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NATIONAL WASTE PREVENTION PROGRAMME 2014-2018

REDISCOVERY CENTRE

GreenBusiness

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Environmental Protection Agency
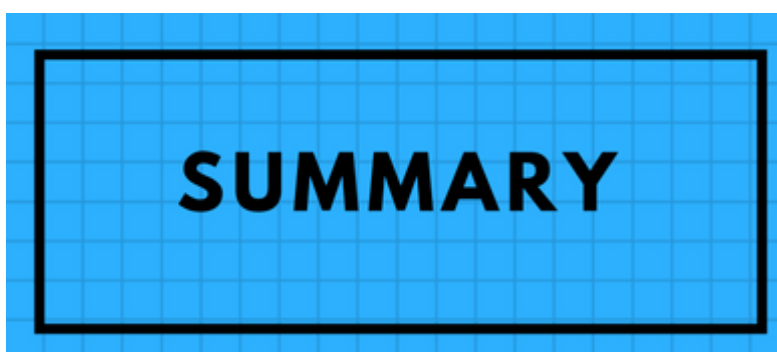
This EPA funded research project looked at identifying key performance indicators that may be useful in assessing the social, environmental and economic impact of reuse organisations in Ireland.

In collaboration with the Community Reuse Network, and other actors within the sector, a number of indicators were identified, proposed and trialled across the Rediscovery Centre's four social enterprises; Rediscover Fashion, Rediscover Furniture, Rediscover Paint and Rediscover Cycling.

Research was also carried out with respect to quantitative and qualitative data available, attitudes towards data collection and commonalities relating to data available within the wider sector.

The results showed a keen interest among stakeholders and policy makers for data from the sector to be made available and a willingness from the sector to provide information that would enable sector impact to be measured.

Difficulties with respect to the practicalities of collecting data were highlighted and recommendations made as to how the process could be aligned with business processes to reduce associated demands.

Resource efficiency concerns

Ireland, and the EU, currently face a crisis in terms of resource availability, use and disposal. Due to our current consumption and disposal habits the resources we use on a daily basis are in danger of running out. Furthermore the extraction of raw materials, manufacturing and the disposal of end of life products are having increasingly harmful and accumulative effects on the environment. On average, 16 tonnes of materials are consumed per person annually in the EU. Much of this ends up as waste with an average waste production rate of 6 tonnes per person annually.[1]

The concept of sustainability can be defined as economic development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The concept of 'need' and 'limitation' is important and whilst the definition was first coined in the Bruntland report almost three decades ago, its adoption is as urgent and relevant today as it was then. Providing for the next generation in a 'sustainable' manner presents both future challenges and opportunities. Key to addressing these challenges is the transition to a circular economy, where products, materials and resources are maintained in the economy for as long as possible. In this economy, waste is minimised, value maximised and reuse and recycling practices are adopted to effectively manage discarded materials. McKinsey (McKinsey 2011) calculates that approximately 30% of the worldwide demand for resources in 2030 could be met through available resource improvements such as these. The report also estimates that the global economic benefit of such activity could be as high as $3.7 trillion each year.

Sustainable development and the business sector

The model of sustainable development is clearly a universal one; the responsibility for which lies, and impacts upon, all elements of society. Businesses, which are no exception, need to ensure that their activities are carried out having regard to the scarcity of natural resources, community impact and the protection of the environment. Business performance monitoring, measurement, evaluation and feedback are key to achieving positive sustainability impact in the form of financial, social and environmental return. Whilst measuring impact based on profits generated is a long established business practice, sustainability monitoring is less ubiquitous. Across Ireland there is evidence of good environmental practice and impact monitoring among small and medium-sized enterprises (SMEs) however exemplary progress in this area resides primarily within the environmental products and services sector of the business community, who are more comfortable within this domain.

Reuse has a significant role to play in addressing unsustainable consumption, creating job opportunities and increasing economic competitiveness by protecting businesses against scarcity of resources and volatile prices. Reuse activity is built upon the knowledge that finished products are worth much more than the raw materials they are composed of and direct reuse preserves the most value and embodied energy in products. For example, a reused iPhone retains around 48 per cent of its original value, whereas its value as recyclate is just

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0.24 per cent of its original value (Ben 2013). Community reuse organisations generate significant social, environmental and economic benefits that contribute to the development of more sustainable lifestyles. At present the majority of reuse organisations in Ireland gather some data relating to their impact, however the nature of the data is generally influenced by the requirements of funders, social supports, governing and licensing bodies. Developing common sustainability indicators appropriate to the nature, scale and diversity of the sector is identified as a key stage in measuring the collective impact of reuse and would be a welcome tool for sector organisations and policy makers alike. In considering appropriate metrics for community reuse organisations, it is important to consider proportionality in respect of the likely complexity of an assessment methodology that can be supported by the sector and the benefits in terms of increased accuracy through additional complexity.

The Rediscovery Centre

The Rediscovery Centre is an environmental education and research centre in Ballymun and the umbrella organisation for 4 social enterprises; Rediscover Furniture, Rediscover Fashion, Rediscover Paint and Rediscover Cycling. The centre's activities provide training opportunities for local long term unemployed people and those distanced from the workplace. All enterprises use materials discarded by others to create new products and demonstrate reuse as a key stage in the effective management of resources. The Rediscovery Centre's operations, like other social enterprises, offer far reaching benefits which are not measured and go unreported resulting in a false representation of their current and future potential to contribute to sustainable development. It is envisaged that the indicators developed during this process can assist the Rediscovery Centre and other reuse organisations in Ireland to more accurately measure and report their social, economic and environmental impact.

Through a collaborative research approach, this project identified social, economic and environmental indicators appropriate for measuring the key impact of the reuse sector in Ireland. The study demonstrated the importance of sustainability monitoring for communicating impact and presents a methodology for the process.

The indicators were validated via the Rediscovery Centre's operations and activities as an initial test bed site over a period of 12 months. The process highlighted barriers to sustainability monitoring and identified recommendations to assist in overcoming challenges of data collection and monitoring at an operational level. The results were used to create a simple impact info graphic to demonstrate the advantages gained through data collection with respect to impact communications. Focus groups and stakeholders were consulted to test the suitability of indicators for more widespread use with an ambition to establish a set of universal indicators for data collection from all reuse organisations and collective sector impact analysis.

Figure 1. Illustrates the project management structure. Overall project management was provided by the Rediscovery Centre reporting directly to the EPA.

Figure 1 Project Team
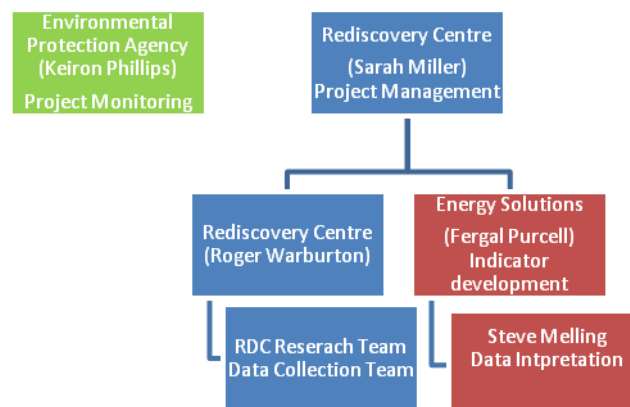
PROJECT METHODOLOGY

The project included a review of current approaches in assessment and benchmarking of environmental, social and economic indicators in the reuse and similar sectors. This informed an initial proposal on specific benchmarking methodologies for the reuse sector in Ireland which were presented to members of the Community Recycling Network of Ireland (CRNI) and the EPA for discussion and refinement.

