

The Case for a Circular Economy Strategy for Northern Ireland

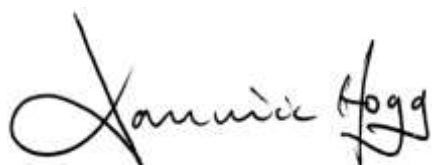
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Report for Business in The Community Northern Ireland and WRAP Northern Ireland

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Executive Summary

Northern Ireland is emerging from an economic downturn, with Gross Value Added (GVA) beginning to rise and clear ambitions for economic growth expressed in a new Industrial Strategy (under consultation).

The Industrial Strategy articulates as one of its aims the development of a circular economy strategy for Northern Ireland. A circular economy region is one where resources are recirculated to attain maximum usage and can contribute to employment, resource efficiency, productivity (a goal of The Industrial Strategy), increased GVA and stimulate innovations in areas including new business models, product design and remanufacturing facilities. A circular economy in Northern Ireland has the potential to create 13,000 jobs, reducing unemployment by 1.5 percentage points.

At present in excess of two million tonnes of Northern Ireland's waste is not being recovered, reused, composted or recycled each year and there are clear opportunities to capitalise on this resource to further accelerate economic growth. Of the waste reported as recycled an estimated 390,000 tonnes is exported as secondary materials representing both a non-circular economy and loss of local reprocessing opportunity. By reshoring capacity for reprocessing material into new products there is potential to create added value products and this move decreases reliance of Northern Ireland on commodity markets, benefits the local economy and create employment.

Key sectoral and waste prevention opportunities identified are shown below with the relevant Northern Ireland multiplier effects applied to show total contribution to Northern Ireland's GVA.

Sector / Source	Contribution to GVA incl. Type 1 multiplier (£m) †	Contribution to GVA incl. Type 2 multiplier (£m)
Healthcare	£17	
Wholesale & Retail*	£24	
Agri-Food*	£114	
Manufacturing (excluding food production)	£42	
Construction	£160	
Waste Prevention excl. food (household, CD&E, C&I)		£117
Total	£474	
<p>*represents just one opportunity within sector as a whole, for Wholesale & Retail EEE life expectancy extension and for Agri-Food avoidable food waste prevention for households and commercial</p> <p>† Note that those figures without a type 2 multiplier have potential for more induced benefits not quantified here.</p>		

A total of £475m of benefit from circular economy opportunities has been identified for Northern Ireland and this represents just some of the potential untapped circular

economy opportunities in Northern Ireland's economy. There are a number of actions identified within Northern Ireland's power to help realise these potential benefits. If these opportunities are not taken, there is a risk that economic growth will be coupled with the production of increasing amounts of waste. This will add to Northern Ireland's waste management costs, while resulting in worse environmental outcomes – including greater greenhouse gas emissions – than would be the case if a more circular approach is adopted.

Contents

Executive Summary	i
1.0 Background	1
1.1 Report Context	1
1.2 Objectives	1
1.3 Northern Ireland Context	2
1.3.1 <i>Leadership on Waste and the Circular Economy</i>	2
1.3.2 <i>Wasted Resources in Northern Ireland</i>	3
1.3.3 <i>Business Composition</i>	5
2.0 The Opportunity – Local Authority Collected Waste	5
2.1 Local Authority Waste / Householder Opportunity	5
3.0 The Opportunity – Business	8
3.1 Methodology	10
3.2 Growth Sectors	10
3.2.1 <i>Life & Health Sciences</i>	10
3.2.2 <i>Wholesale and Retail Trade</i>	11
3.2.3 <i>Agri-Food</i>	13
3.2.4 <i>Manufacturing (excluding food production)</i>	16
3.2.5 <i>Construction & Real Estate Activities</i>	17
3.3 Enabling Sectors	18
3.3.1 <i>Digital and Creative Technologies</i>	18
3.3.2 <i>Financial, Business and Professional Services</i>	19
3.3.3 <i>Education</i>	20
4.0 The Opportunity - Employment	21
5.0 Themes & Recommendations	21
5.1 Themes	21
5.1.1 <i>Green Procurement</i>	21
5.1.2 <i>Leasing Models</i>	22
5.1.3 <i>Digitalisation</i>	22
5.2 Recommendations	22
APPENDICES	24

A.1.0Supporting Information.....25

1.0 Background

1.1 Report Context

In January 2017, the Department for the Economy launched its consultation on *Economy 2030: A Draft Industrial Strategy for Northern Ireland*¹. Within the Draft Industrial Strategy, under 'Pillar 3: Driving inclusive, sustainable growth', the Department states its intention to develop a Circular Economy Strategy for Northern Ireland, working with the Department of Agriculture Environment and Rural Affairs (DAERA). The Industrial Strategy outlines a circular economy as

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

To make this a reality this circular economy strategy needs to be embedded throughout any sectoral growth strategies and key link ups identified to ensure the concept of a circular economy for Northern Ireland is realised. Aside from direct mention of circular economy a key facet of the Industrial Strategy is addressing productivity, particularly given Northern Ireland's productivity compared to GB, in itself not well performing². Resource efficiency and circular economy concepts provide business models that drive towards increased productivity.

Business in the Community Northern Ireland (BITCNI) and WRAP Northern Ireland wish to engage with this strategy via the development of this report, and follow up actions.

1.2 Objectives

The objectives of this report are to give BITCNI and WRAP Northern Ireland:

- an indication of the scale of the opportunity circular economy represents for Northern Ireland; and
- insight into how key sectors in Northern Ireland could move towards a more circular economy and deliver under the indicators outlined under Pillar 3 of the

¹ *Economy 2030 - A consultation on an Industrial Strategy for Northern Ireland - industrial-strategy-ni-consultation-document.pdf*, accessed 7 April 2017, <https://www.economy-ni.gov.uk/sites/default/files/consultations/economy/industrial-strategy-ni-consultation-document.pdf>

² *industrial_policy_wp_2016_061216.pdf*, accessed 13 April 2017, http://www.nerinstitute.net/download/pdf/industrial_policy_wp_2016_061216.pdf

Industrial Strategy (encompassing innovation, education and skills, employment, business growth, export and connectivity).

1.3 Northern Ireland Context

1.3.1 Leadership on Waste and the Circular Economy

Back in the early noughties, Northern Ireland published its first waste management strategy, which set out the aim for Northern Ireland to be a 'centre of excellence in resource and waste management'.³ Progress has been made in encouraging recycling since that point, with the municipal waste recycling rate increasing 18% in the last 10 years to 41.8% in 2015/16. However, at the time of writing, Northern Ireland's recycling rate remains one of the lowest of the countries in the United Kingdom.

Figure 1 illustrates that as GVA has increased, so too have household waste arisings, a trend indicating that the economy remains more linear than might be hoped. Many positive statements have been made regarding the need for a circular economy in Northern Ireland, and individual organisations have taken action: however, there has been relatively little in the way of coordinated, government-led efforts in this regard. By way of contrast, the Welsh Government has recently announced a £6.5m circular economy fund⁴ and Scotland, an £18m fund supported by European Regional Development Funds and the Scottish Government⁵.

