WALES AND THE CIRCULAR ECONOMY

Favourable system conditions and economic opportunities

A paper produced by the Ellen MacArthur Foundation for the Waste & Resources Action Programme (WRAP) and the Welsh Government
Authors:
Lucy Chamberlin; Ella Jamsin; Arpita Raksit (Ellen MacArthur Foundation)

The authors would like to thank the following people for their contributions and support during the project: Jane Richards (Welsh Government), Sophie Richard (WRAP), Steve Creed (WRAP), Lucy Thomas (Welsh Government), Emily Finney (Welsh Government), Eoin Bailey (Enterprise Consulting), Frank O’Connor (Ecodesign Centre), Sharon Prendeville (Ecodesign Centre), Richard Thomas (Cylch), Calvin Jones (Cardiff Business School), Keith James (WRAP), Jocelyn Bleriot (Ellen MacArthur Foundation), Andrew Morlet (Ellen MacArthur Foundation).
TABLE OF CONTENTS

Executive Summary ........................................................................................................... 5

1. The circular economy: a new systems approach .......................................................... 5

2. An opportunity worth billions .................................................................................... 6

3. Wales: a fertile ground for circular economy .............................................................. 7

4. Barriers and challenges to overcome ......................................................................... 9

5. Recommendations for a successful transition ........................................................... 10

Wales and the circular economy: favourable system conditions and economic opportunities .................................................................................................................. 12

1. The circular economy: a new systems approach .......................................................... 13
   The limits of the linear model ....................................................................................... 13
   The principles of the circular economy ...................................................................... 14
   Sources of value in a circular economy ..................................................................... 16

2. An opportunity worth billions ..................................................................................... 17
   Material cost savings ................................................................................................. 17
   Additional benefits ..................................................................................................... 20
   Case studies ............................................................................................................... 21

3. Wales: a fertile ground for circular economy .............................................................. 23
   The manufacturing landscape and the need for resilient growth .............................. 23
   Policy supports circular economy ........................................................................... 24
   Businesses and Communities are already pursuing circular economy value .......... 27
   A key player in Europe .............................................................................................. 32

4. Barriers and challenges to overcome ........................................................................... 33
   e) Education, skills and training channel the reductionist approach ......................... 33
   a) Potential ambiguity: circular economy seen as a cost ........................................... 34
   b) Danger of polarising language and framing ......................................................... 34
   c) Inconsistency of approach .................................................................................. 35
   d) Lack of clarity or practicality in supporting mechanisms ....................................... 36
   e) Education, skills and training channel the reductionist approach ......................... 38
   f) Business as Usual lock-in ..................................................................................... 39
   g) Limited access to appropriate resource flows, qualitatively and quantitatively .... 39
   h) Limited take up of public procurement drivers .................................................... 40
   i) Ineffective implementation of legislation: the case of Extended Producer Responsibility ......................................................... 41
   j) Perceived business risk of a transition and underestimated hazard of maintaining the status quo ...................................................... 42
   k) Limited influence of Wales on fiscal policy and dependence on external markets 42

5. Recommendations for a successful transition ........................................................... 44

Appendix I: Methodology of the estimation of cost savings in Wales ............................. 48
   Medium-lived complex products .............................................................................. 48
   Fast-moving consumer goods ................................................................................. 48

Appendix II - Methodology of the analyses for the ‘Towards the Circular Economy’ reports .................................................................................................................. 48
   Report 1 - Medium-lived complex products ............................................................... 48
   Report 2 - Fast-moving consumer goods .................................................................. 49

Appendix III: List of Interviewees .................................................................................. 50
EXECUTIVE SUMMARY

As a result of its continued pursuit of recycling and resource-efficient strategies, Wales is ideally placed to take the next step and “upgrade” to the circular economy, securing a leadership position in the process.

Initial analysis suggests that material cost savings of up to £2bn a year could be achieved by transitioning to circular processes in an advanced scenario. This constitutes a business environment that has developed reverse technologies, infrastructure and other enabling conditions such as cross-sector collaboration and legal frameworks.

On top of net financial gains, moving towards a circular economy through an inclusive (business, public sector, community, education) and clearly defined roadmap can reduce Wales’s dependency on raw materials, prospectively have a positive impact on the jobs market and increase the value and productivity of agricultural systems.

Capitalising on a fertile ground when it comes to innovative and forward-looking initiatives, which has given it an enviable position in the sphere of sustainable development, Wales can secure a leading position in Europe’s resource efficient strategic agenda going forward.

The opportunity now is for Wales to kick start a new era of resilient, Wales-centric growth that provides meaningful employment for its citizens and innovation for its industries.

1. The circular economy: a new systems approach

The 21st century has ushered in a world of scarce resources and growing population, with increasing wealth and per capita consumption. The economic systems upon which the Western world has relied since the Industrial Revolution are largely based on the ‘linear’ throughput of materials, that is, the extraction, production and consumption of resource in the pursuit of value and wellbeing. But this throughput is essentially a one-way system: there is currently very little value travelling back to replenish the source and ensure long-term prosperity. And there are signs that the linear model is reaching its limit: in manufacturing, certain efficiency gains have become insignificant as margins are squeezed by stagnating demand and increasing costs, whilst in agriculture stunted productivity and soil degradation risk food security and safety on a global scale.\(^1\)

The search for a new economic ‘system’ has become an imperative, and the circular economy is widely gaining traction as a framework that can release new value and decouple growth from resource depletion. A circular economy denotes an industrial economy that is restorative by design, and which mirrors nature in actively enhancing and optimizing the systems through which it operates. Capital assets (for example clean rivers or diverse ecosystems) are maintained and rebuilt, and the waste of one process is eliminated as it becomes the ‘food’ for another. Matter may be seen to cycle in distinct ‘flows’ (see fig.1) – the biological, in which materials are

\(^1\) See Ellen MacArthur Foundation, ‘Towards the Circular Economy’ (2011)
designed to enter the biosphere safely, and the technical, in which materials are designed to circulate at high quality without entering the biosphere. The purer these flows are and the higher the quality at which they cycle, the more value is retained by the economy.

**Principles of the circular economy:**

- Design out waste
- Build resilience through diversity
- Use energy from renewable sources
- Think in ‘systems’

Research undertaken previously by the Ellen MacArthur Foundation in conjunction with McKinsey shows that transitioning to a more ‘circular’ economic model could bring significant benefits, helping to buffer future materials price increases and volatility, reducing material costs and restoring natural capital. This research focused on certain ‘building blocks’, and these were also used to anchor the research conducted for Wales:

- Design for circular economy
- Innovative business models
- Reverse logistics and cascading
- Cross-sector and cross-chain collaboration

![Diagram of materials flows in a circular economy](image)

**FIGURE 1: MATERIALS FLOWS IN A CIRCULAR ECONOMY**

**2. An opportunity worth billions**

The benefits of this new circular economy for a region like Wales would be manifold: cost savings throughout industry, increased resilience to economic and political shocks, innovation, the potential for job creation, land productivity and soil health, and, more generally, a positive economic climate.
As part of this review we leveraged insights from the two ‘Towards the Circular Economy’ reports by the Ellen MacArthur Foundation, with analysis by McKinsey and Company, to perform a high-level outside-in analysis of the opportunity for circular economy in Wales. In the sector of medium-lived complex goods - e.g. automobile, electronic equipment and machinery - we calculated a potential impact of **up to £1.3bn a year in material cost savings** in an ‘advanced’ scenario, with the assumption of important improvements in collection rates, a shift to higher quality recycling as well as reuse and remanufacturing, and improvements in design for circularity. The automotive and electronics industries present the highest potential for these savings - largely because together they produce 75% of the output of the medium-lived complex sectors. In the sector of fast moving consumer goods - e.g. food & beverages, clothing and personal care - we identified an additional potential of **up to £760m a year**. This would be driven by the reuse of packaging, more effective recycling, cascades and anaerobic digestion of food and other organic products, as well as the development of further reuse and leasing schemes in the clothing sector. We found packaging in food and beverages to be the most promising source of savings, followed by clothing and food production waste. It is well to note that the cost savings calculated are across the whole supply chain of the products considered, some of which will be located outside of Wales, so not all of these savings would be realised within Wales.

Beyond these material cost savings, moving to a circular economy would enable a lower dependency on raw materials, making the Welsh economy more resilient to price volatility and supply chain risks. The increase in material productivity is likely to have a positive impact on economic development beyond the effects of circularity on specific sectors.

The model is also a fertile source of innovation: replacing ‘linear’ products with goods that are ‘circular by design’ and creating reverse logistics networks and other supporting systems may be a powerful spur to new ideas and new businesses. Enabling business models favouring access over ownership (selling the service rather than the good itself) also have a crucial role to play. Along with growth for companies comes a chance for greater local employment, especially in entry-level and semi-skilled jobs.

Higher land productivity, less waste in the food value chain, and the return of nutrients to the soil can enhance the value of land and soil as assets. The circular economy, by cycling biological materials through anaerobic digestion or composting processes and back into the soil, reduces the need for replenishment with costly additional nutrients.

**3. Wales: a fertile ground for circular economy**

Even before the recent financial crisis, the decline of Europe’s manufacturing and mining industries over the past few decades have sounded a particularly bleak note for countries like Wales, and contributed to the growing calls for a new economic model. The challenges brought about by a linear model, deriving growth from the consumption of finite resources, have impacted all industrialised countries but their adverse effects have been patent earlier on in the case of resource-intensive economies.
In many ways Wales has already laid fertile ground for a new ‘systems’ approach that unites long-term sustainability and economic prosperity through its focus on ‘green’ growth and positioning of sustainable development at the core of Government. The wealth of initiatives such as the Sustainable Development Charter and Towards Zero Waste One Wales: One Planet strategy, or the roll-out of regional anaerobic digestion facilities, as well as business support programmes funded by the European Regional Development Fund, Technology Strategy Board, WRAP and the Welsh Government indicates a wider shift towards resource efficiency and business innovation and creates a favourable context for development. The planned 2016 Environment Bill is set to create measures for purer materials flows and increased reverse logistics, and to initiate an all-important change in language from ‘waste’ to ‘resource’. Moreover, the focus on embedding a more holistic outlook in education through the Education for Sustainable Development and Global Citizenship (ESDGC) policy also feeds into the ‘systems’ perspective brought by a circular economy.

At an industry level, businesses and community enterprises are already starting to innovate around circular economy, with new business models and practices creating both social and economic value, and traditional manufacturers beginning to consider the provision of services as an alternative to products. A growing number of SMEs and larger companies (e.g. GS Flooring, EEESafe, Dow Corning, Toyota) are creating profit and employment out of byproducts (previously waste), and there is evidence of collaboration along and across supply chains as businesses realise value through sharing expertise and capital assets, adopting an industrial symbiosis approach to the exchange of ‘waste’ products.

Wales-specific ‘connector’ bodies that bring together private and public sector (such as the Ecodesign Centre (EDC) and WRAP Cymru) have an important role to play, with EDC’s recent Baseline Study identifying several recommendations for government that resonate with circular economy. WRAP has identified UK-wide cost savings through implementing circular economy in the sectors of food and drink, built environment, electricals and textiles, and is already explicitly supporting the Welsh Government to reduce and valorise waste through infrastructure development and business support.

At a skills level, Wales’s manufacturing heritage and network of SMEs brings a distinctive advantage when it comes to circular economy, as increased capacity in remanufacturing, processing and repair sectors creates job opportunities for unskilled and semi-skilled workers. Close relationships between business and government catalysed by the nine key industry sectors and identification of Regionally Important Companies (RIC) and Anchor companies are advantageous to

---

2 Sustainable Development, as defined in One Wales: One Planet, is a central organising principle of Government.
3 eg A4B; West Wales and the Valleys Convergence Operational Programme
4 eg Knowledge Transfer Partnerships, in conjunction with the UK Government
5 eg ReMade programme eco-innovation vouchers
6 eg Business Innovation; Business Wales; SMARTCymru
7 Waste Strategy team, Welsh Government
8 e.g. Tata Steel; Welsh Automotive Forum
9 Ecodesign Centre, Ecodesign Baseline for Wales Waste Prevention Programme (2013)
10 http://www.wrap.org.uk/content/how-wrap-supports-circular-economy
both sides, whilst the government’s strong vision for Wales as a player on a European or even World stage provides the appetite to embark on an exciting new journey.

The opportunity is for Wales to leverage this existing landscape in order to capture the social and financial value inherent in the circular economic model. WRAP’s ARID (Accelerating Reprocessing Infrastructure Development) programme has already started to develop reprocessing infrastructure and markets for high-quality recyclate. Wales now has the chance to position itself as a Centre of Excellence for circular economy in Northern Europe, a leading example of the new take-back, remanufacturing and repair services that will play an important role in the re-industrialisation of the Western World.