Through a process of consultation the final approach to data collection and indicator reporting was developed. The methodology was then applied via surveys issued to all the participating community reuse organisations to gather the data required. The ability to measure performance effectively and concurrently with established business management systems as opposed to creating separate business systems was seen as fundamental in the approach given that most of the organisations involved are SMEs and report administration resourcing deficits.To be effective and ensure uptake among SMEs, sustainability monitoring should align with operational practice and be able to demonstrate financial, social and environmental return. To this end the Rediscovery Centre was used as a case study to confirm ease of use and to assess the demands associated with sustainability monitoring. Figure 2. summarises the staged approach to the project methodology.
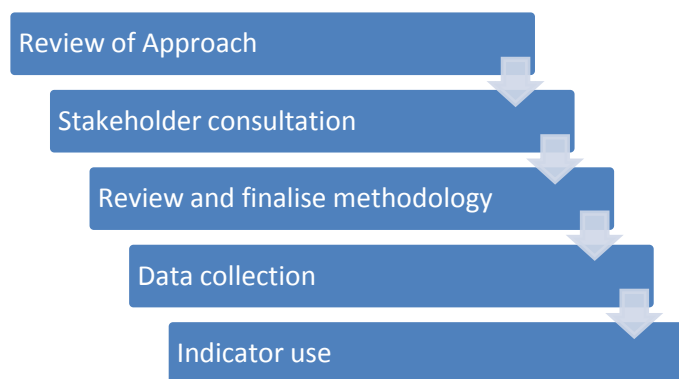

Figure 2. Approach & methodology

REVIEW OF AVAILABLE APPROACHES TO SUSTAINABILITY MONITORING

The initial stage of the study reviewed the different approaches to sustainability measurement. One of the primary ways of measuring sustainability of an organisation is through developing indictor sets. Unfortunately there is an incredibly wide variety of indicators and metrics used across organisations and industries. The lack of standardisation makes comparison between businesses and sectors very difficult. This section looks at a selection of approaches which have been used to monitor sustainability.

SWOT and Triple Bottom Line Accounting.

In 2011, the Department of Geography in Trinity College Dublin in conjunction with Comhar and other stakeholders developed a toolkit for measuring sustainability in social enterprises (Davies et al 2011). This toolkit addresses a basic three-step process to initiate a sustainability impacts assessment. The first step is a process that focuses on strengths, weaknesses, opportunities and threats (SWOT) to environmental social economy enterprises (ESEE). The second-step outlines a process of sustainability indicator generation and the third provides a structure for collecting and reporting on data collected in relation to those indicators. The report outlines procedures for conducting a sustainability impact assessment and information on the core concepts: sustainable development, environmental social economy enterprises and sustainability impact analysis. A range of tools to aid the measure of sustainability impacts are presented, including satisfaction surveys, a social value index and a carbon footprint.

A list of sustainability indicators is divided into two sections generic and sectoral indicators. The generic section is divided into economic, social and environmental indicators generally applicable to most enterprises. Many of these general indicators were used as the basis for indicator development in this study. The second section of the indicators is divided into the seven environmental categories: waste management; energy management; transport management; tourism; education and land management. Many of the methods (for example SWOT analysis) and indicators (for example financial viability) provide valuable internal management and performance evaluation tools for social enterprises.

However, the focus of this report being the benefits of community reuse require the addition of sector specific indicators such as quantities of specific reuse materials diverted from landfill, training attainment and skills delivery, carbon avoided, behaviour changed and employment generated. Indicators based on satisfaction of staff, volunteers and customers via surveys provide useful indicators of the social value of organisations. However the resources employed in collecting, collating and compiling this data was found to be onerous within the focus group of this study and those indicators were not valued as highly others presumably because they are not included in current reporting mechanisms.

Embodied Carbon & life cycle assessment

The need to consider the environmental effects of the production and distribution of goods has been long recognised both from the perspective of consumer awareness and from that of enabling the reliably assessment of the impacts of an entire supply chain. A significant amount of work has been carried out in quantifying the carbon footprint of materials and goods.

The Inventory of Carbon and Energy (ICE) database [Hammond & Jones 2008] contains the embodied energy and embodied carbon of a large number of building materials. The inventory defines the embodied carbon and energy of a material as 'the total primary energy consumed (carbon released) over its life cycle. This would normally include (at least) extraction, manufacturing and transportation'. While focusing on construction materials, with over 1,700 records in the database there are materials of relevance to the community reuse sector contained in the inventory. The inventory is based on secondary research, leveraging data in the public domain. Preference is given to data that complied with ISO 14040 and ISO 14044. The system boundaries for the data is based on a 'cradle to gate' approach and therefore the impacts of transporting materials to their end use location is not considered. It is recommended that users of the database include a site specific evaluation of transport impacts.

The assessment of the embodied energy and carbon of specific goods and services is more complex than that for a specific material as there are a range of inputs and outputs from its production and delivery. In many respects the establishment of embodied carbon and energy data requires suppliers in interlinked supply chains to each have objective and consistent assessment of the products embodied impacts. The UK Government, BSI and the Carbon Trust established a publically available standard for the **lifecycle assessment of goods and services** [PAS 2050] in 2011. The standard details a life cycle assessment approach for the evaluation of the greenhouse gas emissions of goods and services. It relies more on primary data, that is data collected by an organisation rather than secondary data available from published sources or databases. As such it is more of a framework methodology than an easily applicable assessment tool. The standard envisages different levels of verification from certification by a suitable accredited body (eg UKAS, INAB) to self-declaration. Clearly self-declared data is less reliable for use in a robust supply chain analysis.

An important indicator of the sustainability benefits of reuse is data relating to embodied energy and carbon of new products substituted by reuse. However, limiting the assessment to this benefit does not provide a full indication of the environmental benefits. Including the benefit of the avoided, or deferred, impact of disposal and the disbenefit of resource use and impacts of the reuse activity would provide a more comprehensive view of the environmental benefits of reuse.

The UK - Publicly Available Specification 2050 (PAS 2050) specifies requirements for the assessment of the life cycle GHG emissions of goods and services (collectively referred to as "products") based on key life cycle assessment techniques and principles. This PAS is applicable to organizations assessing the GHG emissions of products across their life cycle, and to organizations assessing the cradle-to-gate GHG emissions of products. Requirements are specified for identifying the system boundary, the sources of GHG emissions associated with products that fall inside the system boundary, the data requirements for carrying out the analysis, and the calculation of the results.

The Joint Research Centre (JRC) is the European Commission's in-house science service. The Integrated Product Policy (COM (2003)302) identified **Life Cycle Assessment (LCA)** as the "best framework for assessing the potential environmental impacts of products". It highlighted the necessity for a platform on LCA and to increase the availability of quality-assured life-cycle data. The JRC responded to these needs by establishing the European Platform on Life Cycle Assessment (EPLCA), through which it has facilitated the development of the **European reference Life Cycle Database (**ELCD), the **International reference Life Cycle Data System** (ILCD) **Handbook**, and the **Life Cycle Data Network** (LCDN). However, as of now the level of uptake of these standard methodologies and the publication of quality assured life cycle assessment results for common

products is relatively low. This complicates the assessment of a counterfactual production process avoided through the reuse of a given product.

There have been a number of initiatives to develop databases and associated software tools which are made available on a paid licensing basis. Examples include **WRATE**, which was originally developed for the Environment Agency and is now owned and supported by Golder Associates (UK) Ltd and **ecoinvent**, a not for profit life cycle inventory with over 11,000 entries supported by detailed studies. Relevant to this study there are various entries in the ecoinvent database for bicycles which are supported by a detailed study (LEU 2010) and providing details on the input data for the assessment. However, the life cycle inventory data is not accessible without purchasing a licence. The licences for these databases cost in excess of €2,000 and were not consulted for this study as the intention of the study is to develop a cost effective and proportionate approach to assessment of the benefits of reuse and not to refer to or replicate existing commercially available databases.