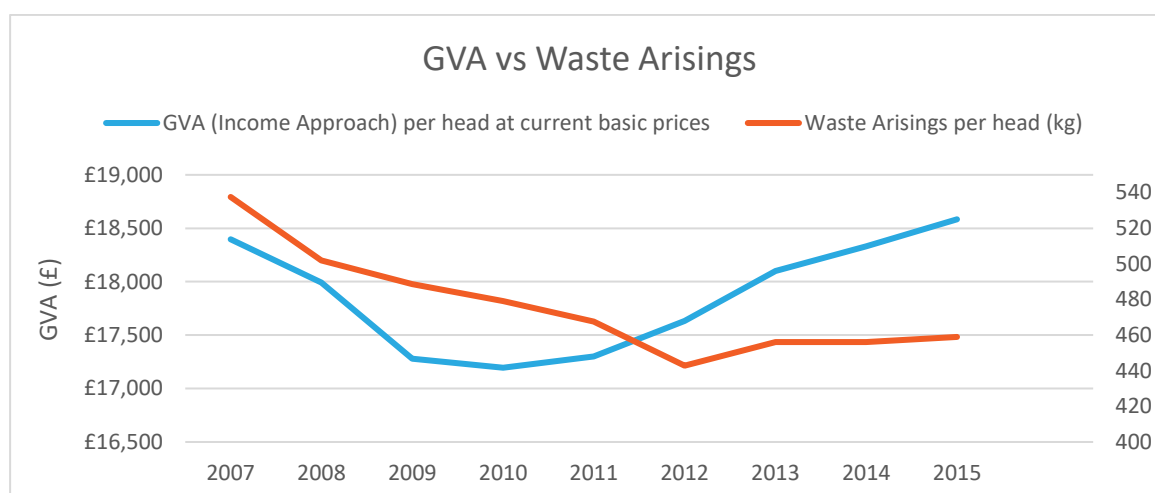
With the Northern Ireland economy recovering from recession, unemployment falling, and economic activity on the increase, there is a real opportunity to refocus on the ambition to be a centre of excellence in waste and resources. This will allow growth to be achieved in a sustainable way, making fuller use of resources and reducing waste arisings.

³ Northern Ireland Affairs Committee (2005) Waste Management Strategy in Northern Ireland Sixth Report of Session 2004–05

⁴ *Welsh Government | Cabinet Secretary confirms £6.5m 'Circular Economy' fund*, accessed 4 April 2017, <http://gov.wales/newsroom/environmentandcountryside/2017/170310-cabinet-secretary-confirms-6m-circular-economy-fund/?lang=en>

⁵ *Circular Economy Investment Fund | Zero Waste Scotland*, accessed 11 April 2017, <http://www.zerowastescotland.org.uk/content/circular-economy-investment-fund>

Figure 1: GVA and Waste Arisings per head in NI 2007 - 2015⁶⁺⁷



1.3.2 Wasted Resources in Northern Ireland

In 2015/16, local authorities collected close to one million tonnes of municipal waste in Northern Ireland. Based on estimates from 2009/10, commercial and industrial (C&I) waste amounts to 1.6m tonnes annually, while estimates of construction, demolition and excavation (CD&E) waste suggest a further 3.5 million tonnes are generated (see Table 1). There is a history of illegal waste sites in Northern Ireland, and while action has been taken to reduce the extent of this problem, it is possible that the non-local authority waste figures may be somewhat underestimated as result of this activity.

Around 40% of all of this waste is managed as residual waste. This means it is destined to find its way to:

- landfill, at a typical cost of £103.40 a tonne (including tax); or
- incineration, at a typical cost of £86 a tonne.⁸

The resource leakage from household, C&I and CD&E waste generates an annual bill of **£185-£224m**, which is borne by residents and businesses – all to pay for potential resources to be disposed of or incinerated.

⁶ (2016) *Northern Ireland local authority collected municipal waste management statistics 2015/16 annual report* | Department of Agriculture, Environment and Rural Affairs, accessed 11 April 2017, <https://www.daera-ni.gov.uk/publications/northern-ireland-local-authority-collected-municipal-waste-management-statistics-2015>

⁷ *Regional Gross Value Added (Income Approach)* - Office for National Statistics, accessed 11 April 2017, <https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedincomeapproach>

⁸ WRAP (2016) *Comparing the cost of alternative waste treatment options - Gate Fees report 2016*, 2016, <http://www.wrap.org.uk/content/new-gate-fees-revealed-wrap-show-changes-market>

Table 1: Reported Waste Arisings in Northern Ireland

Category	Reported Tonnage (million tonnes)	Proportion Reported as Recycled, Reused, Composted & Recovered	Resource Leakage* (million tonnes)
Local Authority Collected Household Waste ⁹	0.86	42%	0.50
Commercial & Industrial ¹⁰	1.29	56%	0.57
Construction, Demolition & Excavation ¹¹	3.53	71%	1.02
Total / Weighted average	5.79	63%	2.10
<i>*Assumes waste not reported as recycled, reused, composted or recovered becomes residual waste.</i>			

There are a number of reprocessors based in Northern Ireland (notably Huhtamaki, Cherry Plastics and Encirc), much of recyclate produced in Northern Ireland is exported – some to elsewhere in the UK, some far further afield – leading to a loss of resources and potential employment opportunities from the local economy.

The UK Exports 12 – 14 million tonnes of secondary materials every year¹², scaling with the assumption Northern Ireland's waste is approximately 3% of the total this equates to 390,000 tonnes of secondary materials exported from Northern Ireland, this is before looking at the opportunity from increased recycling. For these secondary materials, the opportunity that exists is for Northern Ireland to find ways to collect high quality material, add maximum value and make best use of these materials using locally, in addition reducing waste management costs. Not only is there an opportunity to re-shore reprocessing capacity with consequent benefits there is also a unique opportunity for Northern Ireland given its ports to be able to import secondary materials and generate business in this manner by adding value and becoming a reprocessing hub.

⁹ (2016) *Northern Ireland local authority collected municipal waste management statistics 2015/16 annual report* | Department of Agriculture, Environment and Rural Affairs, accessed 11 April 2017, <https://www.daera-ni.gov.uk/publications/northern-ireland-local-authority-collected-municipal-waste-management-statistics-2015>

¹⁰ WRAP (2011) *Northern Ireland Commercial & Industrial (C&I) Waste Estimates 2009*, November 2011

¹¹ RPS (2011) *Construction, demolition and excavation waste arisings, use and disposal in Northern Ireland 2009/10*, Report for WRAP, June 2011

¹² Suez (2016) *A Resourceful Future – Expanding the UK Economy*, accessed 11 April 2017, <http://www.sita.co.uk/downloads/ResourcefulFutureReport-SUEZ-1609-web.pdf>

1.3.3 Business Composition

The main business sectors in Northern Ireland, by contribution to GVA, are:

- Manufacturing;
- Wholesale and retail;
- Agri-food;
- Human health and social work activities;
- Public administration;
- Real estate & construction; and
- Education.

Compared with the UK as a whole, small and medium sized enterprises (SMEs) in Northern Ireland are a more significant contributor, accounting for 75% of private sector turnover and 75% of private sector employment.¹³ Whilst section 5.29 of the industrial strategy outlines an ambition to encourage business growth, SMEs are likely to remain the majority contributor to the Northern Ireland economy for some years to come. This business profile offers both opportunities and challenges.

SMEs are less likely to have already undertaken circular economy activity, and thus have greater opportunity to improve: however, there are challenges associated with engaging with a very large number of actors, and SMEs may face difficulties in accessing the skills and know-how to exploit opportunities to change their business models.

In an EU-wide survey of companies that had not undertaken circular economy activities, the key obstacles identified were lack of a clear idea about costs and benefits of improved work processes (27%), the lack of a clear idea about investment required (27%) or the lack of expertise to implement these activities (26%).¹⁴ Each of these barriers likely requires resources, and support, if it is to be overcome.

2.0 The Opportunity – Local Authority Collected Waste

2.1 Local Authority Waste / Householder Opportunity

Local authorities in Northern Ireland collected 969,157 tonnes of municipal waste in 2015/16, of which 42% were recycled. In a UK context, this places Northern Ireland

¹³ *the-contribution-of-small-businesses-to-northern-ireland.pdf*, accessed 11 April 2017, <https://www.fsb.org.uk/docs/default-source/Publications/the-contribution-of-small-businesses-to-northern-ireland.pdf?sfvrsn=1>

¹⁴ European Commission, and Directorate-General Environment (2016) European SMEs and the Circular Economy

behind Wales (56%), and England (44%) in recycling rate:¹⁵ there is a clear opportunity to increase the proportion of municipal waste that is recycled.

Based on the 2015/16 Northern Ireland dataset of Local Authority Collected Municipal Waste, there are close to 300,000 tonnes of readily recyclable or compostable material within the kerbside residual waste stream (Figure 2), including materials that are suitable for local reprocessing. Where local reprocessors exist, keeping material within the local economy generates business and employment directly from recycling, as well as exerting indirect and induced multiplier effects.

