

Report

April 2015

Circular Economy Thinking and Action at the University of Edinburgh



THE UNIVERSITY
of EDINBURGH

Contents

1	Acknowledgements	3
2	Abbreviations and acronyms	3
3	Executive summary	4
4	Introduction	6
4.1	Outline of the report	6
4.2	Aim and objectives	6
4.3	Methodology	7
4.4	Limitations of the study	8
5	Circular Economy theory and definitions	8
5.1	Background to Circular Economy thinking	8
5.2	Definitions of the Circular Economy	9
6	Circular Economy in a university context	10
7	Circular Economy at the University of Edinburgh: where are we now?	12
7.1	Examples of Circular Economy thinking and practices at the University	13
7.2	General themes from the stakeholder interviews	17
7.3	Summary of challenges	19
8	Circular Economy at the University of Edinburgh: opportunities for the future and proposed next steps	20
8.1	Short to medium term opportunities	20
8.2	Medium to longer term opportunities	23
8.3	Proposed next steps	24
9	Conclusion	25
10	References	27
11	Appendices	28
11.1	Appendix 1: Copy of the call for expressions of interest for Circular Economy research	28
11.2	Appendix 2: Interview tools	29



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1 Acknowledgements

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The views expressed in this report are those of the researchers and project participants and may not necessarily reflect those of the University as a whole.

2 Abbreviations and acronyms

CE100	Circular Economy 100 programme
ECA	Edinburgh College of Art
ECCI	Edinburgh Centre for Carbon Innovation
EMF	Ellen MacArthur Foundation
ERI	Edinburgh Research and Innovation
MOOC	Massive Open Online Course
SBI	Sustainable Business Initiative
SHRUB	Swap and Reuse Hub Cooperative Edinburgh
SRS	Department of Social Responsibility and Sustainability
ZWS	Zero Waste Scotland

3 Executive summary

Higher education institutions educate future leaders, and have the ability to carry out cutting edge research to solve our global challenges. As large organisations with staff, students, buildings, supply chains and market influence they also have capacity to act as catalysts for change within their own practices.

Benefits for taking Circular Economy thinking and action further at the University include:

- Innovative ways of doing things; new research ideas and collaboration opportunities
- Potential financial savings from efficient use of resources
- Reduction in emissions and landfill
- Employment opportunities and skills development for existing staff and students and the wider community
- Opportunity for the University to differentiate itself and set itself as a forward-thinking, exemplar, University.

The Circular Economy is about transitioning from a 'take-make-dispose' linear approach to resource use, to systems that encourage reuse and extraction of maximum value before returning resources to the biosphere. The University of Edinburgh provides a context in which these principles can be researched and studied from different disciplinary perspectives (for example in Design, Engineering, Chemistry, Business, Geosciences, etc.). Edinburgh Research and Innovation (ERI) can enable links to businesses and research impact expertise. Circular Economy practices can be enacted through our operations – linking Procurement to Waste and Recycling and in activities promoting and integrating social responsibility and sustainability more broadly across the University.

During 2014, discussions with the International Office, Global Academies staff, Social Responsibility and Sustainability (SRS) staff and the Ellen MacArthur Foundation (EMF) led to the University participating in the first ever 'Disruptive Innovation Festival' in October. Further discussions were held with lead officers responsible for enabling a shift towards a Circular Economy in Scotland at the Scottish Government-funded Zero Waste Scotland (ZWS) on opportunities to work together. In December 2014, interested academic staff, operations staff in Waste and Recycling and Procurement, and external organisations came together to discuss what is going on in Scotland and at the University level in this area and what could the University do to take this further.

A research project was carried out within the University, with the support of Zero Waste Scotland. The SRS Department recruited a core research team from the Sustainable Business Initiative (SBI) in the Business School to carry out the main piece of research, and smaller teams to focus on specific aspects of Circular Economy from the Schools of Geosciences and Chemistry. The research projects looked at definitions, Circular Economy practices in other institutions, and current practices in research, teaching and operations here at Edinburgh. It also identified opportunities for further work on Circular Economy at the University. As well as a literature and document review, interviews were carried out with over 35 staff members by the researchers.

This report details the findings of the project. It presents a review of the concept of the Circular Economy, approaches taken at other universities, the results from the stakeholder engagement at the University of Edinburgh, and a summary of the current initiatives at the Edinburgh that use Circular Economy thinking, even if they are not presently recorded or known as such.

In terms of findings, a range of practical initiatives, research and teaching on Circular Economy thinking is taking place, which could be developed and promoted further. These include initiatives such as the WARP-it re-use portal for staff, the student led Swap and Re-use Hub (SHRUB) cooperative SHRUB, and activities of the UK Biochar Research Centre, which uses waste to enhance soils. Courses looking at the Circular Economy are on offer in the School of Education and Edinburgh

College of Art, and a number of courses where the themes are used but can be further embedded have been identified in School of Geosciences and the School of Chemistry.

There is interest in taking Circular Economy practices further among many academics and practitioners within the University, and recognition of the opportunity the concept holds for positive impact on the environment and society. However, the project found an overall lack of awareness or understanding of what the term Circular Economy means – pointing to a need for clear definitions and sharing of practical examples. The research highlighted a well-recognised need to better link research, teaching and operations, and to create further links between academic disciplines. It is recognised that institutional structures, ways of working, and mind-sets within a large and complex institution can be hard to change, and that a combination of top-down strategy, and encouraging bottom-up initiatives among students and staff, could help bring about change.

The study outlines opportunities and suggests next steps for taking Circular Economy thinking and action further at Edinburgh. These include:

- identifying opportunities to further integrate Circular Economy in University strategy, policy and practice (through further analysis and engagement with staff and students),
- improving communications and reporting on what is already being done in and around the University (and clarifying metrics for measuring change),
- developing an accessible university-wide elective module (or even a degree programme) on circular economy which draws on aspects from various schools and allows for an across discipline learning experience,
- appointing a Circular Economy champion, or even an academic Chair,
- collaborating with other universities, institutions and organisations,
- continuing to incorporate the Circular Economy theme in events and volunteering programmes, identifying opportunities for courses and hosting a conference.

The project research was carried out during a very tight timeframe from January to March 2015 and it is recognised that certain policies, practices and examples of how Circular Economy is already being worked towards across the University may not be reflected in this report. Time limits also affected the amount of stakeholder engagement which took place. Further engagement with students is recognised as an opportunity and an essential step to further develop this work.

These initial research findings were presented to a group of over 20 staff from the across the University (Schools, ERI, operations) on 1st April 2015, who offered feedback and discussed potential next steps, which are detailed in this report. Ideas for an online toolbox of Circular Economy resources have developed through the course of the project and it is recommended that this is developed further, perhaps in collaboration with other organisations. It is also hoped that the network of internal stakeholders along with external collaborators created by this project will continue to work together in the planning and implementation of next steps.

4 Introduction

“This system-wide change is what characterised the enthusiasm of the likes of Adam Smith, David Hume or James Watt. Remember too that what they said was often controversial. Making the world anew is challenging.” Report on “Scotland and the Circular Economy” (EMF 2014) commissioned by ZWS.

The Circular Economy is about transitioning from a ‘take-make-dispose’ linear approach to resource use, to systems that encourage reuse and extraction of maximum value before returning resources to the biosphere. It goes much further than current understandings of recycling, considering the whole context and the need for entire system change, in order to stop the environmental degradation caused by the way we live now.

The flowering of thinking that took place in Edinburgh between 1740 and 1790 earned Edinburgh the epithet of the *Athens of the North* during what became known as the Scottish Enlightenment. The University continues to highlight and celebrate aspects of the Enlightenment’s legacy in the context of today’s society¹. A 2014 report by the Ellen MacArthur Foundation (EMF), in collaboration with Zero Waste Scotland (ZWS) and Scottish Enterprise, draws parallels between the Scottish Enlightenment and the change in thinking required for a shift to a Circular Economy (EMF 2014).

Scotland became the first nation to join EMF’s Circular Economy 100 programme (CE100), in 2013. As part of this, EMF has a vision of a global network of higher education institutions that explore and critique the key ideas and priorities of the transition.

The University of Edinburgh provides a context in which Circular Economy principles can be researched and studied from different disciplinary perspectives (for example in Design, Engineering, Chemistry, Business, Geosciences, etc.). Edinburgh Research and Innovation (ERI) can enable links to businesses and research impact expertise. Circular Economy practices can be enacted through our operations – linking Procurement to Waste and Recycling and in activities promoting and integrating social responsibility and sustainability more broadly across the University.

Reflecting the commitment expressed in the University’s current Strategic Plan to “make a significant, sustainable and socially responsible contribution to Scotland, the UK and the world, promoting health, economic growth and cultural well-being”², this report highlights the opportunity for the University to make a pro-active contribution towards promoting the Circular Economy.