LCA solutions for Reuse

The above LCA approaches are typically used in assessing the impact of products either in a cradle-to-gate approach or cradle-to-grave approach. Reuse avoids, or defers, the production of a new item and the rate of displacement of new products has to be considered when assessing the impact of reuse activities. To account for this, and other specific factors associated with reuse, WRAP have developed a specific methodology for quantifying the impacts of reusing products in the UK (WRAP 2011). The methodology can be applied to a range of products using an accompanying excel-based tool to provide a consistent means of assessing the impacts of different activities.

The key characteristics of the methodology include guidance on: system boundaries; product lifetimes and displacement effects of reuse; allocation of environmental or economic impacts to different parts of the supply chain; use of costs and prices, and; jobs and labour costs.

The WRAP methodology is based on best practice in life cycle assessment and cost benefit analysis and also provides guidance on sourcing data for the model. The excel tool allows the calculation of three environmental indicators (greenhouse gas emissions, energy demand and resource depletion), and two economic indicators (number of jobs and cost impacts), as well as identifying where these occur in the supply chain.

Zero Waste Scotland has developed a carbon metric which uses a life cycle carbon accounting approach to waste arising in Scotland. The carbon metric includes the impact of raw material extraction, production, transport and end of life disposal irrespective of where they occur. The principal data used is the Scottish national waste flow dataset and waste composition studies combined with carbon factors for waste streams which are sourced from various publications and data sets including ecoinvent, WRATE, and various other industry and government agency sources.

In choosing metrics for reuse it is important to consider proportionality. The likely complexity of an assessment methodology that can be supported by the sector must be weighed up against the benefits in terms of increased accuracy versus additional complexity. In this regard, it is helpful to consider the relative magnitude of the impacts of production of new products, the impacts associated with reuse and preparation for reuse activities and the impacts for final disposal. For example, the WRAP case study on furniture (WRAP 2011a) found that on account of the nature of tables, most displacement benefit comes from avoiding the eventual landfill of a new item, as opposed to avoiding its production.   This is not the case with clothing (WRAP2011b) where the avoided impact of production dominates and the impact of the reuse activity and disposal are proportionately lower. Similarly, an assumption in the proportion of recycled aluminium in a displaced new product will have a major impact of an assessment as recycled aluminium can have a saving of 85-90% in its embodied impacts over primary aluminium [Hammond & Jones 2008].

In considering the general split between the production impacts and waste management stages of the life cycle of a product it is worth noting the production carbon impact of waste is estimated at over 14 Mt/year in Scotland while the carbon impact of landfill and incineration combined is just less than 1 Mt/year (ZWC 2014). In general, with the exception of certain items, such as furniture, the greater emphasis in establishing the lifecycle benefit of reuse should be on the avoided impacts of production. Where possible this approach has been adopted in this report.

Social Impact and economic benefit

Other than environmental benefits, perhaps the most important quantifiable metric is the enterprise and employment development impact of the sector. In a 2015 study on employment in the circular economy (Morgan & Mitchell, 2015), it is suggested that by 2030, on the basis of the current development path, the circular economy could create between 200,000 to 500,000 gross jobs and reduce unemployment by between 54,000 to 102,000. The point is made that jobs in the circular economy are more likely to be additional jobs rather than displacing traditional jobs and also that jobs are likely to be created in areas and sectors of high long term unemployment due to the dispersed nature of reuse activities and the skills required by the sector.

Another study on the economic benefit of the circular economy, (WRAP 2015) observes that in 2007 there were 301,000 people in Europe employed in the recycling sector compared with 177,000 in 2000 - an increase of 70% - and which equates to an annual increase of 8% with many of the jobs created being for people with relatively low skills. The report suggests a potential labour market impact in Europe by 2030 is to create 1.2 million jobs with a reduction in unemployment in Europe by around 250,000.

As an overarching metric for 'third sector organisations' (an increasingly common assignation for the broad not for profit sector including charities, voluntary organisations and social enterprises) the concept of the Social Return on Investment (SROI 2012) has been introduced as a framework for measuring and accounting a broader concept of value by incorporating social, environmental and economic costs and benefits. It provides a framework for evaluation of the social return on investment through a six stage process of 1) identifying and engaging stakeholders, 2) Mapping Outcomes, 3) Valuing outcomes, 4) Establishing Impact and 5) Establishing SROI. A key part of the process of valuing outcomes is monetising impacts. It is suggested that impacts are monetised by consideration of proxies to estimate the social value of non-traded goods to different stakeholders. This is a useful approach for example, in assessing the impact of training and employment for the long term unemployed. In a cost benefit analysis of WRAP's activities (WRAP 2011c) WRAP asserts that it has generated £18 of benefit for every pound spent by WRAP and presents statistics relating to benefits per year through low cost or no cost improvements in the efficient use of resources. The analysis is not transparent however and cannot be replicated or adapted for an Irish context

The simplest and most basic proxy for evaluating the value of a job created is the avoided social welfare payment for unemployed persons. In Ireland this equates to approximately 10,000 euros per person. It is noted that over 20% of those in receipt of social welfare are also in receipt of rent allowance at an additional annual cost to the state of between 5000 & 15000 euro per person. The employment in Enterprise Ireland's 2004, 2005 and 2006 High Potential Start Up (HPSU) schemes was 2,086 in 2010, slightly reduced from the peak figure of 2,169 in 2008. The cost of the scheme was €61m over this period indicating a simple cost per job created of €28,120. The cost benefit ratio of the programme, including salary levels, expenditure on Irish sourced services and expenditure on Irish sourced materials was calculated as between 2.67 and 3.98. This indicated that the value of employment in a new enterprise is significantly in excess of the simple cost per job of €28,120.

Stakeholder feedback

Having reviewed practice and previous work carried out in relation to sustainability monitoring, the project team proposed a set of indicators to gather data with a view to measuring impact. Stakeholder consultation meetings in the form of focus groups with presentations from the project management team were held. Representatives from reuse organisations provided initial feedback on the draft indicators and discussions were held in relation to

- Suggested indicators
- Relevance of indicators for specific organisations
- Interest in indicators in a National context
- Interest in the development of indicators from organisational context
- Review of the current level of data available
- Data collection methods
  - Operational data (e.g. weight in, units sold, value sold, electricity meter, vkm, transport fuel)
  - Surveys (Customer/Visitor)

Following the meetings, agreed indicators were circulated to the members of the Community Reuse Network, in the form of an interactive questionnaire. Members were asked to rank the availability, priority and usefulness of the proposed metrics according to their specific organisational objectives and capacity. A copy of the survey template is included in Appendix 3.

The responses from CRNI member organisations who participated in the survey and the results are summarised below. Site visits and telephone conversations were also held with participating members to discuss the survey, indicators & metrics proposed. Twenty-eight categories of specific indicators were presented and respondents were requested to comment on the relevance of each of the forty-one metrics to their organisation in terms of the availability of data and the priority or usefulness of each metric.

Respondents were asked to indicate the current availability of data indicating where relevant, which of the following applied:
- Those metrics currently monitored in the organisation (i.e. through annual reporting procedure or customer receipts)
- Data readily available but not yet monitored in the organisation
- Available data requiring further effort required to collate
- Those metrics which are not currently quantified or available.

Across 41 metrics proposed (ie Environmental, Economic & Social) a total of 49% were identified as being 'Currently Monitored' and a further 10% were identified as 'Readily Available but not yet monitored'. It was generally felt that the remaining metrics would take significant effort to record or could not be made available.

Respondents were also asked to indicate in terms of priority and usefulness whether each metric ranked High, Medium or Low. For the most part, respondents ranked the monitoring of proposed indicators as having a high priority for their organisation. Interestingly, other indicators such as the 'product lifetime of the new product' were either a Medium or Low priority for the organisations surveyed.