Figure 2: Northern Ireland Local Authority Collected Municipal Waste Management Statistics 2015/16 Kerbside Collections¹⁶

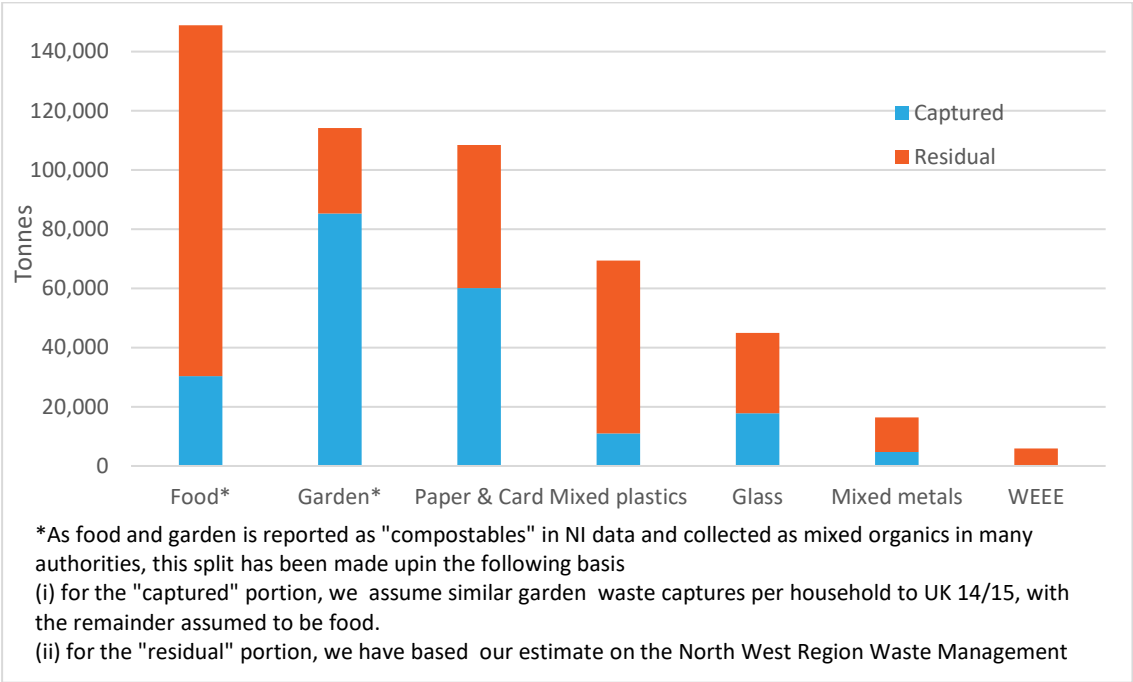


Figure 2 does not take account of additional opportunities associated with waste collected at household waste recycling centres (HWRCs), where the full value is not extracted from material: material that could be reused may only be recycled, and material which could be recycled (or reused) may be discarded as residual waste. There

¹⁵ DEFRA (2016) *UK Statistics on Waste Dec 2016*, accessed 7 April 2017, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/593040/UK_statsonwaste_statsnotice_Dec2016_FINALv2_2.pdf
¹⁶ (2016) *Northern Ireland local authority collected municipal waste management statistics 2015/16 annual report* | Department of Agriculture, Environment and Rural Affairs, accessed 11 April 2017, <https://www.daera-ni.gov.uk/publications/northern-ireland-local-authority-collected-municipal-waste-management-statistics-2015>

is also the potential for waste to be prevented, for example, by being designed out of the system of consumption which currently generates it.

Waste management policy measures in Northern Ireland have given priority to reducing waste to landfill, in part through the Northern Ireland Landfill Allowance Scheme. This has resulted in an increase in export of residual waste in the form of Refuse Derived Fuel (RDF) and increasing interest in the construction of local thermal treatment capacity. The Belfast harbour gasification plant is due to be operational in late 2017.

Policy has been less successful in stimulating waste prevention. A waste prevention programme for Northern Ireland was published in 2014,¹⁷ but as Figure 1 shows, waste arisings per capita have been on a gradual upward trend since 2012. It is fair to say this focus of effort on the lower levels of the hierarchy is not unique to Northern Ireland. Based upon previous UK research¹⁸, waste prevention scaled to Northern Ireland (excluding food which is covered elsewhere in this report) has the potential to add £117m to the economy including type 2 direct, indirect and induced GVA impacts¹⁹. These multipliers account for consequent GVA change for the economy as a whole as a result of direct change, for example if consumers spend less on food, due to decreased wastage, they have more to spend on other areas with consequent impacts (e.g. increased spending on leisure activities leading to increased employment in that sector).

In summary, there is considerable scope to improve the management of waste collected by local authorities in Northern Ireland through measures designed to reduce arisings and extract value locally from materials currently within the residual stream. Furthermore, Eunomia's experience with local authorities in England and Wales suggests that this change can be made at limited (if any) additional cost to local authorities.

Another further step which could be taken to drive reduction of residual waste and encourage waste prevention, reuse and recycling is the implementation of a pay and you throw system. The Republic of Ireland is already implementing this (Pay by Weight) and it is within Northern Ireland's devolved powers to implement should the relevant legislation be revised (namely Waste and Contaminated Land (Northern Ireland) Order 1997 and The Local Government Act (NI) 2014).

¹⁷ *Waste Prevention Programme for Northern Ireland - The Road to Zero Waste - waste-prevention-programme-NI-road-zero-waste-2014.pdf*, accessed 7 April 2017, <https://www.daera-ni.gov.uk/sites/default/files/publications/doe/waste-prevention-programme-NI-road-zero-waste-2014.pdf>

¹⁸ Suez (2016) *A Resourceful Future – Expanding the UK Economy*, accessed 11 April 2017, <http://www.sita.co.uk/downloads/ResourcefulFutureReport-SUEZ-1609-web.pdf>

¹⁹ (2017) *NI Supply Use Tables Multipliers 2012*, accessed 13 April 2017, <https://www.nisra.gov.uk/publications/ni-supply-use-tables-multipliers-2012>

3.0 The Opportunity – Business

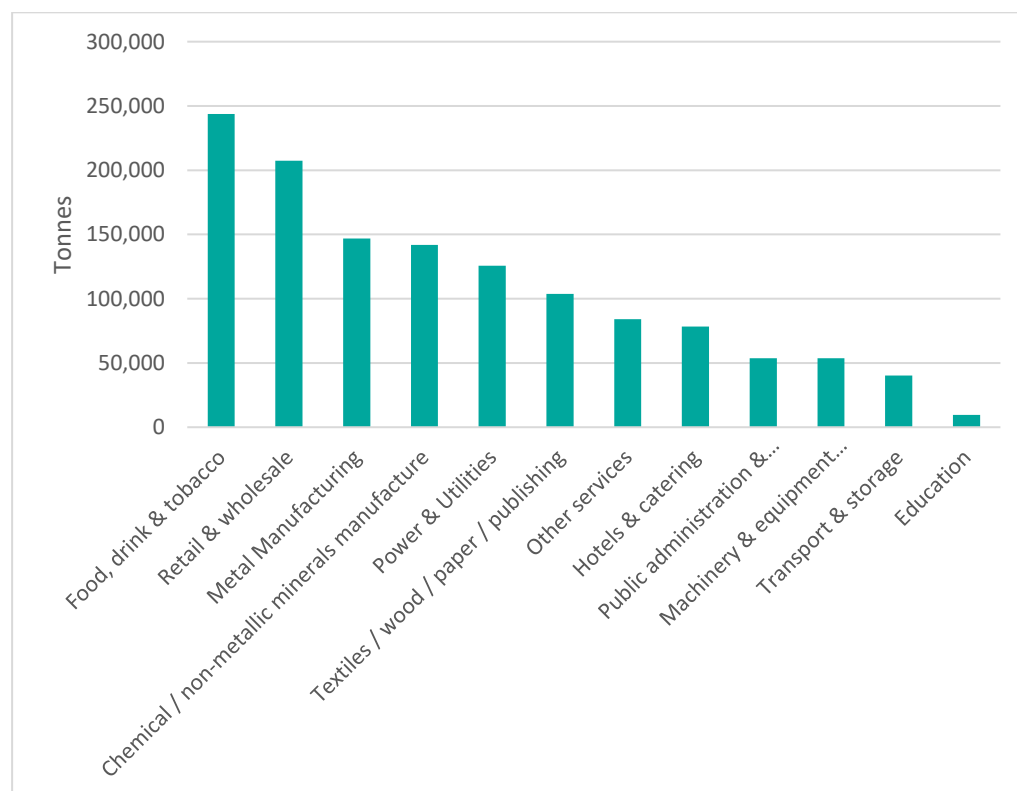
In this section, we seek to quantify the opportunity for businesses to enhance their contribution to a circular economy in Northern Ireland. An important first step towards this is to identify the sectors that have the greatest ‘circularity potential’.

