potentially supports most of the 17 SDGs, particularly SDG 12: "Ensure Sustainable Consumption and Production Patterns" by "changing the way we produce and consume resources". However, the SDGs ignore the distinction between economic growth and sustainable development. SDG 12 includes "Achieving economic growth". SDG 8 explicitly links "Decent Work and Economic Growth", ignoring the performance economy approach of restructuring to generate more jobs without increasing material consumption. As Jackson (2017) puts it:

> "People can flourish without endlessly accumulating more stuff. Another world is possible."

References

Aguilar-Hernandez, G.A. et al. (2021) Macroeconomic, social and environmental impacts of a circular economy up to 2050: A meta-analysis of prospective studies. *Journal of Cleaner Production*, 278, 123421.

Allwood, J.M. (2014) Squaring the Circular Economy: The Role of Recycling within a Hierarchy of Material Management Strategies. In: *Handbook of Recycling: State-of-the-art for Practitioners, Analysts, and Scientists*. [Online]. Available at: http://publications.eng.cam.ac.uk/706968/ [Accessed: 13 May 2021].

Brandt, W. (1982) *North-South, a programme for survival: report* Independent Commission on International Development Issues (ed.). 11. print. London: Pan Books.

Castell, A. et al. (2008) Extended Producer Responsibility Policy in the European Union: A Horse or a Camel? *Journal of Industrial Ecology*, 8(1–2), 4–7.

Charter, M. (2018) Repair Cafes. *The Journal of Peer Production*, 3(12), 37–45.

Chertow, M. & Park, J. (2016) Scholarship and Practice in Industrial Symbiosis: 1989–2014. In: Clift, R. & Druckman, A. (eds.) *Taking Stock of Industrial Ecology*. [Online]. Cham: Springer International Publishing. Available at: doi:10.1007/978-3-319-20571-7_5 [Accessed: 13 May 2021].

Chopra, S. (2020) *Supply chain management: strategy, planning, and operation*. New York: Pearson Education Limited.

Clift, R. (1995) The Challenge for Manufacturing. In: McQuaid, J. (ed.) *Engineering for Sustainable Development*. London: The Royal Academy of Engineering.

Clift, R. (1997) Clean Technology—The Idea and the Practice. *Journal of Chemical Technology & Biotechnology*, 68(4), 347–350.

Clift, R. (2013) Clean technology and industrial ecology. In: Harrison, R.M. (ed.) *Pollution- Causes, effects and control*. 5th ed. [Online]. Available at: doi:10.1039/9781847551719-00411 [Accessed: 5 May 2021].

Clift, R. et al. (2013) Sustainable Consumption and Production: Quality, Luxury and Supply Chain Equity. In: Jawahir, I.S. et al. (eds.) *Treatise on Sustainability Science and Engineering*. [Online]. Dordrecht: Springer Netherlands. Available at: doi:10.1007/978-94-007-6229-9_17 [Accessed: 5 May 2021].

Clift, R. et al. (2017) Planetary Boundaries as a Basis for Strategic Decision-making in Companies with Global Supply Chains. *Sustainability*, 9(2), 279.

Clift, R. et al. (2019) Managing Plastics: Uses, Losses and Disposal Special Issue on Designing Law and Policy towards Managing Plastics in a Circular Economy. *Law, Environment and Development Journal (LEAD Journal)*, 15(2), 93–107.

Clift, R. & Wright, L. (2000) Relationships Between Environmental Impacts and Added Value Along the Supply Chain. *Technological Forecasting and Social Change*, 65(3), 281–295.

Cohen, M.A. et al. (2006) Winning in the Aftermarket. *Harvard Business Review*, 1 May. Available at: https://hbr.org/2006/05/winning-in-the-aftermarket [Accessed: 5 May 2021].

Cosbey, A. et al. (2019) Developing Guidance for Implementing Border Carbon Adjustments: Lessons, Cautions, and Research Needs from the Literature. *Review of Environmental Economics and Policy*, 13(1), 3–22. The University of Chicago Press.