4.1 Outline of the report

The report first provides detail of the aims and objectives of the study, methodology and limitations. An overview of Circular Economy theory and practices in other universities is then provided. Results from extensive desk-based research and the stakeholder engagement interviews is then presented and discussed. The next section draws on the research findings to provide suggestions for possible interventions and next steps to encourage Circular Economy thinking at the University of Edinburgh, and how this thinking can be translated into action. Finally, conclusions from the study are presented.

4.2 Aim and objectives

The aim of the research was to ascertain what progress had already been made at the University of Edinburgh in integrating Circular Economy thinking and action across its research, teaching and operations, and to identify ways to take this work further.

¹ See, for example the Enlightenment Lectures here <http://www.ed.ac.uk/news/2014/ocw-280814>

² <http://www.ed.ac.uk/schools-departments/governance-strategic-planning/strategic-planning/strategic-plan-2012-16>

Specific objectives were:

- Identify Circular Economy and related theory, tools and approaches (academic and practitioner literature) and assess how they could be applied in a University context
- Identify what is already happening in: a) Research, b) Teaching and extra-curricular activity, c) Operations, related to Circular Economy principles at the University of Edinburgh
- Identify innovative Circular Economy related activity in other higher education institutions (in terms of research, teaching and learning and operations) and in organisations outside the higher education sector
- Summarise the current state of Circular Economy thinking across the University community, and to what extent it influences practice
- Identify potential for collaborative taught courses at the University
- Highlight gaps / areas for improvement / further work and opportunities for the University's own operations
- Make recommendations for practical steps on Circular Economy at University of Edinburgh.

4.3 Methodology

Following a workshop in December 2014, which brought together a small group of staff from across the University interested in the Circular Economy concept, this project began with a call for expressions of interest issued by the SRS Department (see appendices), shared with academic contacts across the University via the SRS Academic Network. The overall piece of research was awarded to the Sustainable Business Initiative (SBI) in the Business School, with additional school-specific pieces of research carried out by colleagues in the School of Chemistry and the School of Geosciences. In SBI, the research team was composed of Dr. Adun Okupe, Georgina Jamieson, George Ferns and Hassan Waheed, with oversight from Dr. Kenneth Amaeshi. In the School of Chemistry, the research was carried out by Dr. Mark de Vries and Thomas McGuire. In the School of Geosciences, the research was carried out by Felipe Schrieberg, with oversight from Dr. Marc Metzger. The research was undertaken between January and March 2015, with a workshop and review taking place in April.

In addition to literature review (both academic and practitioner literature), interviews with 36 University staff were carried out. Interviewees were staff members who had either participated in the original December workshop or who were known by the project group to have a particular interest in topics related to Circular Economy and its application at the University.

Twenty-five people (all staff members, apart from one PhD student) were interviewed by SBI – 20 face to face, and five by email. Stakeholders from across the School of Engineering, School of Social and Political Science, College of Art, School of Education, Business School, SRS, Procurement, and Estates Department were included in the sample. The conversations lasted an average of 30 minutes. Conversations were semi-structured, allowing for flexibility in asking follow up questions (see appendices for SBI interview guide). Eleven staff members were interviewed in the School of Geosciences.

Interviewees included a mix of operations / support and academic staff. It was intended that the interviews would also be conducted with students from multiple disciplines and those involved in relevant extra-curricular activities, but time and resources allocated to the project did not allow this.

Within the School of Chemistry, a mapping of current courses took place to identify where aspects of Circular Economy are already integrated. A year four student surveyed the courses that were thought to be particularly relevant to Circular Economy, with sources of information including course books, lecture notes and the student's own notes. Informal discussions were also held with staff in the school to understand different points of view on the topic.

A series of project review meetings were held with a core group of University staff³ from January to March 2015 to share information, track project outputs and to identify further stakeholders.

4.4 Limitations of the study

The University of Edinburgh is a very large and diverse organisation with over 12,000 staff, and over 33,000 students. There are three colleges comprised of 22 different schools, as well as 40 other units in three support groups. This project had very short time boundaries for the research (three months) and by its nature could not cover the breadth and depth of the University or investigate all policies and practices.

Given the limited resources and timescales for the project, undergraduate and master's students were not able to be engaged with in this study, although several examples of opportunities to adopt Circular Economy thinking related to student activities, with support from staff members, were revealed during the course of the stakeholder engagement. It is therefore recommended that future work and stakeholder engagement must also involve our students.

The two in-depth school studies carried out in School of Chemistry and the School of Geosciences were extremely valuable for the overall project and gave a context of how Circular Economy thinking and action could take shape in specific ways relevant to the disparate parts of the organisation. While not all of the details from these aspects of the project have been included in this combined report, they will be drawn on when identifying next steps regarding Circular Economy at the University.

5 Circular Economy theory and definitions

5.1 Background to Circular Economy thinking

The concept of Circular Economy has roots tracing to industrial ecology, which explains industrial economy and its processes as a human ecosystem. The notion of a circular approach to the economy has been put forward as a way for society to move away from the 'take-make-dispose' linear process, which has become endemic to present day business.

Since Thomas Malthus published "An Essay on the Principles of Population" in 1798, scholars have increasingly become concerned with the idea of continuous growth, and the inability of the natural systems we rely upon to support it. It is widely cited that the concept of the circular economy was originally proposed by Kenneth E. Boulding (1966) in his article "The economics of the coming spaceship earth." Boulding suggested that the economy needs to evolve from the traditional "open system" relying on infinite materials to resource continuous production, manufacture, sales, and disposal of goods and services, to a "closed system" to account for true impacts. He conceived of Earth as a spaceship, a finite capsule with finite resources and finite space for waste disposal, hence our economics should reflect this.

The Club of Rome's 1972 report 'The Limits To Growth' lent policy weight to the idea of an economy based on finite resources and a closed loop system, leading to further academic exploration. Crucially, it provided a rational basis for developing alternative models to linear and exponential growth. As the global economy has fluctuated according to resource availability and demand, and the sometimes disastrous social and environmental impacts have been felt worldwide, the search for alternative models with a closed system framing has continued. Among these alternative models, is that of the Circular Economy, which has fallen into common reference through the work of the Ellen Macarthur Foundation since 2010. The next section looks in more detail at what is meant by the term Circular Economy.

³ Approximately 10 staff participated. Numbers of participants varied at each meeting.

5.2 Definitions of the Circular Economy

Common definitions of Circular Economy include the following:

EMF - Towards the Circular Economy:

Products do not quickly become waste, but are reused to extract their maximum value before safely and productively returning to the biosphere (EMF 2013).

EMF - The Circular Model: An Overview:

An industrial economy that is restorative by intention; aims to rely on renewable energy; minimises, tracks, and hopefully eliminates the use of toxic chemicals; and eradicates waste through careful design. The term goes beyond the mechanics of production and consumption of goods and services, in the areas that it seeks to redefine (examples include rebuilding capital including social and natural, and the shift from consumer to user). The concept of the Circular Economy is grounded in the study of non-linear, particularly living systems (EMF 2013).

ZWS's standard definition of Circular Economy is:

A Circular Economy is an economic system where we keep materials and products in use for as long as possible in order to extract the maximum value from them. This contrasts with how we currently 'take, make and dispose' of products. So, this is a move from a 'one-way trip' to a 'circular journey'. What's more it's a win, win, win for businesses, consumers and the environment. A Circular Economy will help to secure the supply of raw materials and key components in Scotland, cushion against unpredictable price changes, encourage growth, and boost local jobs while being better for the global environment (Benton 2015).

Scottish Government – Safeguarding Scotland's Resources - Blueprint for a More Resource Efficient and Circular Economy

"It includes activities which contribute to zero waste, but there is greater focus on the flow and ownership of materials in the economy, in order to keep materials in use for as long as possible. A Circular Economy also requires that water and energy come from renewable resources and that biological materials, such as food waste, are returned to the soil." (Natural Scotland 2013)

In basic terms, the concept of Circular Economy entails the following (adapted from EMF 2013):

- **Designing out waste:** Everything that is biological material can be composted and everything that is technical man-made waste can be reused in the development of new products⁴.
- **Building resilience through diversity:** Build resilient and diverse systems which can withstand external shocks and survive in fast-moving society.
- **Working towards using energy from renewable sources:** Wherever possible, obtain all power sources from systems that utilise energy from renewable sources.
- **Think in systems:** Think about context and environment – how things influence each other and can work harmoniously. Systems should be interdependent and reflect the realities of society.
- **Think in cascades:** Consider the manner in which waste can be cascaded and transferred down or through the chain to benefit the continuous flow and natural development.