4. Barriers and challenges to overcome

Although we have seen that many aspects of the business and policy landscape in Wales are conducive to circular economy, there are also a number of barriers and challenges to be faced. The message of circular economy is one of opportunity, growth and innovation, but the concept is still unfamiliar and often misunderstood. Fragmentation of policy and funding initiatives as well as reuse platforms and collections schemes make for disjointed markets, whilst the limited influence of Wales on an EU or global stage limits its jurisdiction over international standards and legislation.

There is a tendency in both public and private sectors to interpret circular economy as just another recycling, ‘green’ or sustainability initiative, and to revert to the traditional view of waste as a burden. Moreover the conflation of reuse, repair and remanufacturing with recycling (or more accurately, downcycling), fails to recognise the opportunities for valorisation as laid out by both the circular economy and the EU waste hierarchy.

Fragmentation of objectives and targets at a government level means that departments often struggle to collaborate on broader, cross-cutting agendas. The circular economy spans economic, environment, industry and employment sectors, requiring a joined-up approach and means of coordination between stakeholders. This issue of fragmentation proves a barrier for business when it comes to local authority recycling collections: not only do the differing requirements cause confusion, they also disincentivise pure materials streams and hence effective valorisation of waste. The issue also becomes apparent in the plethora of initiatives that are available to help businesses to innovate, but which all too often become ‘background noise’ to SMEs.

Businesses too face challenges of fragmentation when it comes to innovating around circular economy: long complex supply chains crossing many continents make it difficult for manufacturers to fully understand the materials being used in products and to design processes for materials recovery and reuse. Moreover the traditional remit of marketing and sales departments to shift volume of products through a linear system without regard for reverse logistics or valorisation is at present a poor fit for thinking in systems through a circular economy. In addition to

---

11 https://www.gov.uk/waste-legislation-and-regulations
12 Bonnie Hall, BITC
the need for more effective returns models, a key challenge for businesses that are willing to test new circular models is the issue of patchy recyclate and reuse markets and volatile feedstock, and in some cases a shortage of coordinated storage space in which to accumulate volumes necessary for economies of scale. There is an increasing awareness of the need for collaboration between businesses, however this requires a shift in perspective to get around competitive concerns about sharing too much either in terms of material or informational value. There is also an emerging recognition of the opportunity for new entrants to dis-intermediate the traditional waste sector through development of innovative recovery models focused on valorising materials that are lost in the existing model.

Aside from the obvious challenges for directing public funding towards new economic models during times of austerity, Wales currently has limited fiscal and legislative ability to signal business strongly in the direction of circular economy. Most tax powers currently reside in Westminster, whilst directives on design, materials and waste are decided at an EU or even international level. Even when implementing measures such as the 5p carrier bag charge, the Government faced significant opposition from some business interest.

Finally, the issue of education is one that spans government, business and schools: the loss of young graduates to universities and jobs across the border represents a serious challenge to the development of Welsh technical talent, whilst a significant number of SMEs and community enterprises lack the basic business acumen to scale up circular economy initiatives or even to apply for funding support. Despite work in the ESDGC arena over the past decade, there is as previously discussed an absence of awareness of the benefits of seeing the big picture: notions of a circular economy as well as systems thinking in all of these areas at a country level.

5. Recommendations for a successful transition

As a result of its continued pursuit of resource-efficient strategies, Wales now has a unique opportunity to take the next step and “upgrade” to the circular economy, securing its position as a regional leader in the process. Short-term, Wales can rely on established assets to become a key pillar of the European Commission’s vision of achieving a circular model and creating effective material flows. Engineering is one of Wales’s biggest exports, and there are significant opportunities for building a ‘manufacturing service economy’ on a circular model: tapping into its traditional manufacturing skills and leveraging its current focus on ICT to strengthen reverse logistics, the country has the opportunity to become one of Europe’s leading remanufacturing hubs, an activity which typically creates local and regional jobs.

In order to take advantage of the circular economic opportunities in Wales, the following recommendations are proposed:

---

13 Waste Strategy Branch, Welsh Government
14 Welsh Economic Review (2012)
15 Ibid.
Near-term recommendations:

1. Creation of a set of design guidelines for companies to pursue improved circular product design at a country level.
2. An assessment and harmonisation of the rich variety of instruments and governmental measures available, in order to work towards a clearly identified objective, and bringing onboard at country level all the key players in business, education and public sector. This would include launching a ‘roadmap for Wales’ at an organised event for stakeholders.
3. Integration of circular economic approaches in new legislation, for instance the proposed Future Generation and Environment Bills, and regulatory authorities made familiar with the principles.
4. The creation, under clear leadership from government, of circular economy criteria for initiatives, including fiscal incentives for businesses, public procurement and innovation platforms.
5. The ‘upgrade’ of ESDGC teaching and learning to reflect principles of circular economy, and their introduction to further education colleges and apprenticeships.
6. Setting up pilot projects in the automotive and packaging industries, and bringing together key stakeholders to assess valorisation opportunities.
7. Supporting those companies already making gains from circular economic activities to further develop their potential.
8. Construction of a database to track and trace materials and manufacturers in Wales, and ultimately working at a global level to pioneer a materials ‘white list’.
9. Leveraging existing business and community networks to communicate the value of circular economy through a centralised information ‘hub’, a platform for exchange of materials and expertise.
10. Learning lessons from other countries on the successful implementation of legislation and initiatives to support Wales in its bid for circular economy.

Longer-term recommendations:

11. Joining with other regions and multinational companies to press for a shift in taxation away from labour and towards non-renewable resources.
12. Providing strong leadership on circular economy issues in the EU and inviting recognition of Wales as a pioneer – a ‘Centre of Excellence for Circular Economy’ within Europe.
WALES AND THE CIRCULAR ECONOMY: FAVOURABLE SYSTEM CONDITIONS AND ECONOMIC OPPORTUNITIES

As a result of its pursuit of recycling and resource-efficient strategies, Wales is ideally placed to take the next step and “upgrade” to the circular economy, securing a leadership position in the process.

High-level outside-in analysis identifies that material cost savings of up to £2.0bn a year\(^{16}\) could be achieved by transitioning to circular processes in an advanced scenario. This constitutes a business environment that has developed reverse technologies, infrastructure and other enabling conditions such as cross-sector collaboration and legal frameworks.

On top of net financial gains, moving towards a circular economy through an inclusive (business, public sector, education) and clearly defined roadmap can reduce Wales’s dependency on raw materials, have a positive impact on the jobs market and increase the value and productivity of agricultural systems.

Welsh businesses and community enterprises are already starting to experiment with and benefit from new business models, redesigned products, reverse supply chains and cross-sector collaborations. With its strong tradition of industry, manufacturing skills base, reputation for environmental innovation and supportive government and EU context, Wales has the potential to build a robust ‘manufacturing service economy’. Capitalising on fertile ground, which has given it an enviable position in the sphere of sustainable development, Wales can now secure a leading position in Europe’s resource efficient strategic agenda going forward.

If this potential can be reinforced by a unified vision and coordinated policy and action, then Wales can join the vanguard of countries and companies leading the way towards a new industrial revolution.

The opportunity now is for Wales to kick start a new era of resilient, Wales-centric growth that provides meaningful employment\(^{17}\) for its citizens and innovation for its industries.

---

\(^{16}\) These are savings across the whole supply chain of the products considered, some of which will be located outside of Wales

\(^{17}\) Net Impact’s 2012 Talent Report highlights the importance of ‘contributing to society’ for students and jobseekers
1. THE CIRCULAR ECONOMY: A NEW SYSTEMS APPROACH

The limits of the linear model

Since the dawn of the industrial revolution in the 19th Century, we have based our economic success on the extraction and use of resources. We take raw materials from the earth, manufacture them into products using energy, and then sell these products on to a consumer who discards them when they are no longer required.

This ‘linear’ model of production, however, is a one-way system. It is characterised by wastage both along the production chain and when the product is discarded, with figures showing that still only a minority of waste is recycled or reused. Embedded energy is lost when goods are sent to landfill; additionally this model has implications for climate change as it primarily uses fossil fuels to power production and throughput of resources. Ecosystem services vital to life, such as those provided by forests, pollinators, clean water and clean air, are also eroded by the current system of extraction and waste, which fails to account for negative externalities and imposes costs on society whilst depleting natural capital.

At the same time population growth and the emergence of a new middle class consumer in the vast markets of China and India place more pressure on scarce resources, whilst political instability in countries of origin together with the integration of financial markets increase the risk to global supply chains. The consequences of climate change bring added constraints, with uncertainty over continuing availability of fresh water and arable land. Together, these risks and disparities between demand and supply are contributing to unprecedented market volatility and spikes in commodity prices, which in the first decade of the 21st century wiped out a hundred years of real price declines.

Of course, efficiency gains have gone some way towards minimising wastage and environmental damage and increasing recycling, but these are limited in their effectiveness because they take place within a linear system that maintains the cradle-to-grave dynamic. What we typically call recycling is usually downcycling, involving loss of energy and material quality, whilst any efforts to minimise a process that is inherently damaging merely delay the onset of the ultimate demise. What is now needed is a new system that is aligned with the principles of science and living systems, and that creates prosperity by effectively supporting and valorising the materials that flow through it. This inherently generates a synergistic relationship between ecological and economic systems, a positive recoupling of the relationship between the economy and the environment within which it is nested.

---

19 see Paul Hawken, Natural Capitalism.
20 Figure 5, ‘Towards the Circular Economy’ (2011).
21 Figure 4, McKinsey Commodity Price Index, ‘Towards the Circular Economy’ (2011). Certain commodity prices have dropped in the last couple of years, but according to McKinsey experts, the long term trend is upwards.

‘The human pressure on the Earth System has reached a scale where abrupt global environmental change can no longer be excluded’

Johann Rockstrom, Stockholm Resilience Centre
The principles of the circular economy

The circular economy is grounded in the study of non-linear systems, particularly living ones, and refers to an industrial economy that is restorative by intention. It aims to rely on renewable energy; to minimise, track, and eliminate the use of toxic chemicals; and to eradicate waste through careful design. The term goes beyond the mechanics of production and consumption of goods and services, by seeking to rebuild social and natural capital, and to optimise systems rather than components – product optimisation will only lead to tangible positive impacts if these are designed to truly fit and be “metabolised”, which involves a rethink of processes.

The circular economy involves careful management of materials flows, which are of two types: biological materials, designed to re-enter the biosphere safely and build natural capital, and technical ones, which are designed to circulate at high quality without entering the biosphere (see fig.1).

As a result, the circular economy draws a sharp distinction between the consumption and use of materials, advocating instead the need for a ‘functional service’ model in which manufacturers or retailers increasingly retain the ownership of their products and, where possible, act as service providers—selling the use of products, not their one-way consumption. This shift has direct implications for the development of effective take-back systems and of product and business model design practices that generate more durable products, facilitate disassembly and refurbishment and, where appropriate, consider product/service shifts. As circular economy pioneer Walter Stahel explains:

---

22 As described by McDonough and Braungart, Cradle to Cradle, Remaking the Way we Make Things
'The linear model turned services into products that can be sold, but this throughput approach is a wasteful one. In the past, reuse and service-life extension were often strategies in situations of scarcity or poverty and led to products of inferior quality. Today, they are signs of good resource husbandry and smart management.'

**Design out waste**

Waste does not exist when the biological and technical components of a product fit within a biological or technical materials cycle, and are designed for disassembly and re-purposing. The biological materials are non-toxic and can be simply composted. The technical materials—polymers, alloys and other man-made materials—are designed to be used again with minimal energy and to retain a high quality (rather than being recycled). Coined by Braungart and McDonough in their book ‘Cradle to Cradle’, the phrase ‘waste is food’ summarises the circular philosophy.

**Build resilience through diversity**

Since the Industrial Revolution we have focused on building economies of scale which exhibit uniformity and efficiency. Natural systems however display diversity and adaptivity, features that need to be prioritised in an uncertain and fast-evolving world. Diverse systems with many connections and scales are more resilient in the face of external shocks than systems built simply for efficiency, though of course there is an optimum to be achieved: throughput maximisation or ‘streamlining’ driven to the extreme results in fragility, making these systems vulnerable to the effects of shocks like price volatility or interruption of supply. Systems with many nodes and connections, on the other hand, are more resilient, but can become slow to change and thus ineffective. Effectiveness lies between these two extremes: efficiency (doing things right) is welcome, but in the service of effectiveness (doing the right thing). The prime objective is ensuring the health of the whole economy.