Dearing, J.A. et al. (2014) Safe and just operating spaces for regional social-ecological systems. *Global Environmental Change*, 28, 227–238.

Domenech, T. & Bahn-Walkowiak, B. (2019) Transition Towards a Resource Efficient Circular Economy in Europe: Policy Lessons From the EU and the Member States. *Ecological Economics*, 155, 7–19.

Duvall, L. et al. (2016) The Fixer Movement: A Key Piece of the Circular Economy Revolution. In: Ellen Macarthur Foundation *Empowering Repair.* Isle of Wight: UK: Ellen Macarthur Foundation.

Ede, S. (2017) *The Real Circular Economy: How Relocalizing Production with Not-For-Profit Business Models Helps Build Resilient and Prosperous Societies*. Online: Commons Transition. Available at: https://commonstransition.org/the-real-circular-economy/ [Accessed: 13 May 2021].

Ellen MacArthur Foundation (2021) *Universal Circular Economy Policy Goals*. Available at: https://emf.thirdlight.com/link/kt00azuibf96-ot2800/@/preview/1?o [Accessed: 5 May 2021].

European Commission, (2020) *Circular economy action plan*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

Evangelisti, S. et al. (2015) Integrated gasification and plasma cleaning for waste treatment: A life cycle perspective. *Waste Management*, 43, 485–496.

Forum for the Future (2014) *The Five Capitals - a framework for sustainability*. Available at: https://www.forumforthefuture.org/the-five-capitals [Accessed: 5 May 2021].

Freeman, R.E. & Reed, D.L. (1983) Stockholders and Stakeholders: A New Perspective on Corporate Governance. *California Management Review*, 25(3), 88–106.

Friedman, M. (1970) A Friedman doctrine-- The Social Responsibility Of Business Is to Increase Its Profits. *The New York Times*, 13 Sep. Available at: https://www.nytimes.com/1970/09/13/archives/a-friedman-doctrine-the-social-responsibility-of-business-is-to.html [Accessed: 5 May 2021].

Gear, M. et al. (2018) A life cycle assessment data analysis toolkit for the design of novel processes – A case study for a thermal cracking process for mixed plastic waste. *Journal of Cleaner Production*, 180, 735–747.

Georgescu-Roegen, N. (2017) *The entropy law and the economic process.* Cambridge (Mass.): Harvard University Press.

Gomez, E. (2016) 10 Social Enterprise Examples and the Principles That Guide Them. *Conscious Connection*. Available at: https://www.consciousconnectionmagazine.com/2016/02/social-enterprise-examples-and-principles/ [Accessed: 13 May 2021].

Govindan, K. & Hasanagic, M. (2018) A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. *International Journal of Production Research*, 56(1–2), 278–311. Taylor & Francis.

Gregson, N. et al. (2015) Interrogating the circular economy: the moral economy of resource recovery in the EU. *Economy and Society*, 44(2), 218–243.

Heiskanen, E. & Jalas, M. (2000) *Dematerialization through services: a review and evaluation of the debate*. Helsinki: Ministry of Environment : Edita, jakaja.

Isham, A. et al. (2021) Worker wellbeing and productivity in advanced economies: Re-examining the link. *Ecological Economics*, 184, 106989.

Jackson, T. (2010) Keeping out the giraffes. *Long Horizons*, 17–20. London: British Council.

Jackson, T. (2017) *Prosperity Without Growth: Foundations for the Economy of Tomorrow*. 2nd ed. London and New York: Routledge.

Jensen, J.P. et al. (2019) Creating sustainable value through remanufacturing: Three industry cases. *Journal of Cleaner Production*, 218, 304–314.

Keen, M. & Kotsogiannis, C. (2014) Coordinating climate and trade policies: Pareto efficiency and the role of border tax adjustments. *Journal of International Economics*, 94(1), 119–128. North-Holland.