Figure 3: Availability of Data within reuse Organisations

- 45% — Currently Available
- 27% — Not Available
- 17% — Available but effort req'd
- 11% — Alailavle but not monitored
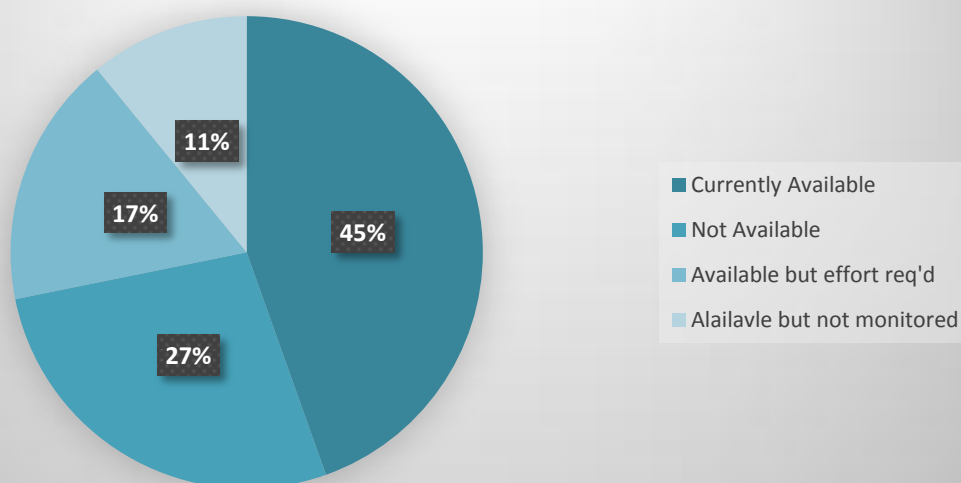
Figure 4: Assessment of percieved priority/usefulness of indicator monitoring

- 62% — High
- 23% — Med
- 15% — Low
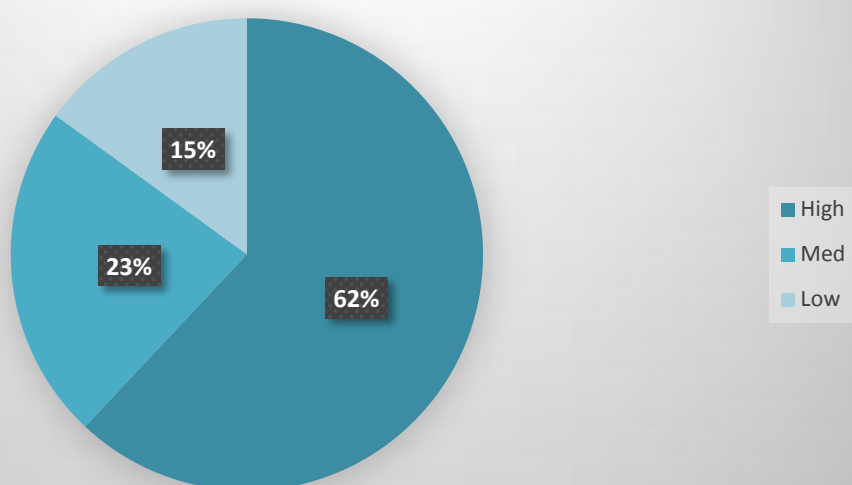
In response to the project survey, accurate data on weight of Materials/ Waste Received was provided by two organisations. In one case the organisation has access to a weighing bridge and therefore data is readily available. In another organisation, the weight of material handled was converted from the number of units collected by service vehicles. For the majority of organisation it was considered that accurate data on material weights could be provided, however one organisation believed it would not possible to quantify the weight materials received and that this is not a valuable indicator due to the large range of products prepared for reuse and the different weights attributed to each individual item.

Similarly, for many organisations, the number of items received is not reportable where large volumes are collected or dropped-off by donors. These organisations attribute benefit in order of weight rather than numbers of items processed. All respondents could provide data on the ratio of collected material to that which is dropped-off and to which stream the waste material was directed (direct reuse, recycling, disposal).

The value and % of products sold was reported in one organisation, whereas in other organisations a high percentage of input waste material is prepared for recycling and the benefit to the organisation is not reported in the survey. All respondents provided data on annual energy use and estimated water consumption and it would be expect that this information would be available from all organisations.. It is clear from the survey that data on staff employment and training activities is available in organisations and that information can be provided on the number of FTEs, Number of Volunteers and Number of CE/TUS places in each organisation.

Not all respondents to the survey were able to provide data on the number of people accessing services. Where this information was provided, respondents could draw information from sales records, attendees on courses or workshops & website traffic.

All respondents provided information on revenues through sales, operational costs and public funding levels where applicable. It was felt the data for these indicators could be provided by most organisations.

Rediscovery Centre Case study
An integral part of this study was to test and validate indicators within a reuse social enterprise setting. The Rediscovery Centre's operations involve bicycle, furniture, paint and textile reuse and provided an ideal case study for the project. Internal engagement in regard to the operational considerations and requirement for reporting by each individual business unit began six months in advance of the proposed study period. The external stakeholder engagement had identified certain key indicators of specific interest, but after a number of internal discussions it was decided not to refine the indicators list and instead report on all the original indicators chosen. The rationale behind this decision was to identify if any of the indicators which would have been discarded by the sector proved valuable in terms of measuring or communicating impact. In some cases the data was already being collected, or it was deemed that it could easily be collated from available company records. For the other indicators where data did not currently exist, it was considered worthwhile to try and collect the data to identify challenges and/or lessons learned whilst doing so.

There was early buy-in from the team with an understanding that the additional efforts required to gather all the indicator data would be potentially worthwhile to the organisation and that a 12 month data collection period would start in January 2015. The reporting procedures and spreadsheets were developed in late 2014 and this phase involved the bulk of the problem solving in relation to reporting challenges. There were numerous challenges which are briefly detailed per indicator in the Appendix 1.

One of the main challenges that needed to be overcome during the design and early implementation phases was making sure that the data collection and reporting processes interfered as little as possible with the daily routines and demands of each enterprise. Each Programme Manager has charge of a wide variety of tasks making their jobs particularly involved; adding an extra task proved to be stressful in some cases. Every

effort was made to ensure that recording and reporting processes were aligned with current business practices to increase uptake and be as minimally intrusive as possible.

Another challenge that needed to be overcome was how to collect and record the qualitative data such as customer and employee satisfaction and progression rates. The initial challenge here was translating this data into useable figures, however this was achieved through the use of Likert Scales and other similar methods which assign ratings and numbers to opinions.

Once the reporting procedures and spreadsheets were developed, other than some regular and random inspections to see that items were being accurately recorded, the reporting was carried out each month by PM's and where required assistance was available from interns and management. The monthly collating of data meant that any slippages or errors could be rectified early. The data parameters collected are also detailed in Appendix 1.

The scope of the project did not include a full life cycle analysis of reuse activities as the complexity and resources required to carry out such an analysis would be beyond the capacity of community reuse organisations and the scope of this project. The methodology applied was based on published data on embodied energy and carbon and from applicable life cycle assessments. Translation metrics are developed to allow activity data (eg kgs waste reused) to be used to develop sustainability indicators. A summary of the methodology for specific social enterprise activity follows.

Bikes

A life cycle assessment of two wheel vehicles, more specifically bikes and electric bikes, was carried out in 2010 (Leu 2010) for inclusion in the ecoinvent database. This was considered the most accurately available data. The assessment includes the production, use and end of life impacts. In order to quantify the production and end of life impacts, a typical 17 kg bike was characterised as summarised in Appendix 4. The composition of a typical average bike is 7.5 kg aluminium, 6.4 kg steel and 3.2 kg plastic and rubber.