**Use energy from renewable sources**

A restorative circular economy requires reduced levels of energy, enabling it to ultimately run on renewable energy. Crop growth relies on current solar income, but significant amounts of fossil fuels are used in fertilisers, farm machinery, processing and through the supply chain. More integrated food and farming systems would reduce the need for fossil fuel-based inputs and capture more of the energy value of by-products and manures. They would reduce the risk of peak phosphorus and insure against losses in soil productivity. Such systems would also increase the demand for human labour—which Walter Stahel has argued should be an integral part of this evolution.

**Think in ‘systems’**

The ability to consider elements in relation to their environmental and social contexts, to understand how parts influence one another within a whole, and the relationship of the whole to the parts, is crucial. Systems thinking refers to the

---

23 Interview with Walter Stahel, London Nov. 2012
overwhelming majority of real-world systems: these are non-linear, feedback-rich, and interdependent, and as such cannot be managed in the conventional, ‘linear’ sense, requiring instead more flexibility and more frequent adaptation to changing circumstances. Systems thinking emphasises stocks and flows. The maintenance or replenishment of stock, such as natural capital, is inherent in feedback-rich systems, whilst valorising the flows of materials, goods and services in a circular economy reduces the risks associated with streamlining and compensates actors with lower costs, additional cash flows and—in many cases—fewer regulatory concerns (as wastes are eliminated, or are now benign flows).

Sources of value in a circular economy

The principles of the circular economy point to some more specific sources for realising the social and economic value inherent in the model (see figure 1):

• The closer the system can get to the inner circle of direct reuse (e.g. reusing as opposed to recycling packaging), the greater the savings on virgin material, energy, labour and capital costs and associated externalities will be. Of course, higher resource prices and fully accounting for externalities such as avoiding landfill can make this opportunity more attractive, whereas cost barriers for collection and reprocessing (for instance) can be prohibitive, so it is important to emphasise the high density and volume levels required to capture economies of scale and make collection worthwhile.

• If products and components can be cycled for longer within the circular economy, then virgin material inflows and associated costs and volatility can again be substituted. This can be achieved through redesigning products to enable more consecutive cycles, or to spend more time within one cycle. For consumable products like food that only cycle once, it is important to review stock management and other choices in order to reduce wastage from that one cycle. Products that are subject to quick technology changes should be designed for upgrade, so as not to hamper progress.

• There is a further arbitrage opportunity to cascade the discarded products of one value chain for use as ‘food’ for another, in the vein of industrial symbiosis. For instance, cotton-based clothing may be used as furniture filling and then as insulation before being returned to the biosphere; food waste may be utilised in animal feed or for molecular extraction in bio-refineries as well as to provide energy and fertiliser through anaerobic digestion. Of course, the assumption here is that the marginal costs of repurposing (eg transport or sorting) are lower than those of virgin materials (including embedded costs and externalities).

• The fourth lever of value focuses on the importance of attaining pure materials streams, in order to maintain quality during the onward journey, and to evacuate the issue of “residual waste” that by definition does not fit anywhere. Currently, most materials streams are mixed due to the way these have been designed and combined in a product or the way they are collected without regard for separation. Optimising the design process for ease of separation or reuse and better material identification, and the collection process for reduced rates of contamination and damage can effectively valorise the flow by reducing costs and extending material longevity and productivity.
2. AN OPPORTUNITY WORTH BILLIONS

The benefits of this new circular economy for a country like Wales would be manifold: cost savings throughout industry, resilience to economic and political shocks, business innovation, job creation in new supply chains, land productivity and soil health, and, more generally, a positive economic climate. A number of case studies demonstrate steps already taken by companies internationally to start capturing the value of this model.

**Material cost savings**

In the two ‘Towards the Circular Economy’ reports by the Ellen MacArthur Foundation, with analysis by McKinsey and Company, we estimated the impact of circular economy at EU and global level in terms of material cost savings for two sectors of manufacturing: medium-lived complex goods (e.g. automobile, electronic equipment and machinery) and fast moving consumer goods (e.g. food & beverages, clothing and personal care). This was done by first studying a number of signature products in detail and then extrapolating the findings to the whole industry.

Taking into account that not all producers will instantly adopt circular business practices, we established two scenarios. In our ‘transition scenario’, we assumed updates to product design and reverse-cycle skills, in line with current technologies and capabilities; the improvements would be in line with interventions already defined by some governments. In our ‘advanced scenario’, we showed the potential effect of a business environment that has undergone more radical change and has further developed reverse technologies and infrastructure and other enabling conditions such as customer acceptance, cross-chain and cross-sector collaboration, and legal frameworks.

As part of the present review, we leveraged the insights from these two reports to quantify the opportunity of a circular economy in Wales. Details of the methodology are provided in the appendices, and we refer the reader to the two reports to find out more about detailed case analyses and practical applications.

In the sector of medium-lived complex goods, we calculated a potential impact of about £700m to £1.3bn a year in material cost savings (see figure 2). The assumptions that led to the estimated percentage costs savings in the ‘Towards the Circular Economy’, which we used here, are:

- Improvements in collection rates (+ 20 to 30% in the transition scenario and a further 30 to 40% in the advanced scenario),
- A shift from recycling to more reuse and remanufacturing (about 30% shift in transition scenario and an additional 5-10% in advanced scenario)
- Improvements in design for circularity.

\[24\] For further information on these two scenarios, please consult Ellen MacArthur Foundation, ‘Towards the Circular Economy’ (2011)
The automotive and electronics industries, which represent £2,693m and £1,261m respectively in manufacturing turnover to the Welsh economy\(^\text{25}\), present the highest potential for these savings.

---

\[\text{FIGURE 2: MATERIAL COST SAVINGS IN MEDIUM-LIVED COMPLEX GOODS SECTORS}\]

In the sector of fast moving consumer goods, we identified an additional potential of about £640m to £760m a year (see figure 3). This would be driven by:

- More reuse and more effective recycling of packaging,
- Cascades and anaerobic digestion of food and other organic products,
- Cascades and the development of further reuse and leasing schemes in the clothing sector.

We found packaging in food and beverages to be the most promising source of savings, followed by clothing and food production waste (see figure 4).

\(^{25}\) Annual Business Survey 2010, ONS, 2012
FIGURE 3: MATERIAL COST SAVINGS IN FAST-MOVING CONSUMER GOODS

FIGURE 4: SPLIT OF MATERIAL COST SAVINGS IN FAST MOVING CONSUMER GOODS PER STEP OF THE VALUE CHAIN, ADVANCED SCENARIO
It is worth keeping in mind that the analyses of the ‘Towards the Circular Economy’ reports make a number of assumptions, briefly outlined above and further detailed in the reports themselves. Furthermore, as we extrapolate cost savings at the EU or global level to the scope of a country, some precautions are in order. First, our methodology makes the implicit working assumption that various trends, such as collection, reuse and recycling rates, can be improved in Europe and in Wales in the same proportions. This may lead to inaccuracies. For example, the reuse of clothing is known to be more mainstream in the UK than it is in other parts of Europe and might thus have less potential for improvement. This suggests that the above calculation might overestimate the opportunity for clothing. We should however not overlook the improvements that innovative designs and new business models can enable.

The second precaution relates to the fact that the material cost savings of a circular economy will probably be spread all along the value chain. If part of the chain is located outside of Wales, part of the opportunity will be captured outside of Wales. Although we cannot quantify this at this stage, a number of observations can be made:

- For the medium-lived complex goods, the Welsh data used to make the extrapolation are the total material costs of Welsh manufacturing companies. By extrapolating from EU to Wales, we are making the underlying assumption that the balance of imports in raw materials vs components is the same in Wales as in the EU. One might however expect the smaller geography to import proportionally more pre-manufactured components, thus having longer parts of their value chains outside of the country. This results in lower savings captured in Wales.

- For the fast-moving consumer goods on the other hand, the analysis is made on the basis of retail sales data rather than manufacturing data. As a consequence, if a product sold in Wales is largely imported rather than produced in Wales, the cost savings at the manufacturing level will likely be largely incurred outside of Wales. For food and beverages, for example, more products are imported than exported in UK. Assuming that the trend applies to Wales as well, this suggests that the cost savings realised within Wales may be lower than estimated here. We however emphasised that a large amount of the opportunity can be captured at the distribution level, the control of which lies within Wales, as is for example the case for packaged food. This also applied to the apparel sector: goods are largely imported, but the cost savings are mostly driven by local reuse and leasing schemes – as described in ‘Towards the Circular Economy’, volume 2. For these, the methodology thus provides a closer estimation of the potential.

**Additional benefits**

Beyond these material cost savings, moving to a circular economy would enable the Welsh economy to be less dependent on raw materials, and thus less dependent on price volatility and supply chain risks.

---

26 ‘Towards the Circular Economy’ vol. 2
The model is also a fertile source of innovation: replacing ‘linear’ products with goods that are ‘circular by design’ and creating reverse logistics networks and other supporting systems may be a powerful spur to new ideas and new businesses. Enabling business models favouring access over ownership (selling the service rather than the good itself) also have a crucial role to play. Along with growth for companies comes a chance for greater local employment in the new supply chains, especially in entry-level and semi-skilled jobs.

Higher land productivity, less waste in the food value chain, and the return of nutrients to the soil can enhance the value of land and soil as assets. The circular economy, by cycling biological materials through anaerobic digestion or composting processes and back into the soil, reduces the need for replenishment with costly additional nutrients and eliminates some of the negative impacts generated by chemical fertilisers.

Finally, the circular economy would furthermore entrain lasting benefits and a more resilient economy. Any increase in material productivity is indeed likely to have a positive impact on economic development beyond the effects of circularity on specific sectors.

**Case studies**

A number of companies across the world are innovating today to start capturing the value of the circular economy, each leveraging some of the building blocks of circular economy: circular design, innovative business models, reverse logistics and cross-sector collaboration.

**Circular design**

Flooring company **Desso** have been one of the pioneers of the “Cradle to Cradle” approach, and were the first carpet manufacturer in Europe to gain C2C certification. The company continues to innovate around the principles of a circular economy, extending these products to a large portfolio of clients in both carpet and artificial grass divisions.

**Ecovative**’s products are fully compostable alternatives to synthetic materials such as petroleum-based expanded plastics. They are made of mycelium grown in and around agriculture byproducts, acting thereby as a glue, and can take any shape needed. At the end of its use, the material can be simply composted at home without needing any special equipment.

**Innovative business models**

Copiers and printers returning from **Ricoh**’s leasing programme are inspected, dismantled, and go through an extensive renewal process — including key components replacement and software update — before re-entering the market under the GreenLine label with the same warranty scheme that is applied to new devices. Ricoh’s objectives are to reduce the input of new resources by 25% by 2020 and by 87.5% by 2050 from the level of 2007. Ricoh’s servicing and remanufacturing plant is in Telford, Shropshire.

**Vodafone** offers a leasing model allowing users to have access to the ‘hottest devices’ every year. The user hires a phone for 12 months. The monthly fee includes unlimited calls and messages and a data plan. The user does not own the device: at
the end of the year, he returns it and swaps it for a new one, or holds on to it for a few months until the desired device is available. This business model aims to ‘close the loop’ and to address the issue of high-value devices and their components leaking out of the value chain.

Reverse logistics

Brocklesby collects oils and fats by-products from restaurants, food manufacturers and retailers. They undergo a process of filtration and purification, giving rise to biofuels building blocks and fatty acid with technical applications.

Gamestop is one of the largest refurbishers and recyclers of electronics in the world. Devices, such as game systems, tablets and mp3 players, are traded in stores against cash or discount. Gamestop collects products in all conditions. If needed, the devices are refurbished or remanufactured and returned to their original factory condition. The components or parts that cannot be used at all are destroyed and recycled.

Cross-chain and cross-sector collaboration

Kalundborg Symbiosis is the world’s first well-functioning example of industrial symbiosis. Companies in the region collaborate to use each other’s by-products and share resources. The residual product of one enterprise is thus used as a resource by another enterprise, in a closed cycle. The companies involved include a power station, a fish farm, a pharmaceutical manufacturer and a wallboard manufacturer. The trade by-products such as heat, sludge, steam, gypsum, ashes or incineration waste.

Aquafil is a nylon yarn producer, using the ‘Econyl system’, a method by which new nylon is produced from post-production and post-consumption nylon waste. The company established the Econyl Reclaiming Programme to facilitate a reverse supply chain and ensure reliable materials inputs. The programme consists in an international waste collection network, based on partnerships with institutions, public and private consortia, and customers, in the goal to recover materials to be used as input by Aquafil’s Econyl plants.
3. WALES: A FERTILE GROUND FOR CIRCULAR ECONOMY

In line with natural systems, the circular economy is essentially a growth-orientated framework, releasing and refining materials flows in order to unlock value already available in supply chains. For a country such as Wales, with a strong history of manufacturing and resource production, the benefits of creating this new industrial economy are manifold. Innovation around circular economy has the potential to create productive employment, tapping into the traditional manufacturing skills base whilst enthusing a new generation of workers and creating a network of resource flows that supports social and environmental capital through optimising the system as a whole.