The concept of the Circular Economy is argued to be beneficial as it will ensure that:

- Impact on the environment will be lower than presently, thanks to minimization of resource consumption and the adoption of cleaner technologies. It will also promote and involve restorative and regenerative processes which goes beyond minimising the use of technical resources or slowing down the rate at which they are used.
- Maximal value will be extracted out of each and every product, and additional employment opportunities can be created (It has been suggested by the EMF (2014C) that the Circular

⁴ Products should be seen in the widest sense to include artefacts, systems, services and environments

Economy could be worth more than \$1 trillion a year by 2025 to the global economy). According to Natural Scotland (2013) there is potentially £2.9bn of savings to businesses and organisations in Scotland from straightforward resource efficiency measures

- Products will be designed to have the capacity to have a long life-span, and be recovered, reused, repaired and remanufactured.

The next section assesses how these principles can be adopted and promoted in a University environment.

6 Circular Economy in a university context

A number of higher education initiatives focusing on supporting a transition towards a Circular Economy exist. This section provides an overview of these initiatives, and a summary of learning that could be applicable to the University of Edinburgh.

6.1.1 CE100

Circular Economy 100 (CE100) is an international platform that has brought together leading companies, emerging innovators, and regions, to facilitate sharing of expertise and collaboration. Scotland aims to accelerate the transition from linear to Circular Economy. Three levels of support are provided, including creating a mechanism for collective problem solving, building a library of best practice guidance to help businesses fast track success and provide a scalable mechanism for building Circular Economy capabilities within businesses (EMF 2015A).

6.1.2 Pioneering Universities

The CE100 has a group of 'Pioneer Universities' which aim to further the collective understanding of Circular Economy and also enable a transition to it through skills development. Pioneer Universities offer programmes of study on the Circular Economy. Many of the research and teaching programmes are focused around disciplines of business, education, design and engineering. Furthermore, they are required to commit to promoting knowledge exchange between business and higher education.

The Pioneer Universities are able to access the CE100 on a non-fee paying basis. Other Universities starting to work on Circular Economy initiatives can participate as Network Universities. The EMF state on their website that they intended to work with a maximum of ten universities during the period of 2013 – 2016 and thus far have identified five including: three in the UK (University of Bradford, Cranfield University, and University College London), one in France (Kedge Business School) and one in the Netherlands (Delft University of Technology). (EMF 2015B&C).⁵

6.1.2.1 University College London

University College London is promoting Circular Economy through its Institute of Sustainable Resources, Institute of Making, and its Centre for Resource Efficiency and the Environment. Seminars on Circular Economy are regularly delivered.

The undergraduate Waste Management and Resource efficiency programme offers a Circular Economy module. Modules in Circular Economy are offered in several MSc courses, including Industrial Symbiosis and Environmental Systems. A core Circular Economy module will be included in the MSc on Sustainable Resource Management to be introduced in 2016. Students in these courses are encouraged to focus on Circular Economy themes in their dissertations.

The University has created of a network of academics to promote cross-disciplinary approaches to research in the area of Circular Economy. They have appointed a Circular Economy champion to drive this agenda forward

⁵ Information in this section was gathered from the universities' websites

6.1.2.2 University of Bradford

In 2014, the University of Bradford was identified as the first EMF Pioneer University, and now acts as a Northern Office for EMF.

Bradford offers the first ever MBA relating to Circular Economy at their School of Management in Innovation, Enterprise and the Circular Economy, led by Professor Peter Hopkinson. This programme was developed with EMF and has numerous links with industry partners.

An Executive Education online course on Circular Economy and a Postgraduate Certificate in the Circular Economy are also offered.

The campus houses the re:centre, a £6million development, which aims to re-invent the relationships between the University, business and the global community. The University and re:centre host numerous events and conferences, including the 10+1 EMF Conference in 2010, EMF's open-house education event in 2014, an EMF conference in 2015. In 2012, Bradford 2012 took part in an international Circular Economy study tour for Business Schools.

6.1.2.3 Cranfield University

Cranfield University and EMF have worked closely together to develop teaching and research programmes to drive the University's transition to becoming a Circular Economy university. Work is being done to develop tools, methods, materials, technology and innovative ways of doing business across the disciplines of design, engineering, environmental science and management. Ultimately, they wish to integrate Circular Economy thinking and practices across the whole University.

Through partnership with the University of Warwick, Cranfield has developed the new Engineering and Physical Sciences Research Council-funded Centre for Doctoral Training in Sustainable Materials and Manufacturing.

Cranfield currently hosts three Schmidt-MacArthur Fellows, who focus on Circular Economy during their courses of study (MSc Environmental Management for Business, MDes Design and Innovation for Sustainability, MDes Innovation and Creativity for Industry). In 2014, the university hosted a Research Fellows summer school, which gave participants the chance to attend the CE100 annual summit.

Cranfield is also collaborating with business, including a current industry research partnership with Coca-Cola Enterprises entitled Sustainable Manufacturing for the Future.

6.1.2.4 Kedge Business School

Kedge Business School has for many years been organising interactions between companies, civil society and the academic world through think tanks and research chairs on sustainability themes. Since April 2013, it has hosted a 'Business as unusual' research chair, and a programme of study on Circular Economy and business model innovation. In 2014, it hosted the Disruptive Innovation Festival in partnership with EMF.

In 2011 and 2012, Circular Economy teacher training workshops and student summer schools have been delivered. A marketing course on Circular Economy is under development.

6.1.2.5 Delft University of Technology

Delft University of Technology joined the EMF Pioneer Universities scheme in January 2015. All eight faculties produce research on Circular Economy. A Circular Economy Design Chair has been appointed in the Industrial Design Engineering Faculty.

An online tool-kit, Circular Delft⁶, has been developed and aims to support students and staffs in applying circular thinking. A Massive Open Online Course (MOOC) entitled 'Circular X – The Circular Economy' will be launched in October 2015.

The university has collaborated with the Dutch government too, contributing to a report entitled 'The potential of a Circular Economy in the Netherlands', and hosting a government funded design project entitled 'Products that Last'.

6.1.2.6 Other examples in higher education

There are examples of Circular Economy initiatives at other universities. The Scottish Institute for Remanufacture is based at the University of Strathclyde and aims to stimulate innovation in remanufacturing through co-funding collaborative projects between industry and academia. The University of Cambridge, in association with Accenture and other partners, launched a toolkit for companies keen to implement Circular Economy⁷. The University of Kent has held workshops and presentations looking at Regulating Consumer Products for a Circular Economy. The University of Surrey hosts a Sustainable Lifestyles Research Group, looking at lifestyle and behavioural patterns and touching on some aspects of Circular Economy, and the Centre for Environmental Strategy hosts the Roland Cliff Lecture Series on Industrial Ecology, which touch on Circular Economy themes.

6.1.2.7 Potential for applying learning from other universities at Edinburgh

Based on the above review, the following approaches could be considered at the University of Edinburgh:

Hubs and centres: Hubs and centres can help to embed Circular Economy principles in taught courses and research activities across different disciplines and create places and spaces

Specific courses or programmes: All the Pioneer Universities had examples of specific courses or programmes related to the Circular Economy. Some Universities are developing online courses, including MOOCs, in this area.

Academic champions: Identifying a senior academic champion can be useful to act as a lead contact within the University and with external partners. A specific research Chair may be appropriate.

Working with others: Close collaboration with the government and relevant agencies and researchers is important. Engagement with businesses is fundamental to being a leader in Circular Economy.

Funding opportunities and creation of challenge/innovation funds: Sources of internal and external funding need to be scoped and assessed for their suitability for any of the Circular Economy-related initiatives proposed in this report.

Seminars and Conferences: To promote university-wide thinking, seminars could be integrated into existing speaker series. A high profile Circular Economy conference could facilitate knowledge exchange and lead to collaborations.

Toolkits: Practical toolkits can provide information, ideas and guidance on applying Circular Economy thinking to staff and students.

7 Circular Economy at the University of Edinburgh: where are we now?

There are numerous activities occurring across the University that relate to the Circular Economy – which are detailed below, under the categories of research and outreach, learning and teaching, operations, and student and extra-curricular. While some initiatives demonstrate progress towards

⁶ <http://circulardelft.wix.com/tudelft#!>

⁷ <http://circulareconomytoolkit.org/about.html>

implementing Circular Economy principles, researchers working on the project did not find many examples of initiatives and practices which fully reflected the concept. Indeed, the University is not an isolated economy, and wider system change is needed for any economy to become truly circular.

7.1 Examples of Circular Economy thinking and practices at the University

7.1.1 *Research and outreach*

Within the School of Geosciences there are some initiatives taking place that reflect Circular Economy principles.