Table 2 shows key statistics on the business sectors identified as priorities. These sectors have been selected based upon:

- their contribution to Northern Ireland’s GVA;
- their contribution to employment; and
- whether they are identified as a growth sector in the industrial strategy.

The highest priority sectors selected in this way include those responsible for the greatest share of C&I waste, as shown in Figure 3: retail & wholesale, food & drink, and manufacturing. Another priority is the construction sector, which is not shown in Figure 3, but which produces approximately 3.5 million tonnes of waste.

Figure 3: Commercial & Industrial Waste Streams in Northern Ireland²⁰



²⁰ WRAP (2011) *Northern Ireland Commercial & Industrial (C&I) Waste Estimates 2009*, November 2011

Table 2: Priority Sectors for Northern Ireland Circular Economy Strategy

Sector	Employment (thousands, seasonally adjusted)	% total employment	GVA (£ million)	% Total GVA	Growth Sector?	Enabling Sector?
Human Health and Social Work/ Life and Health Sciences	135	16%	3,818	11%	Y	
Wholesale & retail trade; repair of motor vehicles and motorcycles	133	15%	4,761	14%		Y
Education	73	8%	2,441	7%		Y
Agri-Food	63	7%	1,987	6%	Y	
Agriculture, forestry and fishing	34	4%	353	1%		
Food products, beverages and tobacco	29	3%	1,634	5%		
Financial, Business and Professional Services	61	7%	2,676	8%	Y	Y
Manufacturing (excluding food products)	58	7%	3,393	10%	Y*	
Public admin & defence; compulsory social security	55	6%	3,625	11%		Y
Construction & Real Estate	61	7	4,808	14%	Y	
Construction and Materials Handling	54	6%	1,966	6%	Y	
Real Estate Activities	7	1%	2,842	8%		
Digital and Creative Technologies	22	3%	1,089	3%	Y	Y

**within the manufacturing sector, particular focus on growth and circular economy opportunities within advanced manufacturing, materials and engineering*

3.1 Methodology

Each priority sector has been assessed for its ‘circularity potential’ based on published literature. Where figures for the scale of circular economy opportunity by sector exist for other regions, these have been scaled as far as possible to reflect the position in Northern Ireland. We have done this by applying:

- a scaling factor to reflect the size of the sector in the comparator region relative to that of the same sector in Northern Ireland, based on the contribution to GVA; and
- adjusting for exchange rate and Purchasing Power Parity (PPP).

Particular emphasis has been placed on figures published by the Ellen MacArthur Foundation for circularity opportunities in Denmark²¹. Denmark is recognised in the Industrial Strategy to be similar to Northern Ireland in terms of being a Small Advanced Economy. Within the executive summary headline figures have had the relevant Northern Ireland GVA multipliers applied to show total GVA benefit.

3.2 Growth Sectors

3.2.1 Life & Health Sciences

Healthcare and social work is Northern Ireland’s largest employment sector, with 135,000 employees in 2015 (see Table 2). The industrial strategy lists Life and Health Sciences as one of its main growth sectors, highlighting Northern Ireland’s contribution to world class research in the sector.²² The sector is predominantly publicly funded and relies on procurement to source a considerable amount of goods and services.²³ Moreover, the healthcare sector is a large waste producer and recycling rates are low.²⁴

Opportunity for circularity

An important opportunity for greater circularity within the healthcare sector lies in improved waste management. This could lead to considerable reductions in waste tonnage and greenhouse gas emissions. There are three main opportunities for waste reduction, related to better waste segregation:

- 1) Reducing avoidable food waste: in hospitals, the greatest source of non-hazardous waste comes from the purchasing and preparation of food.²⁵ This can be tackled by re-designing food delivery and disposal services and ensuring good

²¹ Ellen MacArthur Foundation (2015) *Delivering the circular economy A toolkit for policymakers*, June 2015

²² Department for the Economy Northern Ireland (2017) *A Consultation on an Industrial Strategy for Northern Ireland*, January 2017

²³ O’Neill, C., McGregor, P., and Merkur, S. (2012) *United Kingdom (Northern Ireland) Health System Review*, 2012, <http://apps.who.int/iris/handle/10665/130246>

²⁴ WRAP (2011) *Northern Ireland Commercial & Industrial (C&I) Waste Estimates 2009*, November 2011

²⁵ Ellen MacArthur Foundation (2015) *Delivering the circular economy A toolkit for policymakers*, June 2015

communication between patients, hospital staff and catering staff to avoid unnecessary food preparation.²⁶ At Mayo General Hospital in Scotland (a 265 bed inpatient acute hospital), measures of this kind have led to savings of £55,000/year.²⁷

- 2) Recycling: another important source of waste in hospitals is plastic. In the US, it is estimated that 20-25% of waste from hospitals is plastic, 85% of which is non-hazardous and could be recycled:²⁸ moreover, one of the most common plastic materials used for hospital equipment is PVC, which has high potential for recycling.²⁹
- 3) Refurbishment and reuse: equipment and furniture in healthcare centres can be diverted from the waste stream by being refurbished and reused, leading to considerable savings. For example, the NHS Scotland reuse scheme generated £300,000 in its first year³⁰ and the use of washable nappies at Nobles Hospital on the Isle of Man has led to reuse rates of 99.9%, saving £14,000/year.³¹

Furthermore, the healthcare sector is a major consumer of large capital equipment and can benefit from the adoption of performance models in procurement.³² In such models, the customer pays for the use of a product rather than purchasing the product itself, leading to savings on up-front costs, maintenance and end-of-use treatment. This type of procurement is already being implemented in many hospitals, especially in Germany.³³ It also provides healthcare centres with greater flexibility.

The economic potential for Northern Ireland, scaled from the Ellen MacArthur case study for Denmark, is estimated at £10 – £15 million per annum in savings by 2035 based on performance models in procurement in hospitals.

3.2.2 Wholesale and Retail Trade

The Wholesale and Retail Trade sector is currently the largest contributor to Northern Ireland's GVA, its second greatest employer (see Table 2), and is forecast to be the

²⁶ Resource Efficient Scotland NHSScotland Waste Prevention and Re-use Guide

²⁷ Resource Efficient Scotland NHSScotland Waste Prevention and Re-use Guide

²⁸ HPRC (2017) *Why Your Organization Should Consider HPRC Membership | Healthcare Plastics Recycling Council HPRC*, accessed 29 March 2017, <https://www.hprc.org/single-post/2017/03/17/Why-Your-Organization-Should-Consider-HPRC-Membership>

²⁹ *The role of hospitals in the circular economy: the contribution of PVC waste management plans | PVCMed.org*, accessed 29 March 2017, <http://pvcmed.org/hospitals-circular-economy-contribution-pvc-waste-management-plans/>

³⁰ *Circular thinking - a miracle cure for NHS waste management?*, accessed 29 March 2017, <https://www.edie.net/library/Circular-thinking---a-miracle-cure-for-NHS-waste-management/6636>

³¹ *Circular thinking - a miracle cure for NHS waste management?*, accessed 29 March 2017, <https://www.edie.net/library/Circular-thinking---a-miracle-cure-for-NHS-waste-management/6636>

³² Ellen MacArthur Foundation (2015) *Delivering the circular economy A toolkit for policymakers*, June 2015

³³ Medical Solutions (2015) *Flexible Leasing Support Continuous Innovation*

biggest growth sector in 2017.³⁴ It also is the second biggest sector in terms of C&I waste production (see Figure 3). As the retail sector is the portal via which most consumers purchase the products they use, it exerts a major influence on consumption patterns.