The manufacturing landscape and the need for resilient growth

‘The skilled workforce in Wales and increasing cost of labour abroad means that many businesses are repatriating their manufacturing operations’. Waste Strategy Branch, Welsh Government

Rich mineral and material resources brought investment and economic development to Wales during the Industrial Revolution, transforming the landscape from a largely agrarian society into a lively industrial nation. Large coal deposits and the advantages brought by deep water harbours at Swansea Bay fuelled the success of iron and copper smelting, and these in turn saw a boom in metals manufacturing and other heavy industry\(^{27}\). Along with the rest of Western Europe however, the latter half of the 20\(^{th}\) century saw a decline in industrial production and a shift towards service and public sector employment, which today accounts for the vast majority of jobs in Wales\(^{28}\). Manufacturing and industry in Wales took a further hit during the recession of 2008, and, although high hopes are placed on the sector to lead the country out of the doldrums, the challenges of depressed growth and low output remain\(^{29}\).

According to ONS data shown in the Welsh Economic Review 2012, Wales has the lowest regional GVA per head in the UK, with GDP per capita in the West Wales and the Valleys sub-region being lower than some regions in Greece and Eastern Europe. Unemployment in Wales is higher than the UK average\(^{30}\) and earnings continue to fall below the median for the UK\(^{31}\). Such contributing factors have led to Wales being identified as a recipient for regenerative EU Structural Funds, distributed through the Welsh European Funding Office (WEFO). Professor Wyn Jones, Director of the Wales Governance Centre at Cardiff University, says one of the most serious problems faced by Wales is its tendency ‘to haemorrhage its brightest and best 18 year olds, so many of whom choose to cross Offa’s Dyke for their university education never to return.’ This ‘represents an incalculable loss of human, social and cultural capital for a relatively poor country’.\(^{32}\)

---

\(^{27}\) Wikipedia, Economy of Wales

\(^{28}\) Welsh Economic Review (2012)

\(^{29}\) Welsh Economic Review (2012)


\(^{31}\) http://www.ons.gov.uk/ons/dcp171778_286243.pdf

\(^{32}\) Professor Wyn Jones, Welsh Economic Review 2012
The opportunity now is for Wales to kick start a new era of resilient, Wales-centric growth that provides meaningful employment for its citizens and innovation for its industries. According to Professor Jones, the key issue is to reframe the task for policymakers, from ‘distributing the funds allocated to them by Westminster’ to ‘encouraging wealth creation’ from within Wales. The implication here is significant: there is an acknowledged move towards greater autonomy in the country, including the suggestion of a separate Welsh legal jurisdiction. The Silk Commission of November 2012 recommended further political devolution for Wales, including control of business rates and landfill tax, and shared responsibility with Westminster for setting income tax rates.

If Wales can harness its heritage as a provider of material resources and a hub of industry, linking these features with its newfound optimism and independence, and shaping them to the requirements of a new century, then it has the potential to stake its claim to a leading position at the vanguard of industrial evolution in Northern Europe.

**Policy supports circular economy**

‘There are a lot of government initiatives, but we were ultimately landfill-taxied into action!’, Bill Dobson, SA Brain

To a large extent policymakers are already starting to leverage some of the value of a circular economy through the focus on Sustainable Development as a core organising principle of government. This commits policymakers to a vision of, amongst other things, building a ‘resilient and sustainable economy’ and supporting ‘healthy, biologically diverse and productive ecosystems’ through serving citizens with an emphasis on the long term.

Wales’s overarching waste strategy, Towards Zero Waste, cites ‘closed-loop recycling whereby materials are re-used for their original purpose’, and the ‘high levels of clean, high quality, source-separated recyclates to drive the market’ and supply to Welsh manufacturing. Statutory targets of 70% recycling are set for municipal waste collected by local authorities, and anaerobic digestion facilities set to generate renewable energy and fertiliser from food waste. It is further intended that the government’s sector plans will pursue and implement eco-design, green procurement, resource efficient production and source separation processes – all of which would feed in to a wider move towards system optimisation and circular economy.

The Collaborative Change Programme (CCP) provides Government support to local authorities in developing and delivering a business plan to meet the objectives of Towards Zero Waste as well as the EU Waste Framework Directive. This includes the delivery of higher quality recycling as well as the sharing of good practice, and

---

33 Net Impact’s 2012 Talent Report highlights the importance of ‘contributing to society’ for students and jobseekers
34 Welsh Economic Review (2012)
36 One Wales: One Planet, Sustainable Development Charter (2010)
support is provided by WRAP (Waste & Resources Action Programme) and the WLGA (Welsh Local Government Association).

There are proposals for legislative interventions as part of both a Future Generation Bill and an Environment Bill, which would include 70% recycling targets for business wastes, mandate separation of wastes (pure materials streams) by businesses and collection companies and ban incineration and landfill of certain materials – all of which could support a circular economy in Wales.

As part of Wales’s public procurement policy, sustainable risk assessment procedures are in place which aim to take account of the wider social, environmental and economic implications of procurement, supporting the shift towards an economy focused on a whole-systems approach. The Welsh Government’s Anaerobic Digestion Procurement Programme has been set up to prevent biodegradable municipal waste from ending up in landfill, with a financial support package for local authorities who wish to adopt AD technology and the aim of diverting an additional 140,000 tonnes of food waste a year from landfill.

Education for Sustainable Development and Global Citizenship (ESDGC), as an overarching theme for education in Wales, has the potential to leverage systems thinking in schools, encouraging learners and teachers to consider the interrelated nature of the world and the local and global implications of their actions.

In terms of business initiatives aligned with circular economy, there is a wide variety of support and funding programmes available for businesses, many of which feed into a theme of resource efficiency or system innovation by targeting ecodesign or eco-innovation, funding partnerships with academic institutions and supporting research and development initiatives. Financing for these programmes comes from both Wales and UK governments, as well as from the EU Regional Development Fund, and direction is lent by the Innovation Wales strategy. This document emphasises clear strategic priorities built on Wales’s strengths, and identifies five themes within which to concentrate efforts: improving collaboration, promoting a culture of innovation, providing flexible support and finance for innovation, prioritising and creating critical mass and encouraging innovation in government.

In addition to government policy, there are several organisations working within Wales whose remit resonates with creating value through a circular economy. WRAP Cymru is focused on preventing waste and promoting recycling and recovery (including reuse/preparation for reuse) and is working with both businesses and government to support these objectives, with the aim of reducing

---

39 any form of innovation resulting in or aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment, enhancing resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources
39 European Commission Eco Innovation Action Plan
40 Knowledge Transfer Partnerships and Networks, funded by the TSB and UK government
41 SMARTCymru, Business Innovation, http://business.wales.gov.uk/
42 West Wales and the Valleys Convergence Operational Programme
43 http://wales.gov.uk/newsroom/businessandeconomy/2013/7614427/?lang=en
costs and increasing benefits to all sectors of society\(^{44}\). Actions include starting to develop design principles around longer lifetime and reusable products, exploring new leasing models and supply chain partnerships and supporting the Courtauld Commitment 3 in saving costs and carbon emissions through reducing food waste. The aim is to develop a ‘successful closed loop economy in Wales’\(^{45}\), and WRAP Cymru supports the Welsh Government in implementing the target of 70% recycling set in Towards Zero Waste and helps to inform the various sector plans. Developing best practice guidance for business waste, improving the quality and markets for recyclate and anaerobic digestate and improving collections and reprocessing infrastructure are also initiatives specified by WRAP Cymru, which supports them through projects such as eQuip\(^{46}\), REMade\(^{47}\) and ARID\(^{48}\). These efforts are already creating value for the Welsh economy, supporting small and medium enterprises, reducing landfill waste and carbon emissions and creating jobs\(^{49}\).

Partly funded by the Welsh Government, the Ecodesign Centre is a Welsh Government Centre of Excellence that supports elements of a circular economy. The Centre’s motivation is reducing environmental impacts through ecodesign research and implementation, and it collaborates extensively with academic and business networks to innovate and implement new practices. Through its work with the Ecodesign Centre, the office furniture company Orangebox has been enabled to reduce energy and production costs and to create chairs that are designed to be disassembled and the parts reused\(^{50}\). This enables increased cycling of components at high quality, reducing raw material inputs and enhancing value creation in the process. In its 2013 Ecodesign Baseline for Wales Waste Prevention Programme, the Eco Design Centre has also identified barriers, such as standards and skills, to designing for reduced resource intensity that may be similarly relevant to circular economy.

The Wales Centre of Excellence for Anaerobic Digestion has been researching waste optimisation processes since the 1970s. The Centre is now supported by ERDF (European Regional Development Fund) funding, and provides case studies and best practice as well as technical analysis and consultancy for individual companies. Driven by the Landfill Directive and the Welsh Government’s policy on waste segregation it has seen a surge of interest from business and agriculture over the last five years: it is now coordinating work on optimising food waste streams, producing high-value biopolymers and organic chemicals from nutrients that would otherwise have been landfilled, improving the dewaterability and therefore worth of digestates and generating valuable hydrogen and methane gas fuels from the process\(^{51}\). The multiple benefits of an integrated value-extraction approach are clearly visible here, and illustrate how certain constraints can be turned into opportunities.

\(^{44}\) WRAP Cymru Delivery Plan  
\(^{45}\) ibid.  
\(^{46}\) a leasing scheme that helps companies secure financial assistance for new and second hand recycling plant machinery  
\(^{47}\) encourages manufacturers to use recycled materials in products or packaging; consultancy provided carries out feasibility, technical & markets work for any SME manufacturer in Wales  
\(^{48}\) Accelerating Reprocessing Infrastructure Development – funded by the ERDF  
\(^{49}\) WRAP Cymru ARID Advice Guidance Workshops (May 2013)  
\(^{51}\) Tim Patterson, Anaerobic Digestion Centre
Other centres for research and innovation that have the potential to feed into circular economy development include the Wales Environment Research Hub (WERH) and BEACON Wales, a Biorefining Centre of Excellence that already researches biomass-based products and fuels, and could be valuable in exploring the opportunities for 'upcycling' food waste into high-value products. As an existing centre for environmental and materials innovation, there is significant potential for Wales to broaden its reach and unify these various branches of activity under the umbrella of the circular economy.

Businesses and Communities are already pursuing circular economy value

In addition to government-funded policy and initiatives, there are a number of enterprises in Wales that are currently pursuing value through implementing circular economy practices. As part of this research project, we interviewed several business and community leaders who are working in this area, and used four related aspects of circular economy to focus the interviews: redesign of products and materials with 'end of life' in mind; innovative business models, for instance leasing or providing product services rather than selling products outright; reverse logistics and cascading to enable take-back and reuse of components at high quality; and cross-sector or cross-chain collaboration between companies both along and between supply chains. In many cases, the companies displayed more than one of these attributes, but for ease of identification we have categorised them as follows:

Design and production

Orangebox52 (furniture)

‘In our opinion a significant amount of recycling is downcycling and is merely delaying the landfilling of materials’, Orangebox

As previously mentioned, Orangebox is a Welsh SME and UK leader in the design and manufacture of office furniture, with a factory in Hengoed, Mid Glamorgan. Their award-winning success has been a result of their front-end design process, where their products are designed with material sustainability and longevity in mind. They work hard to eliminate any toxic materials from their value chain, use recycled materials wherever possible (‘waste as food’), and emphasise reuse or repair of their products at ‘end of life’ stage. The Do chair was designed for disassembly, its material inputs reduced, and as a result achieved a reduction in raw material as well as embedded energy and production costs. It is their fastest selling chair to date. Over the past three years, Orangebox has nearly doubled its turnover and is selling an increasing percentage of premium products. They have recently piloted a more vertically integrated approach, setting up a recycling centre at their factory to provide customers with a take-back service.

Liz Walker, Orangebox
Howies\(^\text{53}\) (clothing)

‘Merino wool is the perfect example of brilliant design by nature...capable of regulating your body temperature in all conditions, flame retardant, odour resistant and completely biodegradable’, Howies website

Founded in 1995 and based in Cardigan Bay, Howies is an outdoor clothing company that designs products to last - increasing their value by keeping them in the cycle for longer. Howies try not to mix fibres in their clothes, using pure organic cotton, hemp and merino wool from non mulesed sheep as key materials, supplemented by recycled polyester and cotton which also saves on raw material stocks. They only ever order enough material for the current production line, saving on costs by reducing wastage, and often make use of cheaper leftover material cuttings from other factories. Howies will repair clothes for customers, keeping them cycling at high quality for longer, and have more than halved their packaging carbon footprint by using recyclable plastic bags. They try to recycle as much of their waste as possible, and made a small profit by selling metal to a receiver.