In the Biochar Centre, the School has a facility that is aimed at creating extracting calorific and nutritional value from waste streams. Some research project examples include:

- Creating, testing, and using biochar stoves in impoverished agricultural communities. The biochar sources consisted both of readily accessible renewable resources such as agricultural residue) and waste materials such as paper sludge.
- Using biochar for carbon reduction, sustainable agriculture, and soil management.
- Use of biochar in phosphorus recycling and recovery.

The Edinburgh Centre for Carbon Innovation (ECCI) links researchers with businesses and government to come up with innovative low carbon solutions to climate change issues. Projects include:

- The Low Carbon Ideas Lab offers tailored support, cash bursaries, professional mentoring via Scotland's 2020 Climate Group and access to ECCI's community of key sector players. With a focus on ideas from young people, women, international entrepreneurs and innovators seeking to create change in their organisation (interpreneurs).
- The SMART Accelerator identifies, supports and accelerates the formation, packaging, and financing of Scottish project partnerships that support Scotland's transition to a low carbon economy and society, through creating smarter and more sustainable cities, communities and islands.

ECCI convenes a working group on Waste as Resource as part of the Natural Environment Research Council funded Edinburgh Earth and Environment Doctoral Training Partnership. The working group will comprise representatives from waste management and processing industries, policymakers, national research organisations, and students and academic staff.

Other research projects with potential ties to the Circular Economy include 'Heat and the City' which is a four year research programme examining the development of sustainable, low carbon heating in urban areas which will affect greater overall efficiency in use of fuel in society. In addition, the Environment and Society Research Group are involved with a number of projects that are or could be relevant to Circular Economy principles including 'OPERAs' (Operational Potential of Ecosystem Research Applications) which focuses on developing ecosystem science for policy and practice to enhance sustainable use of ecosystems, with a focus on natural capital and ecosystems services.

Within the School of Chemistry, while a detailed mapping of research was not carried out, it was noted that there are several research groups within the school that are worth mentioning in this context. These include research on dye-sensitised solar cells, which convert solar energy into electricity. These dye-sensitised solar cells are the only type that mimic natural photosynthesis. Work is also taking place on catalysis, improving the efficiency of chemistry research by speeding up reactions, and also recovering and reusing materials used as catalysts. The School is looking for funding to recover helium used in School's Nuclear Magnetic Resonance lab.

In the School of Biological Sciences, collaborative research is taking place with a global alcohol beverage company to produce copper nanoparticles from distillery waste streams, to conserve resources and reduce operating costs. In addition to environmental benefits, this work will conserve resources and reduce operating costs.

In Edinburgh College of Art (ECA), researchers have developed a new lightweight, easily assembled and disassembled structural system that uses waste plywood. Professor Remo Pedreschi is working with Martec Engineering to develop a new light weight easily assembled and disassembled structural system that uses waste plywood. Recent work has demonstrated the systems out performs existing engineered timber systems. Also at the ECA, a Co-Get app is an app was developed and designed by students and staff that allows users to find networks in their local area to swap goods and services. ECA has also worked in partnership with Oxfam and others to create a similar app called shelf life enabling consumers to understand the story behind the donated goods and encouraging people to love items for longer.

Within ERI, the Commercial Relations team works closely with businesses to match them with relevant academics and highlight suitable facilities and equipment. ERI organise 'AIM' days which provide a platform for collaboration and knowledge exchange between business and other external organisations and researchers on particular topics, to identify pathways to solutions and potential collaborative projects.

7.1.2 *Learning and teaching*

In the School of Education, a course on Global Learning: Citizenship and Sustainability incorporates 'Cradle to Cradle and the Circular Economy'. This course is organised by Susan V McLaren, Senior Lecturer in Design and Technology, who has been collaborating with EMF for a number of years, and is open to 4th year primary education students and students of HSS from 3rd or 4th year. 'Cradle to Cradle and the Circular Economy' also features as a core theme throughout the PGDE (secondary) Design and Technology programme. It is introduced to other education students in connection to Learning for Sustainability.

The School of Geosciences found that it offers one of the most extensive catalogues of MSc degrees and courses tied in with sustainability, offering potential for further embedding of Circular Economy ideas into teaching.

Within the School of Chemistry, the Year 2 Environmental Chemistry course was highlighted, which examines environmental pollution and chemical solutions to environmental issues. The courses on Environmental Chemistry and Sustainable Chemistry (years 4/5) were also highlighted with the latter including a green chemistry module.

As part of the MSc in Material Practice at the Edinburgh College of Art, students participate in a project entitled The Circular Economy. Students have recently worked with Scottish Canals looking at ways to reduce landfill by up-cycling canal waste.

In March 2015, the Institute for Academic Development hosted a workshop for all staff and research students on 'Practical strategies around learning for sustainability' in the Edinburgh context. Courses that have been tagged with the label 'Learning for Sustainability' at Edinburgh were highlighted, with pointers to resources and examples from elsewhere. This tagging of courses provides a starting point for identifying where Circular Economy can be further embedded.

7.1.3 *Operations*

The University of Edinburgh's Social Responsibility and Sustainability Strategy (2010-2020) sets out a broad approach and objectives for the University. Circular Economy is not specifically referenced within the context of the strategy, but instead there is an aspiration to make world-leading contributions to understanding and addressing global challenges.

The Estates Strategy (2010-2020) sets out how social responsibility and sustainability commitments will be integrated into the development of new and existing buildings. Estates Developments objectives include a range of resource efficiency and best practice measures, many with the capacity to extend further into the Circular Economy. For example:

- New buildings must achieve “excellent” and refurbishments “very good” through BREEAM (a design and assessment method for sustainable buildings) – this work includes energy efficiency measures and increasing reuse on and off-site of C&D waste;
- We are committed to halving the amount of construction, demolition and excavation waste sent to landfill and using a minimum of 20%, by value, of recycled material in construction.

Examples of how this has been translated into practice include:

- The ECCI building, awarded BREEAM Outstanding at design stage, has been constructed with a high conscience for recyclable material. For instance the flooring was completely reused (ECCI 2015).
- Similarly, the Business School is constructed in such a way that natural light passes through the windows and skylight therefore reducing the need for artificial lighting. In addition, if the building at some point gets demolished, the modular system used means it can be broken down into ‘chunks’ (just like children’s interlocking building blocks) to be reused on other construction sites.
- In the academic year 2013-14, 37,000 tonnes of construction and demolition waste from our capital projects was accounted for with less than 0.5% going to landfill.
- The University has installed a variety of more efficient and renewable energy systems across the estate (examples include: the installation and extension of Combined Heat and Power systems across a number of campuses, installation of ground source heat pumps in some buildings, and the use of free cooling technology within high performance computing facilities).

Within Estates Operations, the University’s Waste and Recycling Policy commits us to:

- Reducing the unnecessary use of raw materials
- Encouraging and enabling the reuse of products and when materials are disposed of, encouraging recycling, composting or energy recovery.

Examples of how this has been translated into practice include:

- All organic matter arising from our landscape operations has been composted or mulched and reused on our estate for the past ten years.
- The Estates Furniture Office manages furniture procurement, distribution and recycling of furniture with around 45 tonnes cascaded and reused internally every year.
- Equipment, tools and resources are internally cascaded and reused via informal networks during normal operations and building clear-outs wherever possible (recently using the online portal WARP-it to increase coverage).
- At the end of its life within the University, all captured waste electrical and electronic equipment is dismantled and then recycled. Usable IT equipment and PCs are sought to be reused.
- External partnerships have been developed with a number of local and regional social enterprises and charities to extend reuse opportunities where appropriate, with over 30 tonnes of previously recycled waste diverted to external reuse routes in 2014-15.

The University of Edinburgh Procurement Strategy (2012-2016) aims *“to meet our needs for goods, services and works in a way that achieves value for money on a whole life basis and generates benefits not only to the organization, but also to society, the economy and the environment”*. The Procurement Department is making a number of efforts to embed sustainability and social responsibility in procurement practices. Some examples of practices that were highlighted in the research include:

- Mapping risks and opportunities across different categories in relation to sustainability, and piloting the Scottish Procurement Prioritisation Tool, which incorporates some Circular Economy ideas.
 - Multi-Function Devices (MFD) are operated on a leasing service whereby they are serviced and replaced when necessary.
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- Efforts to decrease the food mileage by use of local goods and using fair trade products where they are available.
- Throughout the University, the number of printer cartridges used is being reduced, as ink processing becomes more efficient and incorporating whole life costs into MFD contract. Furthermore, Procurement insists that suppliers collect cartridges and refill them instead of staff simply throwing them out.
- Most computers purchased have a high performance rating in terms of electricity use and cooling systems to ensure energy efficiency.
- The freezers, such as those at the Easter Bush campus (that are used to cool chemicals and research material), are regularly inspected for any leaks or inefficiencies and when new fridges are ordered sustainably is taken into account. Moreover, when fridges are discarded and taken away by contractors and local authority they must be recycled as much as possible.
- Options and projects for Helium recovery are also being developed

Within Accommodation Services at the University, the catering team has adopted a strategic healthy food and sustainability agenda, receiving independently assessed awards and recognition for its practices. Significant steps are taken to reduce food waste including: composting (where legally permitted) and the planting of a local community orchard with a social enterprise fair trade provider and ensuring that all cooking oil is fully recycled and taken away to be converted to bio-diesel by Olleco Scotland.