Opportunity for circularity

The Wholesale and Retail Trade sector can transition towards the circular economy by:

- Better management of packaging. Retail and wholesale is a major producer of packaging and key opportunities to reduce this include:
 - Design: retailers and wholesalers are in a position to redesign packaging to reduce total volume, with direct savings due to reduced material costs.
 - Deposit Refund Schemes (DRS) for packaging. In Scotland, a feasibility study on DRS for drinks containers identified £205m in benefits including from litter dis-amenity.³⁵ Scaling on a GVA basis, this presents a potential for £55m of benefits in Northern Ireland.
 - Charge for single use disposable items. Northern Ireland introduced the carrier bag charge in 2013, which was effective in reducing numbers. There are opportunities for similar charges to be levied on other little-recycled single use products, such as coffee cups.
- Implementing business models that focus on added-value services such as repair and maintenance, reuse, remanufacture and redistribution.
 - Retailing might, in some product areas, become less about volume of sales, and increasingly, if the aim is to retain value in products, about take back with a view to remanufacture and repair (either on site or remotely).
 - For retail, the potential issues associated with take-back of a wide range of products suggest a need for different store formats, and to examine the logistics which might be required to serve them.
 - Models for reuse already exist, with stores working with networks of local service providers.
- Upstream and downstream influence.
 - Design. WRAP research on life expectancy for EEE indicates there are potential savings for UK economy of £800 per annum. Scaling to Northern Ireland, this represents £17m of savings.
 - Consumption patterns. Retailer promotions (e.g. BOGOF offers) can drive consumers to make purchases they do not need.

³⁴ *Quarterly Sectoral Forecasts 2017 Q1 - Danske-Bank-Northern-Ireland-Quarterly-Sectoral-Forecasts-2017-Q1-FINAL.pdf*, accessed 7 April 2017, <http://www.northernirelandchamber.com/wp-content/uploads/2017/02/Danske-Bank-Northern-Ireland-Quarterly-Sectoral-Forecasts-2017-Q1-FINAL.pdf>

³⁵ Zero Waste Scotland (2015) *Review of feasibility study for a Deposit Return System for Drinks Containers*, 2015, <http://www.zerowastescotland.org.uk/sites/default/files/Review%20of%20feasibility%20study%20for%20a%20Deposit%20Return%20System%20for%20Drinks%20Containers.pdf>

- Supplier engagement and buying strategies. These can be adjusted to promote the use of suppliers that embody circular economy principles (similar principles to green procurement). For example, Marks & Spencer have engaged suppliers of food and household products to reduced waste by over 250,000 tonnes³⁶. Use strategies including discouraging landfill and disposal of any excess products or seconds.

3.2.3 Agri-Food

The agriculture and food processing sectors account for 63,000 jobs and 6% of Northern Ireland's GVA (see Table 2), while the food sector accounts for 5% of GVA. The Northern Ireland Assembly has outlined its ambition for growth in the agri-food sector post-Brexit, including growing employment by 15% and sales by 60%.³⁷ However, this ambition was not accompanied by any mention of opportunities to reduce waste, increase resource efficiency or grasp circular economy opportunities, suggesting a risk that policy may not be fully joined-up. There is a need to embed circular economy principles throughout sectoral growth plans. Food and drink is the sector that contributes the greatest share of Northern Ireland's C&I waste arisings (see Figure 3) and food waste is widely recognised as a significant problem, and one which, if addressed, will generate economic benefits to those preventing waste.

Opportunity for circularity – Food

In the food processing and consumption sector, the main opportunities for circularity lie in reduction of food waste. There are several ways in which this can be achieved.

- Prevention of avoidable food waste. There is potential to achieve this within the sector, but also by extension through households, using innovations such as extending storage and shelf life. Avoidable household food waste collected at kerbside has the potential to deliver ~£92 million GVA benefit, while avoidable food waste within industry has a ~£22m GVA benefit value. These values are calculated based on the tonnage of food waste^{6,10}, the proportion of this which is avoidable^{38,39} and the GVA benefit per tonne. This is calculated as £313 per tonne for commercial⁴⁰ and £1,042 per tonne for household, based on overall GVA

³⁶ Marks & Spencer *Waste & Circular Economy*, accessed 13 April 2017, <https://corporate.marksandspencer.com/plan-a/our-approach/business-wide/waste-and-circular-economy#7956cba3b304786acdfa3e2c56deb25>

³⁷ Mark Allen (2016) Northern Ireland's Agri-food Sector - background and possible 'Brexit' considerations

³⁸ WRAP (2013) *Household Food and Drink Waste in the United Kingdom in 2012, 2013*

³⁹ WRAP *food surplus and waste research overview (FINAL).pdf*, accessed 11 April 2017, <http://www.wrap.org.uk/system/files/private/WRAP%20food%20surplus%20and%20waste%20research%20overview%20%28FINAL%29.pdf>

⁴⁰ (2017) *NI Supply Use Tables Multipliers 2012*, accessed 13 April 2017, <https://www.nisra.gov.uk/publications/ni-supply-use-tables-multipliers-2012>

gain⁴¹. We account for direct, indirect and induced GVA, which is the net position once the loss of GVA direct to food, drink and agriculture sector is offset against consequential GVA gain in other areas.⁴²

- Re-use/re-distribution of food surplus. FareShare Northern Ireland, a charity which operates across Northern Ireland redistributing surplus food, calculates a social and economic return on investment of £8 for every £1 invested in its work.⁴³ Across the UK, 270,000 tonnes / year of surplus food was identified as being suitable for redistribution:⁴⁴ based on the size of the food sector in Northern Ireland this equates to 17,000 tonnes. At present FareShare redistributes 170 tonnes / year in Northern Ireland indicating the scale of opportunity.
- Any food waste which cannot be prevented or re-used / re-distributed can be separated for use in anaerobic digestion or composting plants, both of which generate beneficial products which can be used in the growing of food. Although moving food not currently being composted/recovered into these systems would save ~£60/tonne) depending on gate fee),⁴⁵ there may be additional costs incurred in collection. This indicates the far greater financial benefits that can be gained by preventing and redistributing food waste wherever possible. However, there is not currently sufficient anaerobic digestion capacity for food waste within Northern Ireland and remedying this represents an opportunity, with the potential for beneficial use of digestate to replace nutrients from mineral sources.

Other opportunities include:

- leasing kitchen equipment, reuse of furniture/cutlery/crockery, and grey water reuse.
- cost-effective collection systems: businesses can jointly procure services from a single provider, for example, through Business Improvement Districts.⁴⁶
- fostering the take up of separate food waste collections: case studies highlighting the prevention-related savings flowing from food waste separation should be

⁴¹ Suez (2016) *A Resourceful Future – Expanding the UK Economy*, accessed 11 April 2017, <http://www.sita.co.uk/downloads/ResourcefulFutureReport-SUEZ-1609-web.pdf>

⁴² Suez (2016) *A Resourceful Future – Expanding the UK Economy*, accessed 11 April 2017, <http://www.sita.co.uk/downloads/ResourcefulFutureReport-SUEZ-1609-web.pdf>

⁴³ Council for the Homeless NI (2014) *CHNI FARESHARE food sharing network SROI*, accessed 10 April 2017, [http://www.chni.org.uk/CHNI%20FS%20SROI_v2\(2\).pdf](http://www.chni.org.uk/CHNI%20FS%20SROI_v2(2).pdf)

⁴⁴ WRAP *food surplus and waste research overview (FINAL).pdf*, accessed 11 April 2017, <http://www.wrap.org.uk/system/files/private/WRAP%20food%20surplus%20and%20waste%20research%20overview%20%28FINAL%29.pdf>

⁴⁵ WRAP (2016) *Comparing the cost of alternative waste treatment options - Gate Fees report 2016*, 2016, <http://www.wrap.org.uk/content/new-gate-fees-revealed-wrap-show-changes-market>

⁴⁶ Eunomia Research & Consulting (2015) *Scoping Study for a Route Map to a Circular Economy in London*, June 2015

developed. Whilst legislation on separate collections is in place already in Northern Ireland, this could assist in uptake.⁴⁷

Opportunity for circularity – Agriculture

Agriculture is less significant as a contributor to Northern Ireland's GVA than the food sector, but it occupies approximately 75% of Northern Ireland's land. Production is largely dominated by livestock, and agriculture is, historically and culturally, an important sector for Northern Ireland. In the last 50 years, agriculture has become increasingly reliant on external resources, and as a result, there are a number of circular economy opportunities.