Kerlin, J.A. (2010) A Comparative Analysis of the Global Emergence of Social Enterprise. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, 21(2), 162–179.

King, A.M. et al. (2006) Reducing waste: repair, recondition, remanufacture or recycle? *Sustainable Development*, 14(4), 257–267.

Kirchherr, J. et al. (2017) Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221–232.

Kirchherr, J. et al. (2018) Barriers to the Circular Economy: Evidence From the European Union (EU). *Ecological Economics*, 150, 264–272.

Korhonen, J. (2003) Should we measure corporate social responsibility? *Corporate Social Responsibility and Environmental Management*, 10(1), 25–39.

Laubinger, F. et al. (2020) Labour Market Consequences of a Transition to a Circular Economy: A Review Paper. *International Review of Environmental and Resource Economics*, 14(4), 381–416.

Laurenti, R. et al. (2018) The Socio-Economic Embeddedness of the Circular Economy: An Integrative Framework. *Sustainability*, 10(7), 2129.

Lawn, P.A. (2000) Ecological Tax Reform: Many Know Why But Few Know How. *Environment, Development and Sustainability*, 2(2), 143–164.

Lehner, M. et al. (2016) Nudging – A promising tool for sustainable consumption behaviour? *Journal of Cleaner Production*, 134, 166–177.

Lightfoot, H. (2021) Servitization: Manufacturing Paradigm Shift or Simply a Business Model? *Si2 PARTNERS*. Available at: https://si2partners.com/resources/servitization-manufacturing-paradigm-shift-simply-business-model/ [Accessed: 5 May 2021].

Lindhqvist, T. & Lifset, R. (2003) Can We Take the Concept of Individual Producer Responsibility from Theory to Practice? *Journal of Industrial Ecology*, 7(2), 3–6.

Los, B. et al. (2014) How Global are Global Value Chains? A New Approach to Measure International Fragmentation. Journal of Regional Science, 55(1), 66–92.

Makower, J. (2021) *The State of Green Business 2021 | Greenbiz*. Available at: https://www.greenbiz.com/article/state-green-business-2021 [Accessed: 14 May 2021].

Malcolm, R. (2019) Life Cycle Thinking as a Legal Tool: A Codex Rerum. *Law, Environment and Development Journal*, 15(2), 208. SOAS.

Mayers, K. et al. (2011) Redesigning the Camel. *Journal of Industrial Ecology*, 15(1), 4–8.

Mayers, K. (2016) Practical Implications of Product-Based Environmental Legislation. In: Clift, R. & Druckman, A. (eds.) *Taking Stock of Industrial Ecology*. [Online]. Cham: Springer International Publishing. Available at: doi:10.1007/978-3-319-20571-7_16

McKinsey, & Co. (2012) *Towards the Circular Economy: Economic and business rationale for an accelerated transition*. London: Ellen MacArthur Foundation.

Mehling, M.A. et al. (2019) Designing Border Carbon Adjustments for Enhanced Climate Action. *American Journal of International Law*, 113(3), 433–481. Cambridge University Press.

Milios, L. (2021) Towards a Circular Economy Taxation Framework: Expectations and Challenges of Implementation. *Circular Economy and Sustainability*. [Accessed: 22 March 2021].

Mitchell, C. (2000) Integrating Sustainability in Chemical Engineering Practice and Education: Concentricity and its Consequences. *Process Safety and Environmental Protection*, 78(4), 237–242.

Mitchell, C.A. et al. (2004) The Role of the Professional Engineer and Scientist in Sustainable Development. In: Azapagic, A. et al. (eds.) *Sustainable Development in Practice*. [Online]. Chichester, UK: John Wiley & Sons, Ltd. Available at: doi:10.1002/0470014202.ch2 [Accessed: 5 May 2021].

Mols, F. et al. (2015) Why a nudge is not enough: A social identity critique of governance by stealth. *European Journal of Political Research*, 54(1), 81–98.