Other examples of design for circular economy in Wales include Dawn Meats, a global supplier of beef and lamb carcase and primal cuts with its retail packing unit based in Cross Hands. They have invested in re-design activities to enable reusable packaging and reusable trays for delivery; trays are lined during delivery and then sanitised before going out again. In a more conventional way, Dawn Meats actively work with customers and suppliers to reduce and recycle materials and have managed to reduce the weight (and therefore cost) of boxes and liners by 220 tonnes per annum. Boots, who own 100 stores in Wales, also work on the recycled content of own brand and supplied packaging and are currently looking into options for biopolymers. According to Andrew Jenkins, their Botanics & Ingredients range toiletries bottles were the first to use recycled polymers: ‘the perceived wisdom was that recycled plastic would be more expensive, but it wasn’t, so in the end several of our suppliers changed their materials’.

Innovative business models

Vert2Grow\(^\text{54}\) (food)

‘The extremely positive feedback we have received from leading players in the commercial and social sector leads us to believe that our QL business model could be the catalyst for substantial economic regeneration and job creation in Wales.’ Mike Miles, CEO

The Quality of Life (QL) business model will be tested on a national and international stage with a new product innovation called ‘Vert2Grow’ designed to address the issue of food security. With the QL model a sales based royalty is paid to the private innovators behind Vert2Grow, with all subsequent profits directed to community development. The Vert2Grow technology will allow a wide range of food produce to be grown all year round using nominal infrastructure, management

\(^{53}\) Adrian Gunn, Howies
\(^{54}\) Mike Miles, Vert2Grow
and resource and on a highly market competitive basis for retail and commercial customers. The V2G food panels can be grown collaboratively in currently redundant spaces both indoors all year round and outside on a seasonal basis and one Welsh university is already currently planning to cut food costs by growing produce for themselves on the panels and also generating income through sales to the local community. The food would be grown within unique grow panels that will be ultra-light and virtually self-maintaining from seed to full growth. The living food panels will be delivered to homes, restaurants, schools and hospitals, eliminating the need for packaging. Vert2Grow uses circular economy principles at different stages of design, manufacture, marketing and distribution.

EEE Safe55 (white and electrical goods)

‘We want to harness the WEEE and use it for local benefit’, Robert Alexander, Managing Director

Another new social enterprise, EEE Safe looks to keep valuable materials cycling within and benefiting the community by providing for the local repair and reuse of white goods. It plans to set up repair and training centres all over Wales and the UK as a source of local jobs, training engineers to a recognised standard in the safe repair of goods and keeping old appliances cycling in the economy. Using a Training Institute model with learning materials means local training centres can roll out accredited EEE Safe repairers. The EEE Safe centres would charge an annual fee of £300 to run a centre, which would also include an online ‘eBay’ style shop (without transaction fees), and would allow managers to keep the profits of the repairs. The centres would also contribute to materials tracking and tracing by recording each appliance on a central system, and there are plans to enable a leasing option so that customers could rent but not have to purchase the appliance from the centre. EEE Safe also works with manufacturers, lobbying for standardisation of recycled and refurbished components to a recognised quality, and plans to have an online trading platform to ensure standards in the trade56. According to director Robert Alexander there is a high demand for second hand white goods, especially from poorer sectors of the community, and they have already created a partnership with the Co-Op. By valorising waste products within the local community whilst providing safe repairs, training and jobs, the EEE Safe model demonstrates the multiple benefits that a circular economy can bring.

Reverse logistics and cascading

Metech Recycling (UK) Ltd57 (WEEE)

‘If something can be reused, we’ll resell it. We give customers a return for their waste!’, Gareth Liversage, Operations Director

Metech Recycling is a global waste management company with an arm based in Aberdare and dealing specifically with waste electrical and electronic equipment (WEEE). Metech Recycling (UK) manually assess, repair and dismantle waste equipment, selling repaired PCs and laptops via online and other reuse platforms.

---

55 Robert Alexander, EEE Safe
56 www.reeesafe.com
57 Gareth Liversage, Metech Recycling (UK) Ltd
and recovering as much material as possible – particularly components containing economically important materials, EU14 critical materials and hazardous materials. By directing these on to suitable refining processes or for safe disposal the economic, resource conservation and environmental benefits of recycling are maximised. They work with both public and private sector clients including health trusts, provide certification of secondary materials, data wiping, and where possible offer a rebate to their suppliers. By harvesting parts, Metech can provide significant savings to clients’ maintenance budgets. Since using Metech’s services, Sony UK TEC’s factory in South Wales have eliminated a £20,000 per annum cost for waste, which is now neutral as waste costs are offset by reimbursements; Metech has recently signed a contract with some of the trusts in Wales, which is also set to be cost neutral. Since one of their customers relocated their factory back to Wales, they have been able to return valuable internal capacitors (worth £25 each) to be reused in new products, saving the company on raw materials and original manufacture costs. In contrast to some larger waste outfits where shredding is the norm, Metech’s dismantling and sorting process enables them to valorise products and components at the highest possible quality.

SA Brain & Company\textsuperscript{58} (beverages)

‘As an industry, brewing has always looked at returning value to the supply chain’,

\textit{Bill Dobson, Head Brewer}

Founded in Cardiff in 1882, Brains brewery now has a presence in over 270 pubs, bars and hotels across Wales and the West of England, and is a Regionally Important Company in Wales. Along with others in the industry, SA Brains already leverage ‘closed loop’ solutions for many of their waste products, cascading them along the value chain to provide spent grains for cattle feed, yeast for yeast extract or pig feed, and organic liquid waste for land injection as fertiliser. The company avoids price distortions created through fluctuating markets by selling their byproducts (spent grains are by far the most valuable) to a third party merchant at a fixed price, who then benefits from a variable selling incentive and deals with standards and accreditation issues as the products re-enter the food chain. SA Brain have also reduced their transport and delivery costs by feeding in to a national provider who coordinates and optimises deliveries across the country.

Other examples of industrial symbiosis and cascading in Wales include Dow Corning\textsuperscript{59}, a RIC, who valorise the primary by-products of silicon production by selling these to European partners, and GS Flooring, a social enterprise who provide reused commercial carpet tiles to community and third sector at reduced cost, and also cascade the spent fibres into a plethora of uses, including insulation and reptilian fencing\textsuperscript{60}. SEDA Packaging also upcycle their high quality technical waste from paper cups by selling it to paper mills, and having realised the investment on a separation plant in under a year are now reaping significant cost savings.

\textsuperscript{58} Bill Dobson, SA Brain
\textsuperscript{59} Mike Squire and Andy Jones, Dow Corning
\textsuperscript{60} Ellen Petts, Greenstream Flooring
Cross-sector collaboration

Welsh Automotive Forum\(^1\)

‘We’re better at cross-sector fertilising these days: there are opportunities for collaboration between the auto, electronics and aerospace sectors, to generate new products and penetrate new markets’, Tim Williams, Chief Executive

The Welsh automotive sector is primarily made up of components manufacturers; it has a turnover of £3bn and employs 16,000 people. According to Williams, the automotive, aerospace and electronics industries are converging more than ever before, and, prompted by Life-Cycle Analysis considerations are moving towards a more design-oriented production process. The Welsh Automotive Forum runs technology showcase events, to which it invites other sectors, and the industry is also collaborating on new materials such as bioplastics (which would decompose as part of the biological cycle) and more recyclable metals. The small manufacturer-suppliers, says Williams, have always been creative in their approach, and Original Equipment Manufacturers (OEM’s) are now more proactive about looking down their supply chains, breaking out of silos and brokering co-innovation to increase the value of materials flows for all stakeholders. As part of their Lean Manufacturing programme, Toyota’s Deeside plant has shared its production processes with its supply chain and other businesses, loaning engineers to SME suppliers and thereby optimising value at multiple points on the supply chain. Work continues apace with the Welsh Government to look at the infrastructure required for future transport and mobility in Wales alongside renewable energy sources.

Forward Waste Management (waste and recycling)

‘We build relationships through time and are always coming across new homes for waste streams’, Lyndon Ward, Forward Waste Management Ltd

Based in Cardiff, Forward Waste Management provides a total consultancy and waste service that attempts to maximise value of resource streams at the highest level. After searching for opportunities for waste to be reused on site, FWM finds alternative routes where the material can be used in its current form or recycled into another supply chain. It also works with hazardous waste streams, and is currently looking at ‘laundering’ impure acid in order to reuse it again and again in a supply chain. The company doesn’t charge a fee for its consultancy services, but only for finding homes for difficult waste streams; they also encourage waste producers to establish protocols with raw materials suppliers.

Other Welsh examples of capturing value through collaboration include Business in the Community, which facilitates a knowledge-sharing network and provides open-door events. Machinery ring cooperatives such as that in Pembrokeshire\(^2\) also provide a collaborative consumption service to farmers, matching equipment needs with availability and enabling members to reduce costs. The rings provide member benefits through joint commodity trading, electricity and fuel purchasing and a labour pool. Several companies, including Sony UK Technology Centre and WEEE

---

\(^1\) Tim Williams, Welsh Automotive Forum
\(^2\) [http://www.pmr.org.uk/](http://www.pmr.org.uk/)
recycler Metech Recycling (UK) Ltd also collaborate with local schools, providing children with practical exposure to the workings of the world around them through fun ‘tear-down’ labs, and encouraging systems thinking by exploring the implications of materials usage and global supply chains.

A key player in Europe

Engineering is currently one of Wales’s biggest exports⁶³, whilst its growing photonics sector is a key enabling technology for many others, including electronics and automotive. Across Europe, the photonics industry underpins twenty others and leverages 10% of the total EU economy—amounting to 30 million jobs⁶⁴. The opportunity now is for Wales to leverage this existing landscape of skills and governance in order to capture the social and economic value inherent in the circular economic model. With early adoption and a regional approach, Wales has the chance to position itself as a regional Centre of Excellence for circular economy, a 21st Century Hub for the new take-back, remanufacturing and material optimisation services that will be key to the European Union’s agenda for a “resource-efficient and ultimately regenerative circular economy.”⁶⁵

⁶³ Welsh Economic Review (2012)
4. BARRIERS AND CHALLENGES TO OVERCOME

Building on the advances already being made in Wales, circular economy has the potential to deliver further social and economic benefits. This section of the paper focuses on some of the challenges and barriers to capturing these, and in doing so indicates possibilities for enhancing growth, employment and innovation in Wales through the release of resource flows and subsequent creation of value.

Summary:

a) Potential ambiguity: circular economy seen as a cost
Traditional perspectives can view waste as a burden rather than a resource, but circular economy invites a systems vision based on economic growth and waste as food.

b) Danger of polarising language and framing
Polarising terminology and the prevalence of ‘recycling’ over ‘reuse’ may negate the message of value ultimately brought by circular economy.

c) Inconsistency of approach
Certain discrepancies between government policy and action on the ground imply difficulties in implementing some measures that could support circular economy.

d) Lack of clarity or practicality in supporting mechanisms
Existing business support initiatives and forums are manifold but do not specifically encourage circular economy practices. Support mechanisms can be aligned around the opportunity and communicated effectively to business.

e) Education, skills and training channel the reductionist approach
Approaches to ESD and adult education can vary across the country, and SMEs may lack commercial or technical expertise and interdisciplinary perspectives.

f) Business as Usual lock-in
Traditional, linear models of marketing and anxieties around collaborating with competitors may contribute to a status-quo bias and prevent businesses innovating for circular economy.

g) Limited access to appropriate resource flows, qualitatively and quantitatively
Access to steady flows of quality recyclate and availability of reprocessing plants are important for businesses pursuing reuse and remanufacturing, and it is difficult to attract investment if recyclate supply is volatile.

h) Limited take up of public procurement drivers
Insufficient awareness of or fragmented approaches to sustainable public procurement may limit Welsh business adoption of circular economic innovation.

i) Ineffective implementation of legislation: the case of Extended Producer Responsibility
European legislation that could nominally support a circular economy, such as Extended Producer Responsibility, may prove a barrier to innovative design and material valorisation if implemented ineffectively in member states.
j) Perceived business risk of transition and underestimated hazard of maintaining the status quo

Immediate concerns about brand image or health and safety may prevent some companies from innovating around circular economy, though equally there is a poor understanding of the risks of maintaining Business as Usual.

k) Limited influence of Wales on fiscal policy and dependence on external markets

As a small country, Wales can be the unwitting recipient of legislation or supply chains dictated from elsewhere, and its influence on global materials markets is limited.