- Reducing reliance on artificial nutrient inputs. In 2015 artificial fertilisers and lime in Northern Ireland cost £75m, an 11% increase on the previous year in volume terms.⁴⁸ Much of the nutrients entering the system are ultimately discharged to the environment and opportunities to reduce artificial fertiliser inputs include utilising organic fertilisers (such as digestate, fertiliser from sewage (closing the nutrient loop), manures and crop residues), precision agriculture, reduced tillage agriculture and cover cropping.
- Reducing reliance on imported feed. Over 90% of feed material consumed in Northern Ireland is imported⁴⁹ at a cost of ≈£640m⁴⁸⁺⁴⁹, indicating potential opportunities for more locally grown feed. This would reduce the reliance of Northern Ireland agriculture on global grain market price fluctuations and has a potential multiplier effect on local employment.
- Reducing losses on farm via appropriate storage, pest / disease management, cross supply chain engagement to reduce wastage through issues such as off-specifications and mismatches of supply and demand.
- Leasing models for capital equipment, particularly to enable use of the latest smart technology that will allow for precision agriculture and efficient resource use.

Ultimately, the key principles are:

- moving agriculture towards a closed loop system that reduces reliance on external inputs; and
- sustainable intensification, where outputs are increased (as is a clear goal in Northern Ireland); whilst

⁴⁷ Northern Ireland Environment Agency (2016) Regulatory Position Statement - Food Waste

⁴⁸ DAERA NI (2016) Statistical Review of Northern Ireland Agriculture 2016

⁴⁹ Northern Ireland Grain Trade Association - NIGTA response to EU proposals to allow member states to restrict or ban the use of authorised Genetically Modified food and feed products., accessed 10 April 2017, <http://www.nigta.co.uk/consultations/127-nigta-response-to-eu-proposals-to-allow-member-states-to-restrict-or-ban-the-use-of-authorised-genetically-modified-food-and-feed-products>

- protecting the environment and contributing wider benefits to society via ecosystem services.

3.2.4 Manufacturing (excluding food production)

The manufacturing sector (excluding food production) accounts for 7% of NI's workforce and 10% of its GVA (see Table 2). Advanced manufacturing is specifically identified as a growth sector in the Draft Industrial Strategy. The MATRIX Panel report on Advanced Manufacturing, Materials and Engineering (AMME)⁵⁰ and the Northern Ireland Partnering for Growth Strategy⁵¹ both highlight the important place of aerospace, defence, security and the space industry in Northern Ireland's economy. With a ten-year plan to double the current £1 billion annual turnover, and increase direct employment from 8,000 to 12,000,⁵² AMME represents a key growth sector for Northern Ireland. Significant progress has already been achieved, with the sector's current annual turnover estimated at £1.3 billion, and overall employment at almost 10,000.⁵³

Opportunity for circularity

Opportunities for circularity within the manufacturing sector as a whole lie principally in the development of added-value services such as remanufacturing and refurbishment. As these services will require the development of new skills and technologies, they are expected to have a net positive effect on employment and GDP, and will fuel innovation. Within the wider circular economy, remanufacturing and refurbishment will promote the adoption of performance-based business models. The economic opportunity offered by these services is anticipated to be £20 – £35 million per annum by 2035.⁵⁴

In particular, the advanced manufacturing sectors of aerospace, defence, security and space industry offer great opportunities for innovation. For example, collaboration between the design, engineering and manufacturing sectors is leading to the use of new

⁵⁰ Department for the Economy Northern Ireland (2017) *A Consultation on an Industrial Strategy for Northern Ireland*, January 2017

⁵¹ ADS NI Industry Council (2013) *Northern Ireland Partnering for Growth: Together Growing the Northern Ireland Aerospace, Defence, Security & Space Industry*, 2013, <https://secure.investni.com/static/library/invest-ni/documents/northern-ireland-partnering-for-growth-together-growing-the-northern-ireland-aerospace-defence-security-and-space-industry.pdf>

⁵² ADS NI Industry Council (2013) *Northern Ireland Partnering for Growth: Together Growing the Northern Ireland Aerospace, Defence, Security & Space Industry*, 2013, <https://secure.investni.com/static/library/invest-ni/documents/northern-ireland-partnering-for-growth-together-growing-the-northern-ireland-aerospace-defence-security-and-space-industry.pdf>

⁵³ Department for Business, Energy & Industrial Strategy (2016) *Transfer statistics in the domestic gas and electricity markets in Great Britain*, accessed 21 October 2016, <https://www.gov.uk/government/statistical-data-sets/quarterly-domestic-energy-switching-statistics>

⁵⁴ Ellen MacArthur Foundation (2015) *Delivering the circular economy A toolkit for policymakers*, June 2015

composite and lightweight materials⁵⁵. Moreover, circular economy concepts of design for re-use and recyclability as well as the efficient use of materials and management of manufacturing by-products can also be applied in these sectors⁵⁶.

3.2.5 Construction & Real Estate Activities

The construction sector represents 14% of Northern Ireland's GVA and generates the largest tonnage of waste. The sector has contracted in the last 6 years but has now stabilised and is poised to grow.⁵⁷ The Annual Business Register and Employment Survey shows growth of 4.8% in the construction sector between September 2014 and September 2015⁵⁸ and an average annual growth of 3% is projected over the 2016-2020 period. More growth is expected in the 'new work' sector than in 'repair and maintenance'.⁵⁹ Growth is expected to be strongest in private housing, public non-housing and commercial buildings.

Opportunity for circularity

The circular economy offers many opportunities for construction. The design of new buildings and choice of materials should be based on circular economy concepts, such as durability, disassembly and flexibility, with an aim of keeping buildings and resources in use for as long as possible.⁶⁰ A number of practices could help deliver this aim.

- Using industrialised production processes, modularisation and 3D printing in order to reduce cost and time of construction and renovation.⁶¹ The Ellen MacArthur Foundation's study regarding Denmark estimates that, of all the circular economy opportunities considered in the study, these specific practices in the construction sector offer the greatest savings potential (33% of total value added by 2035). The estimated potential value for NI from these practices is £80 – £105 million per annum by 2035.
- Selective demolition could lead to increased savings through take-back and reuse of materials such as timber and structural metal, waste separation and high-

⁵⁵ <http://www.frost.com/sublib/display-report.do?id=K088-01-00-00-00&bdata=aHR0cHM6Ly93d3cuZ29vZ2xlmNvLnVrL0B%2BQJEhY2tAfkAxNDk0OTIyMTUzMig1>, accessed 16/05/2017

⁵⁶ Ellen MacArthur Foundation (2015) *Delivering the circular economy A toolkit for policymakers*, June 2015

⁵⁷ CITB (2016) *Industry Insights - Construction Skills Network Forecast Northern Ireland 2016-2020*, 2016, <http://citbni.org.uk/CITB/files/be/be07123e-3ab2-4d50-80c7-e2128626c797.pdf>

⁵⁸ Department for the Economy Northern Ireland (2017) *A Consultation on an Industrial Strategy for Northern Ireland*, January 2017

⁵⁹ CITB (2016) *Industry Insights - Construction Skills Network Forecast Northern Ireland 2016-2020*, 2016, <http://citbni.org.uk/CITB/files/be/be07123e-3ab2-4d50-80c7-e2128626c797.pdf>

⁶⁰ Sustainable Procurement Ltd, and Eunomia Research & Consulting (2017) *Procuring Resource Efficient Construction Projects*, January 2017