Table 1 following shows the average embodied energy and carbon for a bicycle based on the composition breakdown and ICE database values for embodied energy and carbon for Aluminium, plastic and steel (Hammond & Jones 2008). This shows an embodied energy of 1,580 MJ and an embodied carbon of 81 kg CO_2 per bicycle based on the typical breakdown. It should be noted that this is an underestimate of the embodied impacts as it doesn't include the impacts associated with the manufacturing process or the bike and its components, just materials.

	Kg/bike	EE MJ/kg	EC $KgCO_2$/kg	EE per Bike	EC per Bike

Aluminium	7.5	155	8.24	1169	62
Steel	6.4	24.4	1.77	155	11
Plastic	3.2	80.5	2.53	258	8
Total				1581	81
Weighted Average				92.5	4.8

Table 1 – Embodied Energy (EE) and Embodied Carbon (EC) for a typical bike based on values from ICE database

The total embodied carbon in a bike, based on the embodied carbon of its component materials is 81 $kgCO_2$/bike or 4.76 $kgCO_2$/kg bike. It does not however include manufacturing impacts of bikes or the disposal impacts and therefore underestimates the benefit of reuse. A more comprehensive life cycle analysis of bicycle manufacturing and disposal is required to define a better metric. In the absence of such data the study provides a useful metric for the reuse of bikes.

Clothing

In a report edited by the European Commission, clothing is reported to account for between 2% and 10% of consumers' environmental impacts (Tukker et al 2006). Clothing and footwear comes after food and drink, transport, and housing that together are responsible for 70-80% of the environmental impact of consumption. The report analyses impacts under eight environmental impact categories: abiotic depletion, acidification, eco- toxicity, global warming, eutrophication, human toxicity, ozone depletion and petrochemical oxidation.

Given the impact of clothing, there have been many studies into the lifecycle impacts of clothing. A 2002 study carried out by ERM for Marks and Spencer (ERM 2002) found the lifecycle impact of a pair of trousers as 200 kWh and that of a three pack of men's cotton briefs at 105 kWh. However, this analysis included the energy use for washing and tumble drying in the analysis which accounted for 80% of the life cycle impacts. Product manufacture accounted for 13% of the impacts with disposal having a relatively negligible impact. The study also assessed the value of recycling (reuse) and found that the benefit of displacing new cotton clothing with second hand clothing is 65 kWh/kg and the saving for displaced new polyester clothing is 90 kWh/kg.

The broader impacts of the textile industry are reviewed and analysed in a review by the Institute for Manufacturing in Cambridge University (Allwood et al 2006) which assessed global trends in production and reuse. The study notes the movement of production to Asia and the development of a $1 billion/year industry in reuse of clothing primarily through the export of reuse clothing from developed to developing countries. The potentially negative economic effects of these trends in Asia and the developing world are noted, and while pertinent to the sustainability of clothing supply and reuse, are outside the scope of this report.

Life cycle analyses were carried out using the GaBi-EDIP software tool for three textile products: T-shirts, blouses and carpets. It reports a total primary energy consumption of 109 MJ/kg for T-shirts, 51 MJ/kg for blouses and 150 MJ/kg for carpets. There is a good deal of variation in the breakdown of the life cycle impacts for the different products. The greatest impact for T-shirts is in the use phase (over 60%) with 47 MJ/kg being accounted for in the material, production and transportation phases. This again includes washing and tumble drying. The use phase of the blouse is much less energy intensive consuming only 7MJ (14% of the total) compared to 65MJ for the T-shirt. This is primarily a result of the much less extensive maintenance, for instance only washing at 40°C without tumble drying or ironing. The high proportion of impacts in the use phase indicates the need to be mindful of boundaries and phases included in adapting data from published life cycle assessments.

WRAP carried out a study into the benefits of the reuse of clothes in 2011 (WRAP 2011a). The study found that the benefits of direct reuse of T-shirts in 13 tCO_2/tonne and 11 tCO_2/tonne for preparation for reuse or 2.5 $kgCO_2$ per T-shirt. (This indicates a standard weight of a T-shirt of 0.23 kg/T-shirt). The business as usual mass flows and routes for the disposal/reuse of end of life T-shirts is defined together with the associated life-cycle impacts. The business as usual impact for the current management routes is -7.24 tCO_2/tonne T-Shirts. The impact is negative due to the current rates of reuse with 21% direct reuse and 40% preparation for reuse. The business as usual impact for jumpers is -5.2 tCO_2/tonne jumpers (same reuse rates as T-shirts). The GHG gas emissions from final disposal to landfill are 203 $kgCO_2$/tonne cotton indicating that the main benefit of reuse of clothing is the displacement of new products rather than the avoided impacts of disposal to landfill. The GHG emissions from incineration are -344 $kgCO_2$/tonne cotton.

Figure 5 summarises the results of the above life cycle analyses for clothing. Caution is advised in comparing the figures from the Institute For Manufacturing (IFM) Cambridge data and the ERM/Marks & Spencer data as this is presented in MJ primary energy per kg clothing and has been converted to $kgCO_2$/kg using a generic carbon factor of 0.053 $kgCO_2$/MJ primary energy. This is obviously sensitive to the fuel and electricity mix used in the given processes and also on the source and renewable component of the electricity. However the factor used is considered generally representative of primary energy supply in Ireland. It is notable that the WPAP and ERM data for the benefits of reuse are similar albeit the ERM figures being a little higher. It is somewhat surprising that the benefit of reuse in these studies is significantly greater than the impact of production in the Cambridge Institute For Manufacturing study. This points to the difficulty in adapting and comparing different life cycle analyses as the reporting is not detailed enough to allow assumptions and boundaries to be assessed and compared. Given that the WRAP studies are the most recent and are particular to clothing reuse the average of the benefits for preparation for reuse for cotton T-shirts and woollen jumpers, 9.5 $kgCO_2$/kg, is adopted as a metric for general clothing for this study.
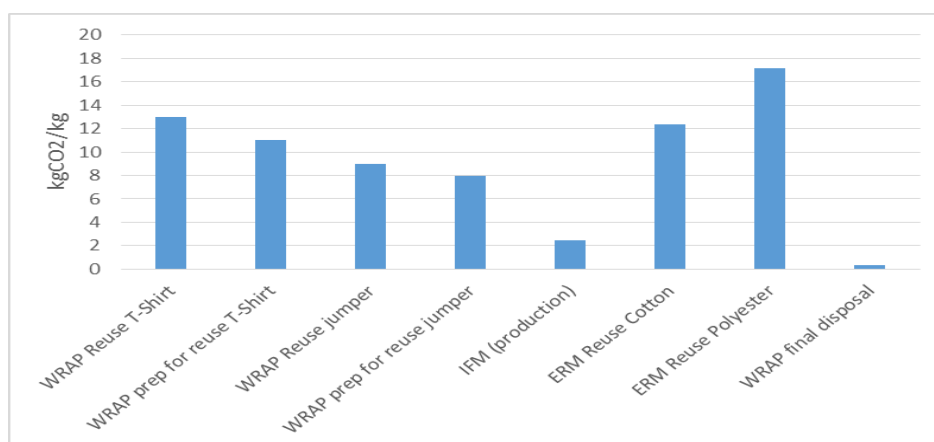
Figure 5 – Life cycle analyses for clothing

Furniture

The Furniture Industry Research Association (FIRA 2011) carried out a study assessing the feasibility of producing product footprint benchmarks for the furniture industry using a consistent methodology assessing the impact of materials and processes from the extraction of raw materials to the manufacturer's factory gate (a 'cradle to gate' assessment). The methodology was designed to be less onerous than an assessment to PAS 2050 while still providing an objective product certification scheme generally consistent with relevant standards. The report assesses the carbon footprint of a range of furniture types including kitchen furniture, mattresses, sofas, armchairs, office furniture and dining tables amongst other furniture items. Manufacturers provided FIRA with details on materials and energy use which were then translated into

carbon footprint data. The study showed a wide range of footprint data depending on the materials used in production, with the footprint of a dining table varying between 17.5 kg CO_2eq and 33 kg CO_2eq. Based on a 29 kg average weight for a dining table this ranges between 600 and 1140 kg CO_2eq per tonne.