These points will now be addressed in greater detail:

a) Potential ambiguity: circular economy seen as a cost

Traditional perspectives such as the ‘polluter pays’ principle may be considered to have contributed to an antagonistic relationship between businesses and environmental lobbies. The externalities such as pollution that companies all around the world produce have led policymakers to impose disincentives (e.g. taxes) in order to compensate society for damage to environment and health. Waste products are viewed as a burden, for society which must dispose of them when they are no longer required, and for business which must pay financially for them to be treated. Thus the scene is set for a standoff between the ‘moneymakers’ and the ‘planetsavers’, and when government or another body sees fit to introduce ‘green’ or ‘eco’ framed initiatives for businesses, the common perception is that these are costly programmes to mitigate negative impacts or token measures that don’t take the reality of business into account.

The circular economy invites a new vision, based on a unified systems perspective: just as growth is the only common attribute of life, so growth is vital to a living and functioning society. In closely mirroring natural systems, the circular economy presents waste as a resource or a ‘food’ rather than a burden, and as such something to be valued and maintained at the highest possible quality, rather than disposed of at the lowest possible cost. The understanding and assimilation of this circular economy vision at government and business levels is vital, since this directs the communication and implementation that follows.

It is therefore crucially important that key decision makers understand the relative costs and benefits of innovative approaches and so they can then provide the necessary support and encouragement for their operational staff.

b) Danger of polarising language and framing

Several interviewees have stressed the fact that terms such as ‘green’, ‘eco’ or ‘sustainable’ have a tendency to exacerbate existing divisions by playing into the assumptions of many business leaders that any initiatives that are environmentally beneficial are automatically deleterious to business. Thus policies such as ‘green
growth’ and ‘sustainable development’, whilst trying to promote a positive message, may unwittingly be inviting the cynicism of the status quo. Centred on economic activity and on opportunity, the circular economy framework goes beyond traditional “end of pipe” solutions and the inevitable tension they create when presented to companies. Rather than offering more schemes and more efficient ways to “clean up”, the circular model embodies a system redesign based on generating positive outcomes from the outset.

The framing and dissemination of circular economy at a localised level can prove a further barrier: in several instances, both business and policymaker interviewees reverted to a discussion of ‘recycling’, which ultimately negates the increased value brought by circular economy practices such as reuse, repair, remanufacturing and pure materials flows, and implies a cost to business which managers may equate to dumping, or landfiling. The lack of clarity in language used around recycling and the waste hierarchy exacerbates this problem, leading to poor understanding and valorisation of resource flows. For example, although Wales’s major waste policy document describes ‘high levels of clean, high quality, source-separated recyclates’ and the ‘right kind of recycling’, it is the target of 70% ‘recycling’ that stakeholders and local authorities recognise and work towards; the alternative here is to capitalise on the greater opportunities for reuse and longer cycling.

The confusion that exists around the EU’s Waste Framework Directive and the conflation of reuse with preparation for reuse and recycling also exemplifies this issue, and it is likely that by classifying reusable materials as waste, policy has contributed to the lack of uptake of reuse over recycling. The classification of hazardous waste materials, moreover, can prove a barrier to industrial symbiosis activities for certain companies. For example, it affects the speciality chemicals manufacturer Dow Corning in that businesses which could otherwise be interested in using its silica waste streams are put off by the ‘hazardous’ label and neither party releases the potential valorisation. Of course, such labels have been applied by the regulator for good reason, but there may be cases in which better coordination of the intentions of both parties is useful.

c) Inconsistency of approach

It is evident from speaking to a number of interviewees that differences in understanding and motivation within an organisation can contribute to fragmentation and ineffectual action. The two core sustainable development principles of policymaking in Wales are

---

67 eg Richard Leonard, Tata Steel
68 http://www.bioregional.co.uk/files/publications/PushingReuse.pdf
69 Mike Squire and Andy Jones, Dow Corning

---
Involvement and Integration\textsuperscript{70}, an approach that ‘makes the connections between, and effectively integrates economic, social and environmental challenges’. It appears that there is an opportunity for increased collaboration among and between government departments - for instance Economy, Science and Transport and Natural Resources and Food. The importance of replacing ‘silo’ mentalities, which focus almost exclusively on given targets and lack practical recognition of the interrelated nature of environment, economy and society, with ‘systems’ thinking as a tool for circular economy is very apparent here.

Several businesses place huge importance on the coordination and consistency of local authority collections,\textsuperscript{71} and government insiders acknowledge this as an area for improvement\textsuperscript{72}. Separate materials streams and effective reverse logistics are a key aspect of a circular economy, and the Welsh Government’s Collaborative Change Programme provides support to local authorities looking to provide higher quality recycling services. However, consensus between local and central government is yet to be reached, particularly with regards to the desirability of a ‘one size fits all’ approach, whether kerbside separation or comingled recycling should be instigated and who should bear the related costs. Price differentials play a significant part here, and according to Tim Peppin of the Welsh Local Government Association, waste reprocessors sometimes offer local authorities similar prices for certain mixed and separated waste materials (e.g. clear and coloured glass), which then makes it hard for the authorities to justify the additional costs of separation. Some businesses also suggest that reuse credits\textsuperscript{73} should be paid consistently by local authorities in Wales, and at a higher price than recycling credits – thereby incentivising reuse as of higher value than recycling.

Varying motivations between business, government or the regulator also make for differences in interpretation and implementation of the same legislation, in some cases leading to potential waste of resource. For instance, Tata Steel used to use its own waste oil on coal before going into the coke ovens, but since the Environment Agency invoked the incineration waste directive Tata must buy in reprocessed oil from elsewhere. According to Environment Manager Richard Leoniard, the purpose of the EU waste directives is to improve environmental performance; Tata’s use of its own waste on site would contribute to that, and a more holistic approach by the regulator could allow full valorisation without causing environmental harm. Of course this may not reflect the full story, but in cases where the letter of the law may conflict with the spirit it is vital that a whole-systems perspective is taken by businesses and regulators alike.

d) Lack of clarity or practicality in supporting mechanisms

Although, as suggested in Chapter 3, there are a large number of opportunities already available for businesses to benefit from Welsh Government or EU support in order to assist with implementing circular economy practices, there appears to be some confusion amongst SMEs over accessibility and

\textsuperscript{70} One Wales: One Planet (2009)
\textsuperscript{71} eg Lorenzo Angelucci, SEDA packaging; Adrian Gunn, Howies; Andrew Jenkins, Boots; Bill Dobson, SA Brain
\textsuperscript{72} eg Waste Strategy Branch; Tim Peppin, WLGA
\textsuperscript{73} Adrian Gunn, Howies
relevance. The new Business Wales website brings together many of these services available to business, and it is to be hoped will clarify the landscape for them, but currently there is a danger of smaller companies feeling overloaded and as a result ignoring and missing out on the assistance offered to them. For instance, the Eco-Innovation Projects for Wales report lists 29 separate initiatives, with funding from an array of sources and listing a variety of qualification criteria.

Aside from the variety of initiatives for business, the programmes available do not yet encourage SMEs to innovate for circular economy. For instance, qualifying criteria for business rates relief in Enterprise Zones could be tied to a business’s exploration of opportunities for circular redesign, or membership of a collaborative network. To some extent it appears that the Welsh Government’s reliance on behavioural change and ‘nudging’ techniques in order to shift patterns of production and consumption (eg with sustainable development in public procurement) has not yet proved fully successful in its conveyance of a serious message. To date the move towards resource efficiency has not been strongly supported by economic or legislative incentives; it may be that the proposed legislation for sustainable development changes this, but it is worth heeding the warning of the Commissioner for Sustainable Futures Peter Davies about the bill’s efficacy: ‘There is a danger that this narrative comes over as being too high level, vague in its application and unclear in respect of outcomes.’

A circular economy means enhancing our use of resources, and as such it sits well with a sharing economy, which is ‘about putting users and assets into a more effective relationship’. Key to optimising these assets and finding markets for disused resources is information – and in today’s world, this means information technology. There are already many forums available for manufacturers and stakeholders and represented on the web, and many of these are connected by location (e.g. at the Waterton Technology Centre) or individual networking. Yet Wales currently lacks a centralised information point giving information about types and volumes of recyclate and other resources available.

In practice, this means that outlets for recyclate and opportunities for materials exchange and asset sharing are left to individual companies to resource, and come down to chance meetings and personal connections rather than a reliable and well-profiled

---


http://www.cynnalcymru.com/blog/thoughts-sustainable-development-bill

Ken Webster, Innovation Director, Ellen MacArthur Foundation

e.g. Automotive, Aerospace and Opto-electronics Forums; SEMTA; EEF etc
internet platform. Howies, for instance, have built a reputation for reusing textile offcuts, but the success of this valorisation comes down to getting a chance call from a manufacturer with whom they have a pre-existing relationship.

If Wales is to adopt a more circular economy and take benefit from valorising its resource flows, then existing support mechanisms should be aligned around the opportunity and communicated effectively to business. A clear sense of direction is a key pre-requisite to obtain consistency and effective synergies when it comes to creating an integrated set of support mechanisms.

e) Education, skills and training channel the reductionist approach

A further aspect of spreading the message of circular economy is dissemination within the education and training systems. As previously mentioned, ESDGC (Education for Sustainable Development and Global Citizenship) provides some context for enabling systems thinking within education, but its prominence in Welsh national policy has more recently diminished. Across the UK, developments in ESD ‘are still relatively small scale... there is no coherent view at policy or practice level about how ESD can most appropriately ...contribute to improved learner outcomes’. The advantages that accrue to children in the catchment area of the Metech Recycling (UK) and Sony UK TEC tear-down workshops, for instance, are a result of the initiative taken by the companies themselves, and do not apply evenly across the country. Moreover, ESD is framed in the traditional terminology of sustainability; the opportunity now is for evolution towards circular economy.

Likewise with adult education and skills training, bodies such as the Welsh Institute for Sustainable Education provide some courses that could enhance growth of a circular system; these could benefit from central dissemination of education for businesses around the advantages of circular economy.

Several commentators remark on the lack of technical expertise available in Wales that may be necessary for innovating around and valorising waste flows. A number of reuse organisations are socially focused enterprises, such as EEE Safe and the Furniture Reuse Network, but there is an acknowledged lack of commercial expertise within the wider community reuse sector. The Welsh Government Waste Strategy Branch point out that some SMEs lack the business nous to be able to win government contracts, and Rosie Sweetman, Director of BITC suggests that all businesses, both large and small, have difficulty finding technical experts with STEM skills. STEM skills are important in circular economy remanufacturing or reengineering processes, and there is also a strong need for interdisciplinary experts who are able to use a systems-thinking approach to tackle new challenges from several angles.

79 http://info.cat.org.uk/wise
80 eg Richard Leonard, Tata
81 eg Dave Rimmer, Drem Ventures Ltd and Welsh Optoelectronics Forum; Andy Middleton, TYF

‘A key challenge is the lack of business acumen in this sector to scale up the work with the commercial sector’

Richard Thomas (Cylch)
f) Business as Usual lock-in

In order to reap the benefits of a circular economy, companies will need to innovate and collaborate along supply chains, apportioning the rewards of innovative product redesign or take-back systems. However, some businesses are anxious about collaborating when for so many years they have acted on a competitive instinct alone; one of the reasons cited in the recent issues experienced at the Welsh reuse network Cylch was a conflict of interest with a plastics recycling company which they had provided with investment funds82. Barriers around competition legislation mean that organisations have to be careful with the manner of collaboration and the information that they disclose, and for some this is a disincentive to circular innovation.

The remit of sales and marketing teams is traditionally to increase the number of units sold as a means to grow the business, but this approach fails to take into account the opportunities for growth and valorisation through repair and remanufacturing of existing materials. At a purchasing level, ‘business as usual’ practices support the custom of over-buying and then disposing of unwanted items, for instance in the clothing industry83. This creates needless waste as superfluous stock clogs up the system, bringing down prices to levels that fail to reflect costs of production and discouraging reuse.

Bias towards the status quo is a key challenge for transition to circular economy, and when businesses are struggling to stay afloat in a difficult economic climate there is inevitably a reluctance to risk bold innovations that are perceived as risky to the bottom line, compared with more traditional approaches.

g) Limited access to appropriate resource flows, qualitatively and quantitatively

A major barrier to investment in markets for recycle or for products for reuse is the need for steady, high quality flows of material as well as of locations to store it before repairing, refurbishing or reprocessing. The issue of storage has proved a conundrum for several, particularly community-based or social enterprises such as Cylch, Howies and GS Flooring: ‘we don’t currently take back clothes’, says Adrian Gunn from Howies, ‘and that is definitely a weakness, but we have no space in the warehouse for sorting’. Price

83 Adrian Gunn, Howies
volatility and sporadic access to feedstock has meant that economies of scale are similarly lacking and therefore reprocessing is not cost effective. Margins from recyclate moreover are not high\(^{84}\), and so it is vital for all stakeholders to work together in order to ‘crowdsource’ the inputs and investments needed for valorisation.