⁶¹ Ellen MacArthur Foundation (2015) *Delivering the circular economy A toolkit for policymakers*, June 2015

quality recycling of building components.⁶² These practices could lead to savings of £15 – £25 million per annum by 2035. This is a particularly attractive prospect for NI as it could help boost the repair and maintenance sector, which is currently not growing as fast as new-build.⁶³

- Leasing materials for use. This would open new business opportunities for providing leased, recycled materials to new construction work.⁶⁴
- Green procurement in the public sector. This is particularly relevant as Northern Ireland is undergoing growth in public non-housing construction sector. When awarding contracts regarding structures which are likely to be more permanent, whole life costs should be given particular weight.⁶⁵
- Sharing, multi-purposing and repurposing of buildings. This is estimated to lead to savings of £35 – £50 million per annum by 2035.⁶⁶

3.3 Enabling Sectors

3.3.1 Digital and Creative Technologies

The Information and Communication Technologies (ICT) sector employs 13,000 people in Northern Ireland, with an additional 15,000 digital-ICT specialists working in non-ICT companies. The growth of the sector is anticipated to accelerate in the years ahead.⁶⁷

There are four ICT sectors in which Northern Ireland is already, or has the potential to become, world class. These are: software engineering, advanced networks and sensors, data analytics and cyber security.⁶⁸ The cyber security sector has grown by 30% in the last twelve months and is now estimated to support around 1,100 jobs. Northern Ireland aims to become a global innovation hub for cyber security, supporting over 5,000 jobs. Belfast has the highest concentration of cyber security jobs in Europe, with companies such as Proofpoint, IBM, Rapid, WhiteHat and Alert Logic all present.⁶⁹

⁶² Zero Waste Scotland (2017) *RAP002-001 - Identification of Circular Economy Opportunities in the Scottish Construction Sector*, April 2017

⁶³ CITB (2016) *Industry Insights - Construction Skills Network Forecast Northern Ireland 2016-2020*, 2016, <http://citbni.org.uk/CITB/files/be/be07123e-3ab2-4d50-80c7-e2128626c797.pdf>

⁶⁴ Eunomia Research & Consulting (2015) *Scoping Study for a Route Map to a Circular Economy in London*, June 2015

⁶⁵ Eunomia Research & Consulting (2015) *Scoping Study for a Route Map to a Circular Economy in London*, June 2015

⁶⁶ Ellen MacArthur Foundation (2015) *Delivering the circular economy A toolkit for policymakers*, June 2015

⁶⁷ Department for the Economy Northern Ireland (2017) *A Consultation on an Industrial Strategy for Northern Ireland*, January 2017

⁶⁸ MATRIX Digital ICT Panel (2016) *Matrix Digital ICT report - foresight and horizon scanning*, 2016, <http://matrixni.org/wp-content/uploads/2016/03/2016-Matrix-Digital-ICT-Report.pdf>

⁶⁹ Department for the Economy Northern Ireland (2017) *A Consultation on an Industrial Strategy for Northern Ireland*, January 2017

Northern Ireland has also gained a global reputation in the creative industries with notable success in the TV and film industry (e.g. HBO's Game of Thrones) as well as an emerging animation sector.⁷⁰

Opportunity for circularity

Technology companies have an opportunity in the circular economy to adopt innovative business models and be as forward-thinking about their business models as they are with their technologies. Providing consumers with repair and recycling options can provide options for business expansion. It is also an opportunity for companies to differentiate themselves by branding themselves as sustainable.⁷¹

ICT is already driving new markets in the sharing economy, by delivering smart logistics and helping consumers to transact swiftly and conveniently. This may prove an important enabler of the circular economy by improving the efficiency of take-back systems and facilitating the retention of value in consumer goods through remanufacture, reuse and repair.⁷²

3.3.2 Financial, Business and Professional Services

Much progress has been made in recent years to improve the availability and affordability of finance for businesses in Northern Ireland but there remains more to be done. Research carried out by the Department for Enterprise, Trade and Investment in 2015 noted that the market in Northern Ireland for early stage and growth finance remains relatively small and faces a number of challenges.⁷³

Opportunity for circularity

Five business models drive the circular economy⁷⁴:

- 1) circular supplies, which use renewable energy and recyclable materials rather than single-lifecycle inputs and products;
- 2) recovery of useful resources/energy from by-products and end-of-use products;
- 3) product life extension, through the repair, upgrading and reselling of products and components;
- 4) sharing platforms, which lead to an increased utilization rate of products by enabling shared use/access/ownership; and

⁷⁰ Department for the Economy Northern Ireland (2017) *A Consultation on an Industrial Strategy for Northern Ireland*, January 2017

⁷¹ techUK (2015) *The Circular Economy: a perspective from the technology sector*, September 2015

⁷² Eunomia Research & Consulting (2015) *Scoping Study for a Route Map to a Circular Economy in London*, June 2015

⁷³ Department for the Economy Northern Ireland (2017) *A Consultation on an Industrial Strategy for Northern Ireland*, January 2017

⁷⁴ Accenture (2014) *Circular Advantage: Innovative Business Models and Technologies to Create Value in a World without Limits to Growth*, 2014

- 5) product as a service, whereby producers/owners offer product access but retain ownership to internalise the benefits of circular economy practices.

The finance sector has a role to play in enabling the development of these models. It is a growing market which is estimated to generate 1% to 4% economic growth over a ten year period.⁷⁵ Opportunities for the finance sector to benefit from this include:

- new business models, including novel forms of finance, or traditional forms, such as lease financing, applied in new areas;
- insurance industries developing specialisation in providing cover for companies selling reused / remanufactured products where these cannot be backed by more conventional guarantees; and
- if circular economy activities become more mainstream, a wider range of financial institutions will need to understand what is driving the changes, and how demand for remanufactured and repaired goods might constitute the basis for a strong business model.

3.3.3 Education

The industrial strategy sets out three main aims for education in Northern Ireland: improving educational outcomes from an early age; supporting those furthest from the workforce; and ensuring the country has the necessary skills pipeline to meet business needs now and in the future (apprenticeships, training programmes etc.). The circular economy can offer opportunities towards all three aims.

Opportunity for circularity

The education system has an important role to play in equipping people with knowledge and skills to be drawn upon by other sectors. For example, the circular economy will require a workforce with the skills necessary to undertake activities such as refurbishment or remanufacturing. Design is another skills area of particular importance in the circular economy. The University of Ulster and Queens University both offer courses in design, as do all of the Further Education Colleges. The Northern Ireland Design Alliance brings representatives from industry and education together to facilitate the development of the sector.⁷⁶ The dissemination of new skills across the labour force will help to reduce unemployment.⁷⁷

Furthermore, academia can be a source of research and innovation for the circular economy. Northern Ireland already has world-class research centres, such as the Northern Ireland Advanced Composites and Engineering Centre, which aims to deliver

⁷⁵ ING Economics Department (2015) *Financing the Circular Economy*, May 2015, https://www.ing.nl/media/ING_EZB_Financing-the-Circular-Economy_tcm162-84762.pdf

⁷⁶ *About | Northern Ireland Design Alliance*, accessed 11 April 2017, http://www.nidesignalliance.com/about-us/#post_74

⁷⁷ Eunomia Research & Consulting (2015) *Scoping Study for a Route Map to a Circular Economy in London*, June 2015

innovative solutions to industry through collaborative research and technological advancement. Queen's University in Belfast, voted 8th in the Research Excellence Framework in the UK, has gained particular recognition in areas such as food security, education, health, engineering and cyber security and is embracing the opportunity for innovation and collaboration with its Global Research Institutes. These academic centres can incorporate circular economy concepts into their research and encourage their implementation.

4.0 The Opportunity - Employment

As outlined in the industrial strategy, employment is a key metric for Northern Ireland. Northern Ireland has the highest rate of economic inactivity in the United Kingdom. Moving towards a circular economy offers key employment opportunities. As already quantified in the ReNEW report published in 2015, moving towards a more circular economy could create over 13,000 circular economy jobs in Northern Ireland, principally in re-use, repair, recycling and renting and leasing.⁷⁸

Based on 2015 unemployment, 13,000 jobs would reduce unemployment by 1.5 percentage points, bringing Northern Ireland's unemployment rate below that for the UK as a whole.