WRAP carried out case study assessments (WRAP 2011b) into the benefits of reuse for domestic furniture. The study focussed on sofas and dining tables and applied the WRAP methodology to these particular waste streams. The study defines the business as usual scenario for disposal and re-use routes covering the full life cycle of the item of furniture. The study reports a net savings of CO_2 per tonne furniture for each waste stream which are summarised in Table 2 following.

	Reuse	Preparation for reuse
Saving per tonne sofa (tCO_2 eq/tonne)	1.45	1.05
Saving per tonne dining table (tCO_2 eq/tonne)	0.62	0.24

Table 2– Carbon savings through reuse of furniture (WRAP 2011b)

There is a relatively low displacement benefit associated with the avoided production of new tables which largely accounts for the difference in the life cycle savings for tables compared to those for sofas. This reflects the higher materials/production intensity of a sofa, in comparison with a table for which the primary impacts are those of the raw material. The ICE database provides an embodied energy and embedded carbon of 8.5 MJ/kg and 0.46 tCO_2 respectively for timber products. This is lower than the saving through reuse of dining tables in WRAP's study and higher than the saving through preparation for reuse. These compare with FIRA's estimate of between 0.6 and 1.1 tCO_2 for the embodied carbon in new tables.
Figure 6 summarises the carbon impacts of sofas and tables from FIRA's research, WRAP and from the ICE database for timber. The FIRA data is a cradle to gate assessment of the embodied impacts in new furniture. The WRAP values are the outcome of a full life cycle assessment of the benefits of reuse of the furniture items compared with the impact of non-displaced new furniture and the impact of the disposal of the reused furniture. The ICE data represents the cradle-to-gate embodied impacts of timber as a product for the construction industry as a proxy for the embodied carbon of raw material for tables.

Interestingly, the benefits of reuse (WRAP) are somewhat lower than the embodied carbon of new tables (FIRA) and similar to the embodied carbon of timber (ICE). The WRAP assessment includes a displacement rate for new furniture of 50% and a shortened lifetime of a reused table compared to a new one which are the main factors reducing the life cycle benefits. WRAP estimates the impacts of final disposal of dining tables at 1 tonne CO_2 eq per tonne dining tables.

The Rediscovery Centre reports that the overwhelming majority of furniture prepared for reuse consists of tables, chairs and other wooden furniture. The WRAP data for environmental benefits of reuse for tables are therefore adopted for this case study.
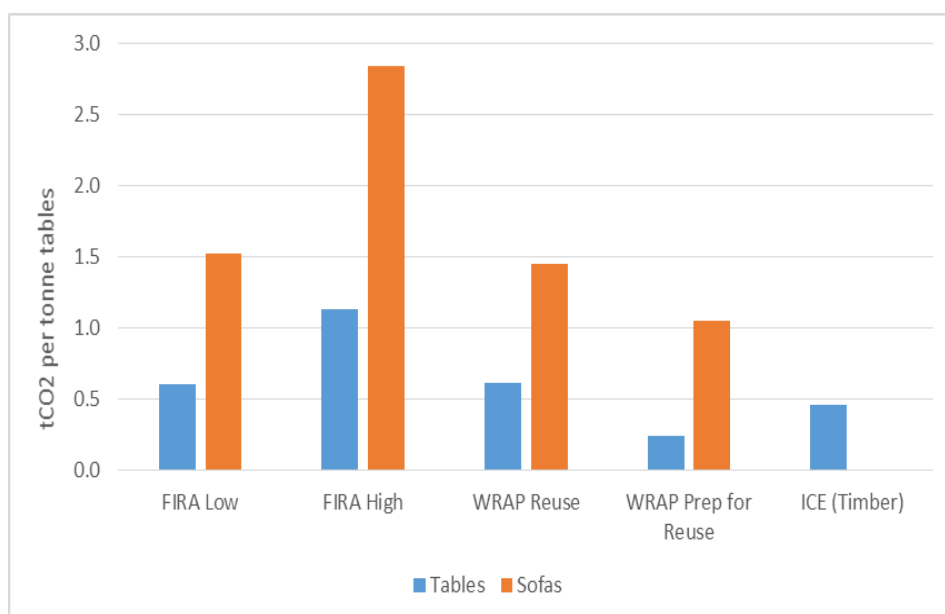
Figure 6 – Embodied carbon and life cycle carbon for tables and sofas

Paint

The ICE database cites an embodied energy of 68 MJ/kg and an embodied carbon of 3.56 kgCO$_2$/kg but notes a very wide variation in data especially for carbon emissions. D8Carbon carried out a lifecycle assessment of paint production and supply by Jotun Paints using Life Cycle Analysis software SimaPro (D8Carbon 2008). Material, fuel and energy processes use the EcoInvent database (v2.0, 2008), containing 4,000 unit and system processes. The results varied from 2.33 kgCO$_2$/kg to 7.87 kgCO$_2$/kg for different paint types and averaged 5.4 kgCO$_2$/kg. The reason for the wide variation was due to water based and organic solvent based paints having very different embodied impacts. The embodied carbon for organic solvent paints was 7.38 kgCO$_2$/kg while that for water based paints was 2.5 kgCO$_2$/kg. The main variation was in the raw materials for each type rather than in production or end of life disposal. The breakdown of lifecycle impacts for the highest embodied carbon solvent based paint and the lowest embodied carbon water based paint is shown in Figure 7 following.
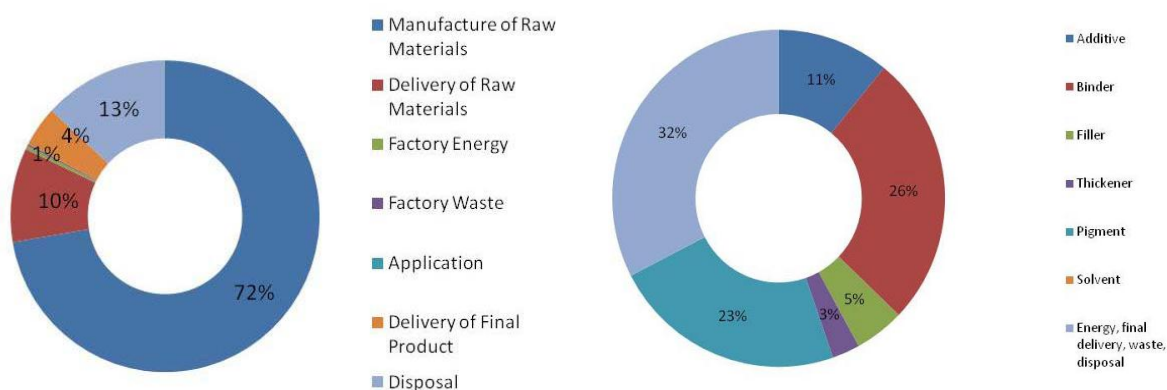
Figure 7 – Breakdown in lifecycle impacts of paints (D8Carbon 2008)

Within the EU, solvent-containing wastes associated with the manufacture, formulation, supply and use of coatings (paints, varnishes and vitreous enamels) are considered hazardous wastes and have associated hazardous waste classifications. These wastes must be appropriately disposed of under hazardous waste regulations.

As a background to the development of an ecolabel scheme for paint, the EU JRC carried out a study into the environmental impacts of paint (Jiannis 2012). The study notes the broader environmental and human health impacts of materials used in paint beyond embodied carbon particularly through the use and disposal of hazardous materials and wastes. A life cycle analysis for two paint types – vinyl emulsion and alkyd emulsion - was carried out showing an embodied carbon of 2.43 $kgCO_2$/kg and 2.31 $kgCO_2$/kg respectively. The LCA includes the impacts associated with the disposal of paint with an assumed disposal rate of 10%. The carbon footprint of the disposal of 750 g of paint was 2.5 $kgCO_2$ or 3.33 $kgCO_2$/kg paint. This is higher than the full life cycle impact of paint seeming to indicate that the impact of disposal is greater than the impact of production.