The SRS Department was established in 2014 as part of Corporate Services Group working with colleagues across the University to support the embedding of social responsibility and sustainability across the University. Some of the programme activities which link to Circular Economy principles include:

- **Edinburgh Sustainability Awards:** staff form teams in their departments or buildings, and are required to take concrete actions on resource efficiency, energy reduction, and responsible and sustainable procurement. Many of the criteria touch on aspects of Circular Economy and are led by champions within departments on various topics. In 2015, over 40 departments across the University participated.
- **Sustainable Labs Programme:** In 2013 the University partnered with S-Lab and the Scottish Funding Council to develop activities around improving environmental and financial efficiency of labs. In 2014/15 the University is funding a continuation of the Sustainable Labs work seeking input from a steering group of interested researchers and practitioners across the University. Labs specific activities include peer audits sharing good practices on a number of sustainability criteria.
- **WARP-it Reuse Portal:** this widely used online portal enables staff to transfer or claim unwanted items across the university, thereby encouraging reuse through inter-departmental item transfer for a range of items (stationary, IT equipment, etc).
- **Events:** In 2014/15 Circular Economy was a theme within many of the events organised or co-organised by the Department, including as part of the Vision for Change series, the Disruptive Innovation Festival and Innovative Learning Week.

7.1.4 Student and extra-curricular

There are numerous extra-curricular and student initiatives which embody Circular Economy principles. Specifically noteworthy are:

- **SHRUB co-op:** which is a student led cooperative with an aim to reduce waste, share skills and promote a smarter, more sustainable way of meeting peoples' material needs. This includes allowing students to donate, buy or even swap excess items (like clothes). The group holds regular workshops and practical events demonstrating upcycling and reusing.
 - **Net Impact Edinburgh** is a student group working on projects in sustainability. In October 2014, it collaborated with the SRS Department to organise a workshop on the Circular Economy, to introduce the concept and provide a hands on approach to tackle issues using
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problem-based learning. The workshop was followed by a panel discussion with representatives from academia, policy and industry.

- **SRS Student Forum** provides a platform for students interested in SRS, students from SRS-related societies, EUSA officers and the SRS Department to exchange ideas, support partnerships and collaborate on projects seeking to improve on and off-campus activities for SRS

Following the research, SBI proposes the following working definition for consideration:

A Circular Economy is sustainable in intention from the process of design through to usage. It adopts a systems-thinking approach and strives to close the loop in all activities and processes. It aims for efficiency through effective use of all resources, both tangible and intangible, to meet society's needs.

This definition also incorporates some feedback received at the workshop held on 1st April to discuss research findings, but may be adapted following further work.

7.2.2 *Perceptions of Circular Economy among interviewees*

The sample of 25 staff members interviewed by SBI unanimously agreed that a more circular approach, breaking away from the over-consumption and environmental degradation of the linear approach, is vital, as resources are finite and need to be protected and conserved for future generations. All 25 of those interviewed by SBI (five of which were surveyed), and eleven interviewed in Geosciences, agreed that the Circular Economy principles could be useful and relevant to the University, if well communicated with relevant stakeholders. There is certainly an appetite for Circular Economy thinking and action at the University of Edinburgh. Stakeholders interviewed who could influence the University policy, research and practices, shared some of the challenges of adoption across the University of Edinburgh. These challenges included the time and financial investment required to embed Circular Economy thinking and action across the University and the need for evidence of benefits.

However, one group of stakeholders that is yet to be widely and proactively engaged is the student population (although some related events were held in 2014 and open to all students). Some of the stakeholders interviewed described student activities currently happening at the University of Edinburgh focusing on reuse, for example, SHRUB.

7.2.3 *An opportunity to lead the way*

Interviewees shared that there was an opportunity for recognition of Circular Economy thinking and action at the University of Edinburgh at the strategic level. They also identified the University's position as one with the capacity to have immense impact on society and government to bring about positive change given its international reach, global research status and economic size (turnover around £0.75bn per annum).

While some shared that legislative action at national level could be used to influence Circular Economy uptake by the University, other stakeholders shared that the University could stand to gain from being seen as a forward thinking University that had chosen to adopt Circular Economy ahead of and rather than in reaction to legislative action.

Staff shared that the University's strategy and policy documents could incorporate Circular Economy principles as they are updated.

Stakeholders interviewed agreed that there is a need for a long-term plan for Circular Economy at the University of Edinburgh, which has clear, achievable milestones, and senior management support.

7.2.4 *The need to link research, learning and teaching, and operations*

There was strong view that all departments (operations /support and academic) should be involved in implementing sustainability in operations e.g. in Schools as well as in academia (learning, teaching and research).

Stakeholders shared that there is a tendency of working in silos by some areas and departments/Schools across the University, and that in order to get Circular Economy thinking and development within the University, it was important to work together – linking research, teaching and operations and policy.

As an example, one stakeholder shared that there was a lack of communication between operations and research. However, Circular Economy could be a great opportunity to pilot some ideas and thinking (from research) that could influence and benefit the work of colleagues in operations.

Some of the stakeholders interviewed felt there was a need to have a clear divide between academia and operations and that operational staff should try to gauge what sustainability may mean for them in operations, but refrain from attempting to engage with and discuss research and teaching. This demonstrates some of the challenges of breaking down barriers and linking our research and operations.

7.2.5 *Combining top-down and bottom-up approaches*

Together with the integration across functions and structures detailed above, most stakeholders shared that a combination of a top-down and bottom-up approach was needed to successfully implement Circular Economy principles at the University of Edinburgh. The University's leadership would have to incorporate Circular Economy principles into their strategic vision for the University and dedicate time and resources to encourage its adoption and ensure it delivered the vision. The leadership also have a role to explain to stakeholders, staff and students how Circular Economy can be applied across the different schools and functions within the university,

The second approach is the bottom-up approach where Circular Economy champions are identified within different schools and functions to drive the Circular Economy agenda from a grassroots level. The champions, whoever they might be, can be chosen or naturally emerge, but should be clearly identified, knowledgeable and approachable. The two approaches can work simultaneously where the top-down approach can provide the processes through which bottom-up change can happen effectively. However, others noted that evidence or research to demonstrate this would be important. Leadership can also develop communications in accessible formats for the University's diverse community.

7.2.6 *The need for alignment between sustainability and Circular Economy*

Stakeholders shared that most were just beginning to understand the meaning of sustainability, and it was felt that Circular Economy was yet another term in the 'social responsibility' umbrella to be understood. Some felt Circular Economy could risk undermining all of the work they have already done on sustainability.

When asked how Circular Economy should be positioned, different views were expressed in terms of whether circular economy fitted under sustainability, or replaced it. Again, this highlights a need for a clear definition and awareness-raising activities.

7.2.7 *Importance of monitoring and evaluation of Circular Economy progress*

Stakeholders shared the importance of monitoring and evaluation of the University of Edinburgh's adoption of Circular Economy principles, to enable to determine the degree of success.

While some stakeholders were wary that it would require the collection of a whole new range of data which might prove to be a 'logistical nightmare', the general consensus was that current data collection formats could be modified and used to monitor Circular Economy implementation at the University of Edinburgh.

7.3 Summary of challenges

The following challenges to embedding a Circular Economy approach at the University of Edinburgh have been identified from the research:

- There is currently a lack of sufficient data on the benefits of implementation of Circular Economy at the University of Edinburgh
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- Lack of understanding amongst staff of what Circular Economy means and benefit to the University
- Staff time constraints
- Financial and budgetary procedure constraints
- Existing operating models and structures within the University that may be resistant to Circular Economy approach
- The University of Edinburgh currently has insufficient policies and guidelines (or exemplars) on how to develop Circular Economy thinking and action within the University
- To adapt models and structures will need mind-set change of key individuals to lead and encourage the adoption of Circular Economy thinking and action at the University of Edinburgh
- Changing mind-sets and action is time-intensive and requires concerted and deliberate effort from the University's leadership and stakeholders to want to develop Circular Economy thinking and practice at the University of Edinburgh
- Courses can take up to two years to be created, needing to be proposed, approved, and then course subjects negotiated. Any significant changes made to courses need to be approved by a board of studies While there is consensus that cross-discipline courses or shared content can throw up challenging logistics, this can be overcome as Our Changing World series at the University demonstrates.