The Anaerobic Digestion Centre cites a particular problem of low-quality or contaminated food waste resulting in substandard digestate, meaning that the price received from farmers is lower than could otherwise be expected. This issue of quality is echoed by Metech Recycling (UK) and Howies, who both report that cheaper products and materials are harder to break down into their original ingredients for reprocessing. Steady flows of pure materials are essential to accelerating a circular economy, and these issues of volatility in volume and quality are typical of new markets which still require the confidence of strong investment.

A related problem is the lack of successful Welsh-based reprocessing and recycling plants: SEDA packaging, for instance, has to send waste to the North of England to be upcycled, Dow Corning send their valuable silicon waste streams to Europe, and Tata Steel are looking at transporting sludge byproducts to Germany, which is the nearest available processing plant. Tata are considering a rotary hearth furnace on site which would allow them to reuse the iron-rich slurries as a raw material input without paying a third party; if the plant were to be based at the Port Talbot site, it would provide a facility for other operators in Scunthorpe and the Netherlands, and would bring jobs growth to Wales.

Likewise with hugely expensive anaerobic digestion plants, individual processors are unlikely to invest on their own and so there is a need for joint ventures and collaborative funding in order to provide the scale required for success\(^{85}\).

**h) Limited take up of public procurement drivers**

Following the work of the UK Sustainable Procurement Task Force in 2005 Welsh Government, with the assistance of the Environment Agency Wales developed the Sustainability Risk Assessment (SRA), to promote consideration of life cycle thinking in contract planning. The SRAs encourage consideration of the potential economic, social and environmental impacts linked to specific procurements. For example in the last all-Wales Print Framework awarded by Welsh Government, the opportunity to move to vegetable based inks and dyes was identified which were less environmentally hazardous and consequently also less costly for contractors to use, manage and dispose of. The collaborative approach to procurement not only saved 25% but also enabled the move to vegetable dye to be made across all the print work procured.

The SRA templates also prompt consideration of options such as

\(^{84}\) Richard Anderson, CRISP
\(^{85}\) Food &Farming sector, Welsh Government
recycled, reused or leased products, and take-back options. In a survey of SRA usage undertaken by Value Wales in 2012, 85% of respondents confirmed that the SRAs are specified in their organisations procurement strategy and or, policy documentation or in procurement desk instruction or standing orders. However, only 49% of respondents stated that in their experience the SRAs were widely used.

The Wales Procurement Policy Statement launched in December 2012 by the Finance Minister sets out a clear expectation that tools, specifically including the SRA templates should be used as a matter of course. Principle 3 of the WPPS focuses on Economic, Social and Environmental Impact, stating that Value for Money should be considered as the optimum combination of whole-of-life costs in terms of not only generating efficiency savings and good quality outcomes for the organisation, but also benefit to society and the economy, whilst minimising damage to the environment. The provision of tools such as the Sustainable Risk Assessment to ensure that procurement decisions take account of long-term impact on the combination of benefits is referenced as a support mechanism from Welsh Government. The WPPS was drawn up in response to the McClelland review of Welsh procurement policy which recognised that while Welsh Government procurement policies were sound.

i) Ineffective implementation of legislation: the case of Extended Producer Responsibility

The topic of Extended Producer Responsibility is complex and well documented. It has concerns for both government and industry and exemplifies a wider issue of EU legislation being ineffectively implemented by member states, leading to lack of consistency and poor materials valorisation. As Rhys Charles 86 explains, in relation to WEEE compliance:

‘The necessity for producer compliance schemes to purchase evidence at inflated prices as a result of the 100% collective producer responsibility system and the practices of waste management companies have resulted in artificially high prices for compliance for producers. As a result any reductions in the costs of recycling that may result from design for reuse and recycling are absorbed by the system and not passed on to producers. No incentive therefore exists to justify the financial investment required for R&D and process changes necessary in order to deliver products with improved design for the end of life phase of their life cycle.’

Due to the way in which EPR has been transposed into UK law by the Department for Business Innovation and Skills (BIS) therefore, the ‘downgrading’ of individual producer responsibility into collective producer responsibility (which necessitates producers joining compliance schemes) does not represent an economic incentive

86 COATED Engineering Doctorate, College of Engineering, Swansea University
to redesign for reuse, repair or remanufacturing. By contrast, in Japan manufacturers own a majority of recycling and recovery operations and operate the producer compliance schemes; recovered materials are sent directly back to manufacturers for reuse, and so incentives for redesign and product development are high.

If producers in Wales were able to benefit more directly from the inherent material value in their own products, through a shift in EPR implementation, they may be more inclined to assist in establishing new recovery and manufacturing processes and thereby to provide economic and social benefits to the country. Since waste and other EU legislation is transposed into law at a UK level, Wales should use its leverage to assess and influence these economic instruments such that they support the transition to circular economy.

j) Perceived business risk of a transition and underestimated hazard of maintaining the status quo

For many businesses, the perceived risk of innovation around circular economy outweighs the benefits. Sony UK TEC, for instance, is very concerned with its brand image, and is one of many companies reluctant to allow second hand, repaired products to enter the market since it believes that this could give customers a negative perception of the brand. It could be argued however that some customers might perceive the brand in a more positive light as a result (as being more socially and environmentally attuned). Uncertainty where the exact repercussions of new circular economy practices are not fully understood presents the further risk of a disincentive to innovation.

There is also a perceived risk around health and safety: especially with electrical items, companies are concerned about their liability should a third party repair a product irresponsibly and they be the ones held to account in court. Boots likewise is concerned about liability should they be held responsible for a customer misusing a newly designed product, whilst the health hazards of contamination prove a barrier to certain businesses reusing food packaging.

k) Limited influence of Wales on fiscal policy and dependence on external markets

As yet (pending a UK Government response to the Silk Commission) the Welsh Government does not possess jurisdiction over taxation (eg income tax, inheritance tax, landfill tax) and relies heavily on the UK and EU for funding. When it comes to setting strong economic incentives therefore its hands are somewhat tied, and its traditional reliance on behavioural change and ‘nudging’ techniques have proved indifferently effective.

---

87 Rhys Charles, ibid.
88 Andrew Jenkins, Boots
89 e.g. Dawn Meats; The Co-Operative
Likewise for legislation: many of the directives that have some bearing on implementing a circular economy come from the EU and are transposed into UK and Wales law - for instance the Waste Framework Directive, Eco Design Directive, WEEE Directive or EPR legislation. According to Andrew Jenkins of Boots, common standards are key, but ‘products and materials don’t respect geographic boundaries and differences in legislation hinder our efforts towards circular economy’. The international nature of 21st century supply chains has challenges particularly for a smaller country such as Wales, where much of the material entering production or usage has been designed and sourced elsewhere, and changing entrenched processes requires significant leverage with much larger regions and corporations.

One of the most fundamental challenges for circular economy innovation is the global market value of virgin materials: if the upfront cost is less than for the equivalent recyclate, then companies are disinclined to invest in new materials and practices, particularly if availability of the recycled resource stream is volatile. Howies could buy a regular intensively-farmed cotton t-shirt for less, but because of their values and customer base they choose to buy organic, non-toxic shirts with traceable supply chains, and to pay more; there is currently no cost saving for them from buying recycled material.

‘Many reprocessors sell low quality material to China and India, so Welsh companies can’t source good secondary materials, even though there is a demand for them.’
Waste Strategy Branch

---

90 Mike Squire and Andy Jones, Dow Corning
5. RECOMMENDATIONS FOR A SUCCESSFUL TRANSITION

‘A vital ingredient in any sphere of activity is leadership.’
John McClelland, Maximising the Impact of Welsh Procurement Policy (2012)

As part of its continued pursuit of resource-efficient strategies, Wales now has a unique opportunity to take the next step and ‘upgrade’ to the circular economy, evolving its supply chains from linear purveyors of products into networks that create social and economic value through the cyclical flow of materials. Engineering is one of Wales’s biggest exports, and there are significant opportunities for building a ‘manufacturing service economy’, in which engineers as well as low-skill workers are employed in the remanufacturing and repair services that constitute a circular model.

Near-term recommendations

1. Wales could create a set of design guidelines for companies and manufacturing networks to pursue improved circular product design at a country level. Redesigning products for remanufacture and reuse is a fundamental principle of circular economy, and these guidelines need to be supported by strong, unified policy, for instance through the Environment and Future Generations Bills or Innovation Strategy.

2. Policy documents and other instruments and Government communications may be assessed and harmonised in the context of circular economy, in order to provide clear explanation of the potential benefits and a strong direction for business, education and public sector players in Wales. In order to bring these entities together and inject momentum, the Government could publish its own ‘roadmap’ for the country, bringing all stakeholders together at a launch event and laying out a compelling vision statement.

3. New legislation, especially that proposed in the upcoming Wales Future Generation and Environment Bills, can provide Government policies with concrete backing by specifying a circular approach to economic development and environmental management. Regulatory authorities also need to be apprised of and aligned with this approach as far as possible; there are indications that the newly created Natural Resources Wales authority (which took over from the Environment Agency) is already taking a proactive stance to balancing waste valorisation and industrial symbiosis opportunities with its traditional role of protecting environmental health.

4. Businesses could be supported by initiatives and financial incentives tailored to encourage circular materials flows. Criteria for grant and other funding,

\[91\] Welsh Economic Review (2012)
\[92\] Richard Kenworthy, Toyota; Richard Leonard, Tata Steel
such as that available in the Enterprise Zones or through Finance Wales, can be adapted to include circular economy principles, encouraging and supporting Welsh industry to valorise resource streams and redesign products and business models. Government procurement also needs to reflect circular economy objectives in practice by rewarding those who are investing in new markets. As the new National Procurement Service takes over from Value Wales, there is the opportunity for a fresh approach which mandates procurement managers to source from those businesses innovating around circular economic models.

5. As with the business-focused initiatives and other policy documents, ESDGC in Wales can be ‘upgraded’ to reflect circular economic principles, and implementation across the schools network enabled.

6. Since the opportunities for most cost savings have been identified in the automotive and packaging industries, the Welsh Government could work with companies and supply chains in these areas – for instance through the current Lean Manufacturing programme with Toyota or the Automotive Forum or with SEDA packaging. A pilot project, such as the cycLED initiative currently being worked on by the Ecodesign Centre to optimise critical resource flows in LED products, could be set up to bring together key stakeholders to assess current practices and potential valorisation points.

7. Those companies that are already practising an aspect of circular economy (eg as listed in Chapter 3) can be encouraged to move to the next level, for instance through the agency of the nine Welsh Government sector teams. For example, SA Brain could investigate the potential for valorising its spent grains by processing these into fish food, which has a higher value than livestock feed, or Sony UK TEC could map out the business case for enabling components to be reused in other products – even though they may at this stage be reluctant to allow third party repair.

8. At present, existing materials stocks and flows across manufacturers in Wales are not clear. A database could be built up to provide information about these assets, in order to inform business leaders and policymakers in Wales on the scope for circular economy adaptation and implementation; Germany’s federal materials agency, for instance, is considered to be a very useful lever. Ultimately, Wales may wish to consider working with some larger companies (for instance some of its RIC or Anchor companies) on a materials ‘white list’, pioneering

---

93 http://www.edcw.org/en/project/cycled
94 Richard Kenworthy, Toyota

"Stronger collaboration has the potential to realise some £150million of savings over the next 5 years if we plan and work together. Standardising our specifications and removing variation from common items has been shown to take out cost and release savings." Jane Hutt, Minister for Finance, February 2011

"A good database would be amazing. If it was in one place and let you find what you needed easily and have it delivered – a bit like Amazon, for instance. It doesn’t have to be industry specific.” Adrian Gunn, Howies
the global business case for such a list and perhaps feeding this into organisations like the World Economic Forum.

9. In a similar vein, Wales could create a centralised circular economy information ‘hub’, a managed internet platform including available waste resource streams for industrial symbiosis. As well as providing for materials symbiosis, the hub could act as an asset exchange, listing technical experts available for ‘informational symbiosis’ and giving details of assets available for collaborative consumption. For example, there could be a Wales-specific business-to-business group hosted and coordinated by FLOOW2. The site could also provide company case studies, illustrating success stories and giving recognition to those businesses innovating around circular models. It would be useful for the hub to leverage the existing plethora of forums and networks that exist in Wales, for instance linking in with the automotive, electronic, optoelectronics or technology forums or the further education colleges and apprenticeship networks. Several of these entities are based at the same location in Waterton Technology Park, and already cross-fertilise new innovations.