In 2011, WRAP published a study into the potential environmental benefits of reducing paint waste through bulk delivery. The study cites the D8Carbon study as well as a Crown paints quantification of the embodied carbon in their paint of 2.72 $kgCO_2$/litre paint and the greatest environmental impacts are cited as being associated with waste paint rather than waste packaging.

Figure 8 summarises the embodied carbon data for paint discussed above. The D8Carbon study is the only one to categorise solvent based paints and water based paints separately and shows a significant difference between the two. The other data are relatively similar ranging from 2.31 $kgCO_2$/kg in the JRC study to 2.716 $kgCO_2$/l in the WRAP study. The average of the D8Carbon data for water based paints and JRC data for water based paints is 2.41 $kgCO_2$/kg paint and this is adopted as the life cycle impact of paint for the purposes of this study and the development of reuse metrics.
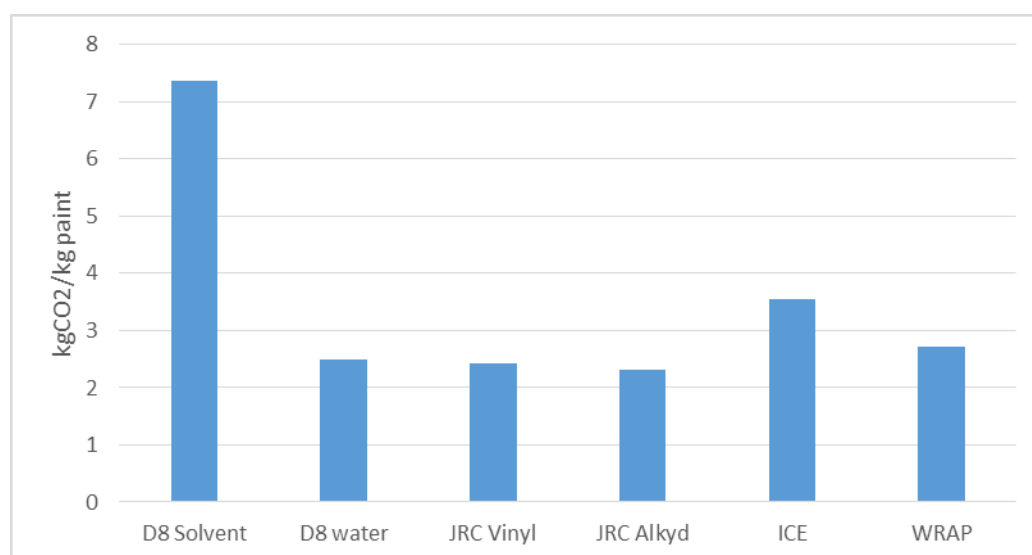
Figure 8 – Embodied carbon data for paint

Social Benefits
The simplest and most basic proxy for evaluating the value of a job created is the avoided social welfare payment for unemployed persons. Taking as the basic rate the jobseekers allowance rate of €188 per week the value of a job created, or of providing training leading to long term employment is €9,776 per annum.

The societal value of employment however goes further than avoided unemployment benefits and includes tax contributions from employed persons and the contribution to overall economic development. As noted previously, Enterprise Ireland's High Potential Start Up (HPSU) schemes have a simple cost per job created of €28,120. The cost benefit ratio of the programme, including salary levels, expenditure on Irish sourced services and expenditure on Irish sourced materials was calculated as between 2.67 and 3.98. This indicates that the value of employment is in the order of €75,000 to €110,000. This may not be comparable to the value of a job created in the reuse sector depending on salary levels and degree of purchase of Irish sourced services and goods. As a conservative estimate of the value of employment creation through the community reuse sector, the cost to Enterprise Ireland per job created of €28,120 is taken as a proxy for the value of employment creation.

In quarter 4 2011, crafts persons accounted for the greatest share of total unemployment (22%) (DSP 2012) and c. 80% of unemployed people with only second level education. This clearly points to a value of education and training in terms of increasing employment opportunities. The value of training in this regard is somewhat difficult to evaluate, but taking the approach of defining proxies as per the SROI methodology, (SROI 2012) an appropriate proxy for the value of training would be the market value of training provision.

An analysis of the cost of attending skills development courses run by private sector organisations can typically be in the region of €2,000. These courses offer direct technical training only and do not include persona development activity present in most social enterprise programmes where trainees are provide with additional life skills such as IT, literacy, communications etc.,

The Housing Associations' Charitable Trust[2] (HACT) is a social enterprise-based ideas and innovation agency for the UK Housing sector. In September 2014 HACT launched the *Social Value Bank* - the largest set of methodologically consistent social value metrics ever produced. The Social Value Bank provides 'on-the-ground access to the Wellbeing Valuation approach. This approach is increasingly used by UK Government departments and is included in Green Book guidance and recommendations of the Organisation for Economic Co-operation and Development (OECD[3]).

The Social Value Bank covers a broad range of community interventions, focusing (at present) on those areas of activity particularly of interest to UK housing providers: employment, local environment, health, financial inclusion and youth. The Social Value Bank contains 53 outcomes differentiated by age and geography to produce 636 values. Table 3 following summarises the value ascribed to employment and training

Outcome	Value (UK £)	Value (€)
Full-time employment (EI)		€28,120
Full-time employment (HACT)	£10,767	€13,889
Part-time employment	£1,229	€1,585
Vocational training	£1,124	€1,450
Regular volunteering	£2,357	€3,040

Table 3 – Value of employment (HACT & EI)

The value of full time employment in the HACCT social value bank is lower than that based on Enterprise Ireland's assessment. The EI value for full time employment is adopted for this study while the HACT proxies are adopted for other categories of outcome.

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[2] http://www.hact.org.uk/social-value-bank
[3] http://www.oecd.org/

CASE STUDY RESULTS

Materials reuse

The Rediscovery Centre implemented procedures for data collection throughout 2014 to allow a full year's activity data to be collected during 2015. Data was recorded on a monthly basis during 2015 and Figure 4 summarises the monthly rates of diversion through sales and services by product category. Table 4 shows the annual figures for waste input, diversion and disposal by category.

There is a discrepancy of 6.7 Tonnes between the material received, the material recirculated through sales or services and the waste disposed or landfilled. This is due to a data lag where materials were received and resale remain in stock or where older stock is prepared and reused. Indeed a fraction of January weights recorded as diverted via sales or services could be attributed to materials received in 2014. The total weight of paint input is high and this is due to increased membership of paint donating bodies.

The total weight of furniture items processed over the period can be considered lower than normal, however, the centre stopped accepting donations in early 2015 due to stock issues.