8 Circular Economy at the University of Edinburgh: opportunities for the future and proposed next steps

From this research it is clear that Circular Economy thinking can lead to innovative ways of doing things, contribute to new research ideas, and highlight collaboration opportunities. Integration into an organisation's operations can result in financial savings from optimal use of resources and bring benefits for society and the environment. For staff and students it can contribute to the development of new ways of thinking and tackling global challenges in a resource-constrained world. There are several opportunities for a university to differentiate itself as forward-thinking and exemplar in relation to the Circular Economy.

For the University of Edinburgh, if there is an appetite for this, there will be many opportunities to explore the concepts and further work which will need to take place to clarify goals, targets and milestones. Following the preliminary research in this project, draft findings and recommendations were shared with selected internal stakeholders from the University of Edinburgh and with ZWS at a workshop on 1st April 2015. This provided an opportunity to stimulate further ideas on Circular Economy thinking and action at the University of Edinburgh.

Colleagues shared ideas on a vision for Circular Economy at the University whereby all students would have awareness and understanding, and staff would be working with students, with each other, and with wider stakeholders on activities aimed to integrate a circular approach in practice. It was recognised that while there might be specific actions which could be looked at in the short term, other opportunities would need a longer timescale and strategic imperatives. Next steps will include looking at how the opportunities can be taken forward with those responsible for specific areas, and the benefit to the University strategic plan and identifying how these can be resourced, both internally and in collaboration.

8.1 Short to medium term opportunities

8.1.1 *Integration within University strategy, plans and procedures*

The University is currently updating its overall Strategic Plan, and opportunities for considering sustainability and Circular Economy becoming embedded within this plan should be explored. Strategic planning will provide avenues for monitoring and reporting progress on Circular Economy, as

called for by interviewees in this project. A strategic fit can help to set an overarching goal from which specific operational or research focus and student experience targets can be developed.

The University of Edinburgh Climate Change Strategy and Climate Action Plan is also being updated in the coming year, and the use of renewable energy and reducing consumption/emissions links into a Circular Economy and could be integrated within the strategy and plan. As Estates and Procurement and other Operational strategies and plans are developed, linkages could and should continue to be identified, with specific milestones and indicators of progress. Continuing to move from focusing on recycling towards closing the Circular Economy loop is recognised as crucial if our Strategic Plan is to endorse Circular Economy objectives.

In terms of buildings, the University is already designing new developments in its estate in ways that have longevity, and also designing in aspects that may not have an immediate financial payback, but actually have a much longer-term cost-in-use pay back and are adaptable or reusable. The ECCI building was noted as a great example of where aspects of Circular Economy were already built in. Workshop participants noted that other buildings coming online could be identified to champion Circular Economy principles in design, construction and use, incorporating learning from similar projects elsewhere, such as Bradford's re:centre. Further analysis on benefits and potential trade-offs would be useful. Building research and developing market understanding of the drivers and incentives which encourage companies that bid for our opportunities, and whom we procure from (in buildings and other categories) to design for circularity and , whether legally obliged or not, to take greater ownership of the end-to-end product lifecycle and whole life cost/benefits is also key.

Given the role of the Scottish Funding Council in funding teaching and learning provision, research, and other activities across Scottish Universities, identifying how Circular Economy will be supported by SFC in education policy, outcomes agreements and funding decisions in future, would also be important.

As this was a short project trying to take an initial look at opportunities across the University, there is still a need for further analysis into specific operational and strategic aspects. Analytical 'deep dives' into specific areas of the University, where there are willing stakeholders, examining both policies and practices, could help with framing new strategy, policy commitments and procedural frameworks.

To capitalise on opportunities and links with government and others, a particular leader within the University or a small group of appointed champions could form a Circular Economy steering group and make closer links into engaging with the Scottish Government, Scottish Environment Protection Agency, Scottish Enterprise and Zero Waste Scotland Circular Economy steering group.

8.1.2 *Learning, teaching and research*

As identified above, pockets of innovative research, learning and teaching activities are already underway at the University. Due to the time and resource constraints of this project there are likely many more areas than those mentioned in the report.

There are opportunities for academics to identify how Circular Economy can be introduced into courses, and a number of relevant courses have already been identified through this project in different Schools. An online course in Social Responsibility and Sustainability to be made available to all students, and an online module for staff on the same themes, are currently being planned. Circular Economy thinking should be embedded in these materials. Sharing via the network established for this project and through other existing or new forums can help to facilitate this.

Colleges, Schools and other Departments can consider how Circular Economy practices and sustainability issues more widely could be included in course handbooks, decision making workflows and used in relevant staff inductions.

Other events and activities for both staff and students can provide learning opportunities on the Circular Economy. The Circular Economy events in 2014 at the University of Edinburgh were part of

the EMF Disruptive Innovation Festival and provide a good starting point which can continue in 2015 (see section on programmes below).

Building on these research findings, University staff can contribute to further research on Circular Economy Opportunities in Universities. For example, various schools (Geosciences, Chemistry, Business School, School of Education, Education, Edinburgh College of Art, and Engineering) could provide more information on how Circular Economy relates to and is being tackled in particular disciplines. Opportunities for inter-disciplinary collaboration could then be identified.

The SRS Department is currently exploring approaches to supporting a Living Lab culture at the University – to better link research and operations within the institution (a challenge identified in the stakeholder interviews), so that research sees its direct impact, and we can provide practical learning experiences for students. Circular economy research projects which offer recommendations for our procurement, construction, waste and other resource management practices could constitute flagship projects within a University of Edinburgh Living Lab. Funding sources need to be explored however.

Looking externally, ERI and other commercialisation activities *in situ* can play a role in identifying and supporting links with industry, on the Circular Economy themes. This can include a detailed identification what kind of research, key businesses are engaging in, and what types of research they would like to collaborate on with the University of Edinburgh, not only promoting our research interests but in collaboration on life cycles for operational efficiencies. Valuable links with other universities can also be made, for example with the Scottish Institute for Remanufacture based at the University of Strathclyde.

8.1.3 *Programmes of support, encouragement and recognition*

Given the learning from this project in terms of lack of awareness around the terminology of Circular Economy and its links to the current social responsibility and sustainability strategy, we recognise again that practical engagement and communications programmes can play an important role. During the workshop it was also noted that we should celebrate and highlight the things that we are already doing, rather than focus on 'gaps', as that reflects more a Circular Economy thinking method.

The SRS Department exists to enable the University of Edinburgh to understand, explain and deliver on its ambition to be a leading socially responsible and sustainable University, whilst supporting the strategic direction of the University. In 2015/16, a key focus for these programmes will be linking to climate change and energy savings, but opportunities for resource efficiency and Circular Economy should be integrated and have a direct effect on consumption in longer term. Supporting and promoting champions across the University can help to achieve this. SRS currently coordinates staff champions on sustainability themes like energy, and recognises individual and team achievements through the Edinburgh Sustainability Awards. A Circular Economy champion, or champions, and special awards which recognise efforts in relation to the Circular Economy, could encourage action and teambuilding.

Many stakeholders expressed the importance of having an interactive platform for sharing what is happening at the University as regards the Circular Economy, as well as examples and inspiration from elsewhere. To this end, a Circular Economy Toolbox as was originally proposed in the project plan can be a vital instrument with which to drive forward the agenda at the University, through providing opportunities for collaboration and knowledge sharing. Many examples of teaching, research and practical initiatives were already mapped through this project, which can be included in the online resource. The creation of an innovative, interactive, online platform could form the basis of a paid student internship, and stimulate competition in the form of dissertations or projects by undergraduate students.

During this project, the University of Edinburgh has been invited to join the EMF Network Universities programme, which will facilitate linkages with other institutions and organisations to share knowledge, ideas and good practices. As programmes of work on Circular Economy at Edinburgh develop, this could lead to us being part of the network of Pioneering Universities.

If funding sources were to be found, the Sustainable Labs programme which has been piloted at the University could be sustained more effectively, with a specific aim to embed Circular Economy principles within the programme, and in turn bring efficiencies within laboratory management practices. Funding could also support specific initiatives in areas such as Estates or Procurement linking operational perspectives, with innovative teaching, learning and research activities for staff and students. Opportunities for developing a Challenge Fund, open to bids from staff and students, could be explored. A mapping of potential funding sources for Circular Economy activity in the University community or in collaborations would be beneficial and could be included in the online toolbox.