Moreau, V. et al. (2017) Coming Full Circle: Why Social and Institutional Dimensions Matter for the Circular Economy. *Journal of Industrial Ecology*, (In Press).

Murray, B. & Rivers, N. (2015) British Columbia's revenue-neutral carbon tax: A review of the latest "grand experiment" in environmental policy. *Energy Policy*, 86, 674–683.

North, P. (1999) Explorations in heterotopia: Local Exchange Trading Schemes (LETS) and the micropolitics of money and livelihood. *Environment and Planning D: Society and Space*, 17(1), 69–86.

OECD, (2018) *The Macroeconomics of the Circular Economy Transition: A Critical Review of Modelling Approaches*. 130. Available at: doi:10.1787/af983f9a-en [Accessed: 10 December 2020].

Örsdemir, A. et al. (2018) Is Servicization a Win-Win Strategy? Profitability and Environmental Implications of Servicization. *Manufacturing & Service Operations Management*, 21(3), 674–691. INFORMS.

Pahl, S. & Timmer, M.P. (2019) Patterns of vertical specialisation in trade: long-run evidence for 91 countries. *Review of World Economics*, 155(3), 459–486.

Porritt, J. (2005) *Capitalism as if the world matters*. London ; Sterling, VA: Earthscan.

Porter, M.E. (1985) *Competitive advantage: creating and sustaining superior performance*. New York : London: Free Press ; Collier Macmillan.

Porter, M.E. & Kramer, M.R. (2011) Creating Shared Value. *Harvard Business Review*, 89, 2–17.

Purvis, B. et al. (2019) Three pillars of sustainability: in search of conceptual origins. *Sustainability Science*, 14(3), 681–695.

Raworth, K. (2017) *Doughnut Economics: 7 Ways to Think Like a 21st Century Economist*. London: Random House Business Books.

Rockström, J. et al. (2009) A safe operating space for humanity. *Nature*, 461(7263), 472–475. Nature Publishing Group.

Sahakian, M. (2016) The Social and Solidarity Economy: Why Is It Relevant to Industrial Ecology? In: Clift, R. & Druckman, A. (eds.) *Taking Stock of Industrial Ecology*. [Online]. Cham: Springer International Publishing. Available at: doi:10.1007/978-3-319-20571-7_10 [Accessed: 13 May 2021].

Schau, E. et al. (2012) Life cycle approach to sustainability assessment: a case study of remanufactured alternators. *Journal of Remanufacturing*, 2(5), 1–14.

Schröder, P. et al. (2019) *The Circular Economy and the Global South : Sustainable Lifestyles and Green Industrial Development*. [Online]. Routledge. Available at: doi:10.4324/9780429434006 [Accessed: 10 December 2020].

Schröder, P. et al. (2020) Making the circular economy work for human development. *Resources, Conservation and Recycling*, 156, 104686.

Smart Prosperity Institute (2021) *Just the facts please: The true story of how BC's carbon tax is working.* Available at: https://institute.smartprosperity.ca/content/just-facts-please-true-story-how-bc-s-carbon-tax-working [Accessed: 12 May 2021].

Stahel, W. (2010) *The Performance Economy*. 2nd ed. Palgrave Macmillan.

Stahel, W. & Clift, R. (2016) Stocks and Flows in the Performance Economy. *Taking Stock of Industrial Ecology*, 137–158. Online: Springer International Publishing.

Stahel, W.R. (2013) Policy for material efficiency—sustainable taxation as a departure from the throwaway society. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 371(1986), 20110567. Royal Society.

Stahel, W.R. (2019) *The circular economy: a user's guide*. London ; New York: Routledge, Taylor & Francis.

Steffen, W. et al. (2015) Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223), 1259855.

Stratan, D. (2017) Success Factors of Sustainable Social Enterprises Through Circular Economy Perspective. *Visegrad Journal on Bioeconomy and Sustainable Development*, 6(1), 17–23.