10. There is an opportunity for Wales to learn from other countries and regional authorities at both EU and global levels. For instance, Wales should continue to watch closely the 2014 business waste separation regulations in Scotland, and how local authorities deal with these; inspiration may also be taken from Japan’s effective model for producer responsibility. As a country with a strong base of SMEs and manufacturing, Wales may also be able to learn from the German model of Mittelstand. These small and medium-sized companies are credited as the ‘engine of the German economy’, and make a major contribution to innovation, employment and economic output – especially in the engineering and industrial sectors. Germany is also lauded as a centre for resource efficiency.

**Longer-term recommendations**

11. In order to encourage higher employment and lower virgin material use, the circular economy makes a case for shifting taxation from labour (i.e. a renewable resource) to non-renewable resources such as mined materials. Several companies and think tanks are involved in research or projects modelling and quantifying the economic impacts of a taxation shift, and there is growing interest in this area - with the European Resource Efficiency Platform (EREP) encouraging member states to ‘shift the tax burden away from jobs'...
to resource use in order to promote resource efficiency. Given this context of EU support, Wales could join forces with another economic region or multinational corporation to provide scenarios for such a shift, pioneering the case for transition at a high profile level.

12. As well as learning from other regions, Wales has the opportunity to mark itself out as a leader in the circular economy space. It should consider seeking to influence and support the direction of policy and implementation of regulation at EU and UK levels (eg waste directives; EPR) that will encourage circular economy both in Wales and further afield, by contributing to consultations and using its existing connections. The EU is now moving in the direction of circular economy (see quote) and there is an opportunity for Wales to position itself as a progressive, ‘pioneer’ region in Europe – garnering economic and political support and consolidating its situation as a ‘Centre of Excellence for Circular Economy’. Using leverage points such as WEFO and communicating strong leadership on circular economy, Wales can invite wider EU recognition as well as financial backing to empower its position.

‘In a world with growing pressures on resources and the environment, the EU has no choice but to go for the transition to a resource-efficient and ultimately regenerative circular economy. Our future jobs and competitiveness, as a major importer of resources, are dependent on our ability to get more added value, and achieve overall decoupling, through a systemic change in the use and recovery of resources in the economy. According to the OECD, this could lead to steady economic growth with business opportunities across the whole economy.’

Manifesto for a Resource Efficient Europe, December 2012

http://ec.europa.eu/environment/resource_efficiency/documents/action_for_a_resource_efficient_europe_170613.pdf
APPENDIX I: METHODOLOGY OF THE ESTIMATION OF COST SAVINGS IN WALES

Medium-lived complex products

The methodology is based on the methodology for the first ‘Towards the Circular Economy’ report, as detailed below. This provides percentages of material and energy cost savings that can be captured by applying circular economy principles, in a transition or advanced scenario.

To extrapolate to Wales, the approach consisted in applying these cost savings percentages to the total material input costs of all sectors of medium-lived complex products in Wales.

These input costs were calculated using 2007 Input/Output tables (provided by the University of Cardiff). For this, we mapped the industry categories of these tables onto the categories used in the ‘Towards the Circular Economy’ report, volume 1. For consistency with this report, from which the cost savings ratios were taken, the input costs were scaled up to 2011. The growth rate was calculated as the 2007-2011 growth rate of the material input costs of the same industries for the whole of the UK, as a proxy for the growth rate in Wales, in the absence of Wales-specific data.

Fast-moving consumer goods

The methodology is based on the methodology for the second ‘Towards the Circular Economy’ report. This analysis provides, for FMCGs in Europe:

- The percentage of material cost savings per material input costs,
- The percentage of material input costs per end consumption.

These are provided separately for the transition and advanced scenarios and at different steps of the value chain.

To estimate the material cost savings that could be captured by Wales in this sector, we applied these ratios to Welsh retail sales data in all FMCG categories. These were calculated using UK retail sales data (purchased from Euromonitor and Datamonitor), scaling them proportionally to Wales v UK populations (based on ONS and Euromonitor data) and gross income (based on ONS data).

APPENDIX II - METHODOLOGY OF THE ANALYSES FOR THE ‘TOWARDS THE CIRCULAR ECONOMY’ REPORTS

Report 1 - Medium-lived complex products

The estimation of total global cost savings consisted of three steps: case analyses, calculation of material saving ratios and calculation of global savings.

a) Case analyses. We identified circular opportunities at different stages of the value chain, namely production, packaging, and consumption. For each stage, we estimated the global materials savings and other effects based on a representative example:

- Breweries for production,
- Beverages for packaging,
- Food waste for consumption.
The textiles category was modeled for the whole textile value chain, i.e., from production to consumption, due to its particularly differentiated set of opportunities for reuse.

b) **Calculation of material saving ratios.** For each of the four cases above, we calculated the material savings ratio, defined as the ratio of material savings from the application of circular setups ($) over the cost of materials inputs ($). In order to build a realistic metric, we only took into account the material savings that could be obtained from profitable circular practices. Our analysis showed that this ratio would be affected by local factors. The savings ratios were thus estimated separately for three geographic regions: Canada and the U.S., Europe, and the rest of the world.

c) **Calculation of global savings.** The ratios calculated in step b) were applied to the cost of materials inputs for each of ten FMCG goods categories. The costs of materials inputs were derived using end consumption data (i.e. retail sales) from Euromonitor in 2011 and the share of materials inputs for each category. These percentages of material input were obtained through interviews with experts for each of the ten consumer goods categories.

**Report 2 – Fast-moving consumer goods**

The total cost savings for the EU was estimated in three steps: impact of circular business models on a product level, scale up from the individual product to its entire market, and scale up from a selected number of products to eight sectors of high potential.

a) **Impact on product level.** The analysis compared, for a selection of case studies, the inputs needed to make a new product in today’s system with those that would be needed to make the same product using circular economy principles. It focused on several key areas of economic impact, including material inputs and energy inputs.

b) **Scale up to the entire market** The results of the analyses for each area were combined with informed assumptions to determine the total savings in material and energy inputs at market level, if producers across the product industry were to adopt circular production techniques. This analysis was performed for two scenarios: a more conservative ‘transition scenario’, where assumptions were made mainly on changes in product designs and reverse supply chain skills; and an ‘advanced scenario’, showing the potential effect of a world that has undergone more radical change and has further developed reverse technologies and infrastructure and other enabling conditions.

c) **Scale up to medium-lived complex products.** To perform the scale-up, we compared the total absolute cost savings on materials and energy (net of the required materials and energy used in the respective reverse cycle) for the selected products with the total input costs in the EU for each respective product. We then applied the range of percentage savings from the detailed analysis to the eight selected target sectors to see what kinds of net material cost savings might be expected, were all producers to adopt similar circular setups.
### APPENDIX III: LIST OF INTERVIEWEES

<table>
<thead>
<tr>
<th>Name</th>
<th>Job Role</th>
<th>Company /Government sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonnie Hall</td>
<td>Account Manager</td>
<td>Business in the Community</td>
</tr>
<tr>
<td>Rosie Sweetman</td>
<td>Director, Wales</td>
<td>Business in the Community</td>
</tr>
<tr>
<td>Gareth Liversage</td>
<td>Operations Director</td>
<td>Metech Recycling (UK) Ltd</td>
</tr>
<tr>
<td>Gerald Davies</td>
<td>Sales Director</td>
<td>Metech Recycling (UK) Ltd</td>
</tr>
<tr>
<td>Liz Walker</td>
<td>Marketing Manager</td>
<td>Orangebox</td>
</tr>
<tr>
<td>Richard Thomas</td>
<td>Re-use Coordinator</td>
<td>Cylch</td>
</tr>
<tr>
<td>Simon Nurse</td>
<td>Head of Operations</td>
<td>Odoni Elwell</td>
</tr>
<tr>
<td>Tim Peppin</td>
<td>Director of Regeneration and Sustainable Development</td>
<td>Welsh Local Government Association</td>
</tr>
<tr>
<td>Tim Williams</td>
<td>Chief Executive</td>
<td>Welsh Automotive Forum</td>
</tr>
<tr>
<td>Richard Leonard</td>
<td>Environment Manager</td>
<td>Tata Steel</td>
</tr>
<tr>
<td>Ian Prescott</td>
<td>CSR, Environment, Health and Safety Manager</td>
<td>Sony UK Technology Centre</td>
</tr>
<tr>
<td>Lorenzo Angelucci</td>
<td>Managing Director</td>
<td>Seda UK Ltd (part of Seda International Packaging Group)</td>
</tr>
<tr>
<td>Rob Scoulding</td>
<td>Energy and Environment Manager</td>
<td>The Co-Operative Group</td>
</tr>
<tr>
<td>Robert Alexander</td>
<td>Managing Director</td>
<td>EEE Safe</td>
</tr>
<tr>
<td>Paul Lindsay</td>
<td>Operations Director</td>
<td>Aerospace Wales Forum</td>
</tr>
<tr>
<td>Mike Squire</td>
<td>EHSS Manager</td>
<td>Dow Corning</td>
</tr>
<tr>
<td>Andy Jones</td>
<td>Reuse &amp; Recycling Specialist not Waste Manager</td>
<td>Dow Corning</td>
</tr>
<tr>
<td>Mike Miles</td>
<td>CEO</td>
<td>Vert2Grow</td>
</tr>
<tr>
<td>Ellen Petts</td>
<td>Managing Director</td>
<td>Greenstream Flooring</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Welsh Government Officials</th>
<th>Branch / Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy Executive</td>
<td>Advanced Materials and Manufacturing, Department for Economy, Science and Transport.</td>
</tr>
<tr>
<td>Senior Strategy Adviser</td>
<td>Advanced Materials and Manufacturing, Department for Economy, Science and Transport.</td>
</tr>
<tr>
<td>Deputy Director, Head of Waste and Resource Efficiency Division</td>
<td>Department for Natural Resources and Food.</td>
</tr>
<tr>
<td>Head of Waste Strategy Branch</td>
<td>Department for Natural Resources and Food.</td>
</tr>
<tr>
<td>ICT Project Manager</td>
<td>ICT, Department for Economy, Science and Transport.</td>
</tr>
<tr>
<td>Monitoring Manager</td>
<td>ICT infrastructure and Digital Wales, Department for Economy, Science and Transport.</td>
</tr>
<tr>
<td>Senior Programme Manager</td>
<td>Technology, Science and Innovation for Business, Department for Economy, Science and Transport.</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Value Wales.</td>
</tr>
<tr>
<td>Waste Strategy Team Leader</td>
<td>Department for Natural Resources and Food.</td>
</tr>
<tr>
<td>Director of Environment</td>
<td>Department for Natural Resources and Food.</td>
</tr>
<tr>
<td>Technology and Innovation Manager</td>
<td>ICT, Department for Economy, Science and Transport.</td>
</tr>
<tr>
<td>Business Development Manager</td>
<td>Financial and Professional Services, Department for Economy, Science and Transport.</td>
</tr>
<tr>
<td>Waste Strategy Team Leader</td>
<td>Department for Natural Resources and Food.</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Entrepreneurship and Business Information</td>
</tr>
<tr>
<td>Business Change Manager</td>
<td>Working Smarter Programme, Food and Farming Sector.</td>
</tr>
<tr>
<td>Name</td>
<td>Title</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Mark Dempsey</td>
<td>Environmental Policy Adviser</td>
</tr>
<tr>
<td>Lyndon Ward</td>
<td>Managing Director</td>
</tr>
<tr>
<td>Linda Crichton</td>
<td>Head of Collections and Quality</td>
</tr>
<tr>
<td>Helen Middleton</td>
<td>Market Development Manager</td>
</tr>
<tr>
<td>David Hieatt</td>
<td>Co-Founder</td>
</tr>
<tr>
<td>Dave Rimmer</td>
<td>Director</td>
</tr>
<tr>
<td>Richard Anderson</td>
<td>Director</td>
</tr>
<tr>
<td>Bill Dobson</td>
<td>Head Brewer</td>
</tr>
<tr>
<td>Andrew Jenkins</td>
<td>Sustainable Development Manager</td>
</tr>
<tr>
<td>Adrian Gunn</td>
<td>Director</td>
</tr>
<tr>
<td>Richard Kenworthy</td>
<td>Director</td>
</tr>
<tr>
<td>Andy Middleton</td>
<td>Director</td>
</tr>
<tr>
<td>Beth Winkley</td>
<td>Head</td>
</tr>
<tr>
<td>Susan Jay</td>
<td>Business and Markets Manager</td>
</tr>
<tr>
<td>Rhys Charles</td>
<td>COATED Engineering Doctorate, College of Engineering</td>
</tr>
</tbody>
</table>