8.2 Medium to longer term opportunities

8.2.1 *Incentivise Circular Economy thinking and action*

As programmes of work develop and Circular Economy principles become embedded in strategies and policies, it will be important to identify incentives and best practices that can motivate students and staff to sustain this as well as leadership and project seed funding across the University. Further work to identify incentives for action into the medium term would help to clarify the most effective options. Linking with funding councils and other sponsor or collaborator organisations, commercial, public or third sector to secure substantial funding would have an important role to play. If a pilot Challenge Fund could be developed in the short term, then over the medium to longer term, the lessons learned and return on investment achieved both financial, resource and impact could be analysed and this could be scaled up.

Building on any short-term progress made in embedding Circular Economy into top-level strategies and those with particular relevance to the theme (SRS, Procurement, Estates), Colleges, action is needed in Schools and Departments within the University who have their own strategies and plans (for example on teaching and research) to identify specific local action points on Circular Economy thinking and action. How this can be incentivised would need to be considered. Circular Economy changes will take time, and with a huge number of staff and students, a more measured long-term, step-by-step, approach will be needed.

Looking ahead, the University could use its position as a leader in higher education and global research, as a large employer, and an organisation that purchases significant amounts of goods and services and construction works, to influence wider society towards embedding Circular Economy principles. It could, for example, identify opportunities to influence bidders and suppliers in a wide range of sectors and act as an example of 'theory into practice' for other Scottish organizations. Links with procurement communities, public sector organisations and the Scottish Government will be important in this respect.

8.2.2 *Develop an Innovation Hub*

A specific hub or centre within the University could help bring together researchers and practitioners (within the University and from business and other external organisations) to exchange ideas and expertise, and showcase innovation. The hub could contribute new product designs, new business models, and showcase ways of working together to solve problems. This could be linked to an existing hub and model such as the Edinburgh Centre for Carbon Innovation, or could be a key theme within a Living Lab approach which would enable connections around any social responsibility and sustainability themes. Links with the Rapid Advanced Manufacturing Centre / FabLab which has been set up at the University would also be important. Such a hub would need substantial investment and would benefit from support from government or Horizon 2020.

8.2.3 *Teaching and research*

Building on the specific courses and programmes already in place, and those that can be developed in the next few years, the University can identify ways in which all students and staff are able to access learning opportunities on the Circular Economy in the longer term.

There may be opportunities to develop specific programmes such as an MSc degree on the Circular Economy, which could potentially bring together students from design, business, environmental and other backgrounds. A Circular Economy Professorial Chair could potentially be appointed to provide academic leadership, and to champion integration of the theme across disciplines.

A hub or centre for Circular Economy could also offer professional master classes as Continuing Professional Development opportunities to develop skill sets across sectors (for example for teachers, business professionals, public sector workers, etc.).

8.3 Proposed next steps

This project has identified the following next steps, taking into account the work that is already happening at the University of Edinburgh, and learning from other organisations. The feasibility of these will need to be considered and funding and benefits may need to be identified in order to progress them:

- **Develop online toolbox and resources:** to bring together examples of research, teaching, operations and student projects. It is proposed that the toolbox of resources includes practices and initiatives related to Circular Economy thinking, as well as those that demonstrate true Circular practices. Resources would need to be allocated to further develop all of the toolbox content and to keep it up to date as changing and innovative options emerge over time.
 - **Join the EMF Network Universities programme and building networks:** to share learning and good practice and continue to participate in initiatives such as the Disruptive Innovation Festival. Working with others such as and other pioneer universities, locally like Strathclyde or within UK and EU with the global academies or individual academic links. Continue to build an internal network of researchers and practitioners and further develop links and networks with government and with industry.
 - **Awareness raising and communications:** Determine how best to integrate with communications campaigns and reporting on SRS and impact strategic initiatives across campus. Link with events and educational activities that are happening around the University.
 - **Scope funding sources:** identify sources of funding that could support Circular Economy research, teaching, awareness-raising, network development, events and operations development including supplier engagement. Horizon 2020 (EU) and commercial sources need exploring and appropriate partnerships established.
 - **Building skills and capacity and links with learning and teaching:** Specific programmes to develop skills and understanding in staff and students can be developed. Circular Economy projects and case studies can be incorporated into courses across the university in different disciplines. Or, interdisciplinary projects can be developed which bring together different courses or work on projects within the University operations or in its supply chains. Circular Economy can also be embedded in online courses, including MOOCs, which can be accessed all over the world for free (providing internet access is available).
 - **Deep dive research into policy and practice:** As new strategies, policies and procedures are developed within and for the University, specific analytical pieces which look at opportunities for circular economy thinking (for example in building development, procurement practices, specific sectors or materials etc..) can help to identify specific next steps.
 - **Developing goals, milestones and metrics:** This will need to align with University strategy and policies in different dimensions, to demonstrate the added value of the Circular Economy approach.
 - **Further develop laboratories programme with Circular Economy principles:** Building on the current sustainable labs pilot project, a specific programme which supports labs across the University on integrating Circular Economy thinking and practice would be beneficial through reducing resources, waste, cost and risk.
 - **Celebrate action:** Explore how Edinburgh Sustainability Awards could specifically recognise circular economy champions and evidence case studies that can be picked up and shared by other groups.
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- **Develop Circular Economy Research:** Work with Schools to identify specific research projects such as a specific supply chain / procurement project along with other opportunities which bring together Engineering and ECA.
- **Scope opportunities for a Circular Economy Professorial Chair and Innovation Hub:** an academic Chair would provide a focal point for encouraging interdisciplinary research and teaching. An Innovation Hub could facilitate sharing of knowledge and inspire creative solutions for challenges related to the transition towards a Circular Economy.

9 Conclusion

This report has presented the findings and recommendations resulting from a three month research project looking at Circular Economy thinking and action at the University of Edinburgh. Overseen by the Department for Social Responsibility and Sustainability, researchers from the Business School, and from the Schools of Chemistry and Geosciences, carried out literature and document review and interviews with staff members. Their aim was to assess where and to what extent Circular Economy principles have been embedded into research, teaching, extra-curricular and operations activities across the institution, and to identify opportunities for taking this further. It is recognised that this project was restricted by a short timescale, and so further work is needed to gain a fuller picture of University activity in this area.

The researchers found that a range of research and teaching on Circular Economy thinking is taking place, and some practical initiatives exist which could be developed and promoted further – including current practices and policies within the University, initiatives such as the WARP-it re-use portal for staff, the student led re-use cooperative SHRUB (Swap and Reuse Hub), and activities of the UK Biochar Research Centre, which uses waste to enhance soils.

Courses looking at the Circular Economy are on offer in the School of Education and Edinburgh College of Art, and a number of courses where the themes can be further embedded have been identified in School of Geosciences and the School of Chemistry. There is interest in taking Circular Economy practices further among many academics and practitioners within the University (reflected also through our well-attended stakeholder meetings during the project), and recognition of the opportunity the concept holds for positive impact on the environment and society. However, the research found an overall lack of awareness, or understanding of what the term Circular Economy means. When asked about the concept, many respond with examples of recycling or sustainability initiatives in general – pointing to a need for clear definitions and practical examples.

The research highlighted a need to better link research, teaching and operations, and to create further links between academic disciplines. It is recognised that institutional structures, ways of working, and mind-sets within an institution can be hard to change, and that a combination of top-down strategy, and encouraging bottom-up initiatives among students and staff, would help bring about change.

The report makes several recommendations for taking Circular Economy thinking and action further at Edinburgh. These include identifying opportunities to further integrate Circular Economy in University strategy, policy and practice, delivering information and engagement programmes to develop staff and student understanding (including events and training), and improving communications and reporting on what is already being done in and around the University.

In terms of research and teaching, this report recommends appointing a Circular Economy champion, or even an academic Chair, collaborating with other universities and businesses. It is recognised that there are many social aspects related to a transition to a Circular Economy that require further research, such as looking at impacts on livelihoods around the world, as well as research on practices and processes. The report identifies opportunities for embedding Circular Economy in courses, including online ones.

Following this research project, the next steps will be: the creation of a toolbox of Circular Economy resources for staff and students, and further discussion with our network of interested stakeholders

across the University to plan how to take the wide range of recommendations in section eight further. We welcome opportunities to collaborate with external partners and other universities.

Higher education institutions such as the University of Edinburgh can play a pivotal role in a transformation of the global economy. They have the ability to supply the market with cutting edge research that promotes the adoption of Circular Economy initiatives, and can also study and analyse the concept from a theoretical perspective. Universities educate designers, engineers, future business leaders, procurement decision makers, potential market influencers, policy makers and many others. In addition, they have leverage to pressure supply chains as well as lobby government and political agencies. There is clearly an opportunity for the University of Edinburgh to take further its collaborative work, both within the institution and with external partners, on Circular Economy.