Sustainalytics (2021) *ESG Risk Ratings*. Available at: https://www.sustainalytics.com/esg-data [Accessed: 5 May 2021].

Tilak, J.B.G. (2008) Higher education: a public good or a commodity for trade? *PROSPECTS*, 38(4), 449–466.

Timmer, M.P. et al. (2019) Functional specialisation in trade. *Journal of Economic Geography*, 19(1), 1–30.

Tonner, K. & Malcolm, R. (2017) *How an EU Lifespan Guarantee Model could be implemented across the European Union*. European Commission, Directorate General for Internal Policies.

Truby, J.M. (2010) Towards Overcoming the Conflict between Environmental Tax Leakage and Border Tax Adjustment Concessions for Developing Countries. *Vermont Journal of Environmental Law*, 12(1), 149–184.

U.N. (1987) *Our Common Future. Report of the World Commission on Environment and Development.* New York: United Nations.

UN (2015) *Transforming our world: the 2030 Agenda for Sustainable Development*. Available at: https://sdgs.un.org/2030agenda [Accessed: 14 May 2021].

UNCTAD, (n.d.) Merchandise trade matrix – exports of individual economies in thousands United States dollars, annual. Available at: https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx [Accessed: 10 December 2020].]

Vandermerwe, S. & Rada, J. (1988) Servitization of business: Adding value by adding services. *European Management Journal*, 6(4), 314–324.

Velenturf, A.P.M. & Purnell, P. (2021) Principles for a sustainable circular economy. *Sustainable Production and Consumption*, 27, 1437–1457.

Vickers, I. et al. (2017) Public service innovation and multiple institutional logics: The case of hybrid social enterprise providers of health and wellbeing. *Research Policy*, 46(10), 1755–1768.

Wang, Z. & Sun, Z. (2020) From Globalization to Regionalization: The United States, China, and the Post-Covid-19 World Economic Order. *Journal of Chinese Political Science,* 26, 69–87.

Ward, J. et al. (2015) *Carbon Leakage*. Available at: http://documents1.worldbank.org/curated/en/138781468001151104/pdf/100369-NWP-PUBLIC-ADD-SERIES-Partnership-for-Market-Readiness-technical-papers-Box393231B.pdf

Ward, Marguerite. 2020. As the pandemic, fires, and inequity all rage, free market icon Milton Friedman's declaration that the sole responsibility of business "is to increase its profits" sounds emptier than ever. *Business Insider*, 13 September. https://businessinsider.com/milton-friedman-theory-role-of-business-feels-emptier-than-ever-2020-9

Webster, K. (2015) *The circular economy: a wealth of flows*. London: Ellen MacArthur Foundation.

WEF (2020) *The Future of Jobs Report 2020*. Available at: https://www.weforum.org/reports/the-future-of-jobs-report-2020/ [Accessed: 13 May 2021].

Wiebe, K.S. et al. (2019) Global Circular Economy Scenario in a Multiregional Input–Output Framework. *Environmental Science & Technology*, 53(11), 6362–6373.

Wijkman, A. & Skanders, K. (2015) *The Circular Economy and Benefits for Society: Jobs and Climate Clear Winners in an Economy Based on Renewable Energy and Resource Efficiency*. Online: The Club of Rome. Available at: https://clubofrome.org/wp-content/uploads/2020/03/The-Circular-Economy-and-Benefits-for-Society.pdf [Accessed: 13 May 2021].

Wilkinson, R.G. & Pickett, K. (2010) *The spirit level: why equality is better for everyone ; [with a new chapter responding to their critics]*. Published with revisions, published with a new postscript. London: Penguin Books.

WRAP (2021) *WRAP and the circular economy | WRAP*. Available at: https://wrap.org.uk/about-us/our-vision/wrap-and-circular-economy [Accessed: 5 May 2021].