5.0 Themes & Recommendations

5.1 Themes

5.1.1 Green Procurement

Whilst there is ambition to grow the private sector and thereby reduce the proportion the public sector contributes to GVA, the public sector is likely to remain one of the most important contributors to Northern Ireland's GVA. The public sector is in a position, through its procurement activity, to favour goods and services that are aligned with a drive to a more circular economy. This could be achieved through measures such as:

- specifying recycled content of any goods procured;
- specifying limits on the quantity of waste produced and how it is to be handled;
- durability and reparability criteria; and
- requiring reporting against KPIs tailored to sustainability considerations.

⁷⁸ ReNEW (2015) *Job Creation in the Circular Economy - Increasing Resource Efficiency in Northern Ireland*, accessed 11 April 2017, <http://www.wrap.org.uk/sites/files/wrap/ReNEW%20CE%20Employment%20Report.pdf>

A key challenge in moving towards green procurement in the public sector is to revise how costs are assessed by procurement bodies. One way to do this is to ensure that goods and services are procured based on total cost of ownership. Products that have been designed for reuse and ease of disassembly may last longer because they are more easily repaired, and may have a higher end-of-life value. Similar principles can be inculcated in the private sector through measures such as buying protocols and product specifications.

5.1.2 Leasing Models

There are a number of sectors where sharing / leasing models offer opportunities to move towards a more circular economy. Leasing is already a widely-used source of financing in many sectors but there are many more opportunities in a circular economy context, particularly to focus upon how products are managed at the end of the lease.

5.1.3 Digitalisation

Digitalisation offers a number of circular economy opportunities across sectors, for example:

- enabling sharing of equipment through sharing information on usage and identifying opportunities to share;
- using smart data to better integrate supply chains and reduce waste, particularly in food supply chain; and
- adopting an 'intelligent assets' approach, in assets are tracked through their lifespan and an efficient reverse logistic system is put in place at the end of their use.

5.2 Recommendations

On the basis of the evidence set out in this report, we are able to offer a non-exhaustive list of policies and actions we believe are within Northern Ireland's devolved powers to implement (with support from relevant bodies).

Leading Measures

- Develop a Green Procurement strategy, using purchasing power to stimulate a more circular economy.
- Provide support for businesses to engage in circular economy business models, disseminating research findings and assisting circular economy start-ups. This could be supported by accessing ERDF Circular Economy Business Support funds.
- Provide financial and technical support on trials and R&D demonstrating the business case for circular economy practices.
- Work with sector representatives to develop sector specific circularisation plans, imbedding these into any growth plans and identify opportunities for growth.
- Work with the design sector (e.g. by engaging with the Northern Ireland Design Alliance) to encourage a focus on designing out residual waste wherever possible.

- Utilise the results of previously commissioned work to review local authority waste collection methods with a view to increasing household recycling.
- Introduce deposit refunds for beverage containers and consider a similar scheme for small WEEE to increase recycling;
- Implement a central electronic duty of care system to provide greatly improved data on C&I and CD&E waste, allowing the effect of circular economy measures to be monitored more effectively.
- Implement pay as you throw systems for households to deter the production of residual waste, which is likely to encourage waste prevention, reuse and recycling.

Supporting Measures

- Require reusable products (e.g. glasses, plates, cutlery) to be used at public events.
- Raise awareness of the impact of linear economics, with the aim of triggering behavioural change and consumption pattern shifts.
- Overhaul producer responsibility for WEEE to facilitate improved design, collection and management of WEEE, and incorporate reuse targets.
- Introduce producer responsibility requirements for furniture, including reuse targets.
- Require supermarkets to offer excess food to food redistribution organisations.
- Provide support for reducing food waste in businesses through auditing.
- Provide financial and/or practical support for food redistribution schemes.

Advancing Waste Management

- Review biowaste treatment infrastructure in Northern Ireland and consider how additional capacity needs may be met.
- Move towards a concession-based model for commercial waste collection in specified zones, utilising the model pioneered by BIDs.
- Introduce a requirement to sort (fractions of) commercial waste.
- Undertake a strategic review of the market for commercial waste collection, to ensure commercial businesses have opportunity to recycle wherever possible.

APPENDICES

A.1.0 Supporting Information

Table 3: Figure 1 Supporting Data

	GVA (Income Approach) per head at current basic prices	Waste Arisings per head (kg)
2007	18,397	534
2008	17,991	502
2009	17,279	489
2010	17,195	479
2011	17,300	468
2012	17,634	446
2013	18,099	443
2014	18,331	456
2015	18,584	459

Table 4: Figure 2 Supporting Data

Material	Total Tonnes			Capture Rate
	Captured	Total	Residual	
Food*	30,383	148,871	118,488	20%
Garden*	85,279	114,216	28,938	75%
Organics / compostables	115,661	263,087	147,426	44%
Paper & Card	60,085	108,448	48,363	55%
Mixed plastics	11,010	69,441	58,431	16%
Glass	17,835	44,947	27,112	40%
Mixed metals	4,748	16,435	11,686	29%
WEEE	54	5,879	5,825	1%

Table 5: Calculation of GVA ratio between Denmark and Northern Ireland

	Denmark		Northern Ireland	GVA ratio
Sector	GVA by sector (EUR million) ¹	GVA by sector (£ million) ²	GVA by sector (£ million) ³	NI/DK
Construction	11,032	8,111	1,966	0.24
Real estate	23,472	17,259	2,842	0.16
Public admin, defence, education, health, social work	53,114	39,054	9,884	0.25
Manufacturing	34,517	25,380	5,027	0.20

¹ Source: Eurostat; ² conversion rate EUR/GBP = 1.36 (average for 2015); ³ Source: ONS

Table 6: Executive Summary Supporting Information

Sector	Opportunity (£m)	Multiplier	Contribution to GVA incl. Type 1 multiplier	Contribution to GVA incl. Type 2 multiplier
Healthcare	£13	0.9	£17	
Wholesale & Retail*	£17	1.4	£24	
Agri-Food*	£104	1.8	£114	
Manufacturing (excluding food production)	£28	1.5	£42	
Construction	£93	1.7	£160	
Waste Prevention excl. food				£117 ⁷⁹
Total	£254		£474	
Note	See report figures	Healthcare uses public sector ⁸⁰ multiplier, household food waste already has a multiplier applied so just commercial multiplied, others as stated ⁸¹	As cited	

⁷⁹ Suez (2016) *A Resourceful Future – Expanding the UK Economy*, accessed 11 April 2017, <http://www.sita.co.uk/downloads/ResourcefulFutureReport-SUEZ-1609-web.pdf>

⁸⁰ (2017) *NI Supply Use Tables Multipliers 2012*, accessed 13 April 2017, <https://www.nisra.gov.uk/publications/ni-supply-use-tables-multipliers-2012>

⁸¹ (2017) *NI Supply Use Tables Multipliers 2012*, accessed 13 April 2017, <https://www.nisra.gov.uk/publications/ni-supply-use-tables-multipliers-2012>

Table 7: Scaling of circular economy opportunity figures from the Ellen MacArthur case study for Denmark

	GVA ratio per sector	Net value added (Denmark)		Net value added (Northern Ireland) ¹		Conversion to DKK ²		Net value added for NI (PPP adjusted) ³		Net value added for NI (rounded values)	
	NI/DK	million EUR		million EUR		million DKK		million GBP		million GBP	
SECTOR		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Construction	0.24										
industrialised production processes (modules, 3D printing)		450	600	109	145	814	1,085	78	104	80	105
reuse and high-quality recycling		100	150	24	36	181	271	17	26	15	25
Real estate	0.16										
sharing, multi-purposing and repurposing of buildings		300	450	49	74	369	553	35	53	35	50
Healthcare/hospitals	0.25										
adopt performance models in procurement		70	90	18	23	132	170	13	16	10	15
Manufacturing	0.20										
reuse-refurbishment		150	250	30	50	222	370	21	35	20	35

¹ value obtained by multiplying Denmark value by GVA ratio by sector; ² conversion rate DKK/EUR = 0.134 (average for 2015); ³ PPP ratio (GBP/DKK) = 0.096