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11 Appendices

11.1 Appendix I: Copy of the call for expressions of interest for Circular Economy research

Sent out in December 2014 to the University's SRS Academic Network

Call for Expressions of Interest for 3 month project on

'Developing Circular Economy Thinking and Action at the University of Edinburgh'

The Department for Social Responsibility and Sustainability (SRS) are being supported by Zero Waste Scotland to work with academic researcher(s) to identify how principles of the Circular Economy can be embedded in Research, Learning & Teaching and Operations at the University of Edinburgh. SRS seeks Expressions of Interest from individuals / Schools to undertake the main part of this work.

Project Timing: January to end March 2015

Deadline for Expressions of Interest: 9th January 2015.

The purpose of the project is:

1. to review and map current initiatives and resources across in the areas of Research, Learning & Teaching and Operations at the University of Edinburgh and good practices elsewhere
2. to engage with key stakeholders and outline practical recommendations for the University on what practical steps – in Research, Learning & Teaching and Operations – would support moves to an exemplar "Circular Economy University".

Objectives

Identify Circular Economy and related theory, tools and approaches (academic and practitioner literature) and assess how they could be applied in a University context i.e. what would a Circular Economy University look like?

Identify what is already happening in: a) Research, b) Teaching and extra-curricular activity, c) Operations, related to Circular Economy principles at the University of Edinburgh

Identify innovative Circular Economy related activity in other higher education institutions (in terms of research, teaching and learning and operations) and in organisations outside the higher education sector

Summarise the current state of Circular Economy thinking across the University community, and to what extent it influences practice (comparing to ideal Circular Economy University identified in objective)

Identify potential for collaborative taught courses and short Continuing Professional Development offerings in specific University of Edinburgh Schools to embed Circular Economy principles across the University (linking different disciplines, and linking research and teaching to operations), combining learning from literature and from the University of Edinburgh case study

Highlight gaps / areas for improvement / further work and opportunities for the University's own operations to close the loops and cascade materials and resources and propose tools for optimising the system (to model the thinking we are part of promoting and instilling)

Make recommendations for practical steps on Circular Economy at University of Edinburgh.

Methodology, Proposed Steps and Timing

The principle methods to be used would be: desk-based research (internet sources, academic and practitioner literature) plus some primary research involving interviews and focus groups.

Step 1: Desk-based: Scan for existing practices at the University and good practices elsewhere. Start to build 'tool-box' of resources available (within University of Edinburgh and outside University of Edinburgh) for research; learning / teaching; and operations.
Timing: January to February.

Step 2: **Semi-structured interviews with key stakeholders:** An interview framework would be developed to identify additional resources and examples of good practices and case studies on Circular Economy at University of Edinburgh along with any drivers and barriers for change. Timing: February.

Step 3: **Draft report:** A write up of phase 1 and 2 would be prepared by the researcher for sharing with key stakeholders. To include draft 'Toolbox of Resources' with hyperlinks and case studies which the Department for SRS would convert to web based format. Timing: first half of March.

Step 4: **A workshop:** Convened with support from SRS Department to review findings in the draft report and examine gaps, recommendations and next steps. Timing: second half March

Step 5: **Final write up:** Including and integrating outcomes and discussions from the workshop. Timing: end of March / early April.

Key Stakeholders at the University to consult / engage with:

Procurement, Waste and Recycling, Accommodation Services, Schools of Architecture, Education, Biology, Business, Chemistry, Engineering, Geosciences, College of Art and Students Association.

Outputs

1. In-depth report written in accessible language (10,000 words) identifying the gaps, the shortfalls, the opportunities - immediate, interim and long term aspirations / targets plus two page illustrated Executive Summary;
2. A workshop bringing together stakeholders to review this project's findings and work collaboratively on next steps. SRS Department would support / coordinate.
3. Virtual toolbox on embedding Circular Economy thinking in a University / organisation. To include short case studies, theory, advice / recommendations – extracted from main report and made visually appealing. SRS Department website can host the toolbox and provide technical support for conversion to online format.

Interested researchers are invited to submit a maximum two-page Expression of Interest:

- Summary of interest and experience in this area,
- Comments on methodology and approach and
- Appended CVs (in addition to the two pages).

Either individuals or teams will be considered.

11.2 Appendix 2: Interview tools

11.2.1 Information sent to interviewees:

This study aims to understand how Circular Economy thinking and action may be developed at the University of Edinburgh. The approach is to speak to key stakeholders that represent the teaching, research and operations within the university.

It is expected that the conversations should last for at least forty-five minutes but no more than an hour.

The conversation will be a discussion of your experiences and insights into how Circular Economy thinking and action can be developed at the University of Edinburgh. To prepare for this, please be prepared to share your insights and experience on:

- What the term 'Circular Economy' means to you;
 - How Circular Economy thinking can be developed in the University of Edinburgh;
 - How this thinking can be translated into action;
 - Comments on any experience you may have of similar initiatives at the University of Edinburgh or other higher institutions.
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11.2.2 *Conversation guide used by SBI during interviews*Circular Economy Research Conversation
Guide February 2015

Research Aim	Questions
Warm up questions	<ul style="list-style-type: none"> • Thank you for agreeing to participate in this research study. • Researcher confirms confidentiality and states the conversation will be recorded • Before we begin, do you have any questions about the research study or this meeting?
A. To gain insight into the background of the participant	<ul style="list-style-type: none"> • Can you please provide some information about your background? • How did you come to work in this department/research area?
<p>B. To gain insight into what participant understands the Circular Economy to mean: To understand how participants frame/construct the meaning of Circular Economy and how this thinking can be developed in the University of Edinburgh</p> <p>If participant requires, we will provide some guidance into meaning of Circular Economy, our working definition:</p>	<ul style="list-style-type: none"> • Tell me what 'Circular Economy' means to you • Can you talk me through your current approach to research/teaching/operations? • Going on from what you said above, do you think Circular Economy thinking can be/should be integrated into teaching/research/operations (delete as necessary) at the University of Edinburgh? • If yes, how would you suggest this is carried out in your area? If no, why do you say so?
<p>If participant requires, we will provide some guidance into meaning of Circular Economy, our working definition: Circular Economy: materials used and retained for as long as possible</p> <p>Defined as different from the linear economy, with the focus on extracting the maximum value from resources while they are in use, and then recover and regenerate products and materials after service life.</p>	
C. To understand how contextual and societal influences inform and or constrain the adoption of Circular Economy thinking and action	<ul style="list-style-type: none"> • How does the environment, as an educational institution come to play in any of your responses? This is to examine the factors that they point out are important/relevant to their Circular Economy behaviour in a higher institution context • Is the University of Edinburgh ready for Circular Economy thinking in your opinion? • How would you evaluate the current activities you/your department do, in terms of eliminating waste, and recovering value from materials and regenerating products (this can be in regards to research, operations, or teaching) • Why do you say so? • Are you aware of any similar initiatives being carried out now or in the past in the University of Edinburgh, or other higher institutions that relate to the Circular Economy? • What did/do you think of this?

D. How can the Circular Economy thinking be translated into action?

To determine the extent to which the participant understands his/her department/school/research can play a role in the development of Circular Economy thinking and action in the University of Edinburgh

- What do you think can be done to maximize the value extracted from products or processes and eliminate waste in operations?
- How do you think this Circular Economy thinking can be understood, with regards to teaching and research?
- Have you tried any of this in your role?
- If yes, what was your experience? If not, why not?
- How would you go about implementing this?
- Do you think you will find support for this?
- Can you identify other stakeholders/departments?
- What do you think can be done with other stakeholders to develop Circular Economy thinking at the University of Edinburgh?
- Will you be willing to do this together with them?
- Why or why not?
- Do you have any exciting interactive material to be shared?
- Are you happy for information to be shared and included onto the toolkit that will be developed?

E. Word Cloud on Circular Economy at the University of Edinburgh

- What three words would you say best describes Circular Economy
- What three words would you say best describes Circular Economy at University of Edinburgh? (this relates to what stage participant feels the University of Edinburgh is, as regards closing the Circular Economy loop)
- Do you see any similarity between the Circular Economy and Sustainability discourse?
- What would you say this is, and how is the Circular Economy discourse different from Sustainability?
- This brings us to the end of this meeting.
- Before we close, do you have any questions or further comments you would like to make?

F. End of conversation/cool down

To end the conversation

To request member check and further relationship, for when we might need to contact them for updates to their work, as needed

- Are you able to suggest another contact for interview?
- We shall be writing up and analysing our conversation, and would like the chance to continue the conversation with you as required. Are you okay with this?



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