	KG - Material Input (ENV17-ENV19)	KG- Material diverted through Sales and Services (ENV15-ENV16)	KG- Waste Output (ENV11-ENV14)
Rediscover Fashion	600	515	342
Rediscover Furniture	173	2,249	147
Rediscover Paint	10,096	5,716	2,808
Rediscover Bicycles	3,845	4,206	5,092
Rediscover Education	N/A	148	125
Rediscover Business	N/A	N/A	104
Total	**14,715**	**12,834**	**8,617**

Table 4 – Waste Flows in the Rediscovery Centre for 2015

A total of 12.8 tonnes was recirculated back into the economy via RDC sales or services. A total of 8.6 tonnes of waste material representing the majority of waste material from the RDC was disposed via Rediscover Paint and Rediscover Bicycles as metal waste to Hammond Lane and as paint products to Dublin City Council. A further 488Kg of general waste, 281 KG dry recycled material & 79KG of compostable waste was generated from the RDC's business activities and staff activity.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rediscover Paint	0	277	469	455	434	277	738	749	465	756	647	449
Rediscover Bicycles	450	486	435	480	435	345	765	195	180	90	135	210
Rediscover Furniture	88	160	69	242	102	157	155	105	189	257	356	369
Rediscover Fashion	23	45	43	52	44	40	14	5	11	11	13	97
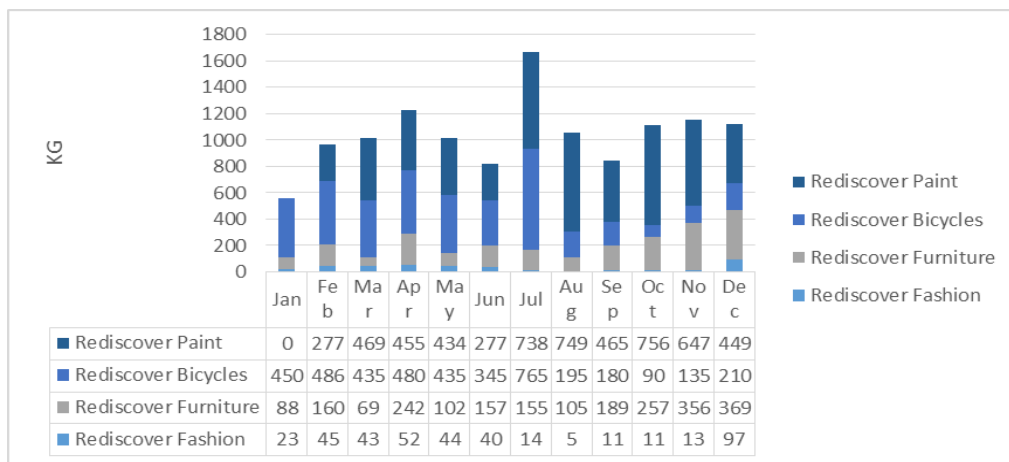
Figure 9 – Monthly breakdown of Re-use Activity

Environmental Sustainability Indicators

The initial evaluation of the RDC's environmental impact has been calculated by data points recorded over the monitoring period for sustainability indicators ENV15 - Tonnage diverted from disposal through sales and ENV116 - Tonnage diverted from disposal through services.

To quantify the environmental impact of the RDC in terms of Greenhouse Gas Emissions reported as CO_2 -eq savings, the following conversion factors were applied to the respective weights of material recorded over the monitoring period. The conversion factors are as detailed in Section 7 and are summarised in Table 5 following.

Product	Prep for reuse benefit - Tonne CO_2 eq/Tonne
Clothing	9.5
Office Desk	0.24
Paint	2.41
Bike	4.76

Table 5 - Conversion Rate - Preparation for Reuse - Tonne CO_2 eq/Tonne

Table 6 and Figure 10 following summarise the quantities of products reused through the RDC activities and the associated life cycle CO_2 savings. The total CO_2 savings through preparation for reuse activities in the Rediscovery Centre in 2015 was 39.2 tonnes for a total 12.7 tonnes of reused products.

RDC Activity	Reuse through Sales and Services (ENV15-ENV16)	Tonne CO_2 eq -Services (ENV15-ENV19)
Rediscover Fashion	515	4.9
Rediscover Furniture	2,249	0.5
Rediscover Paint	5,716	13.8
Rediscover Bicycles	4,206	20
Rediscover Education	148	~
Total	12,686	39.2

Table 6 –Metric Conversion to CO_2 -eq Avoided

	Rediscover Fashion	Rediscover Furniture	Rediscover Paint	Rediscover Bicycles
Tonne CO2eq - Diverted through Sales and Services (ENV15-ENV19)	4.9	0.5	13.8	20.0

■ Tonne CO2eq - Diverted through Sales and Services (ENV15-ENV19)
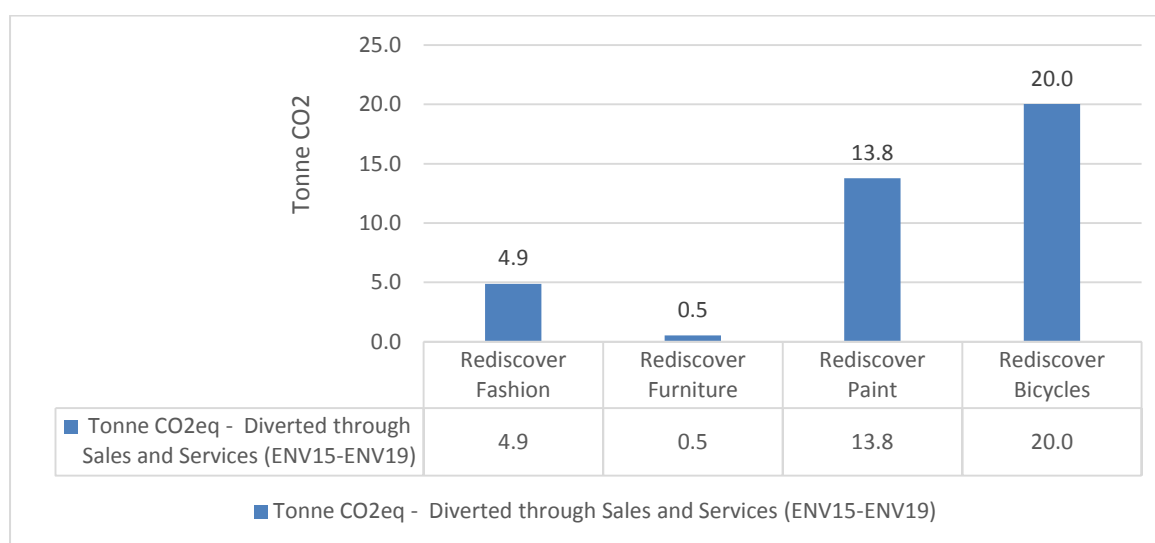
Figure 10 – Breakdown of CO_2 reduction through Reuse at the RDC

Social and Economic Indicators

The total revenue generated through sales of products at the RDC was €27,851 and the total revenue generated through services was €75,884. Figure 11 shows the breakdown per RDC activity in terms of total revenues including sales and services.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rediscover Education	1960	1925	1620	3475	930	720	1450	2950	1095	1550	3900	0
Rediscover Paint	240	975	150	150	165	1070	360	986	225	737	150	2575
Rediscover Bicycles	1170	1036	1352	670	2843	4475	3838	776	1014	2891	1092	3687
Rediscover Furniture	2232	1101	675	1495	833	1287	1433	535	1356	1155	2947	1685
Rediscover Fashion	874	4972	1939	2021	2610	1287	2813	2564	2667	3991	3256	3808

Figure 11 - Revenue Generated Through Sales and Services (€)

The numbers of customer interactions at the RDC is shown in Figure 12. A total of 3,121 interactions were recorded at the RDC over the period. These include actual customers and visitors to the centre.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total	284	284	317	344	289	262	204	160	187	318	278	194
Rediscover Bicycles	110	85	102	93	87	84	111	87	111	45	25	30
Rediscover Paint	29	36	33	33	25	76	45	33	29	44	45	0
Rediscover Furniture	52	48	52	50	25	51	48	40	47	69	52	11
Rediscover Fashion	93	115	130	168	152	51	0	0	0	160	156	153

Figure 12 - Number of Customers/Clients/Visitors

It is difficult to arrive at a full picture of the effectiveness of reuse organisations especially with respect to the socio-economic value added. Social benefits can be hard to link directly and solely to reuse schemes' activities. However, with this in mind, two methods for attributing social value to activities at the RDC have

been considered - Social Return on Investment (SROI) and The 'Social Value Bank' as discussed in Section 7. Work relating to the development of factors to translate this data to the Irish context is ongoing as well as the exploration of other European social value models.

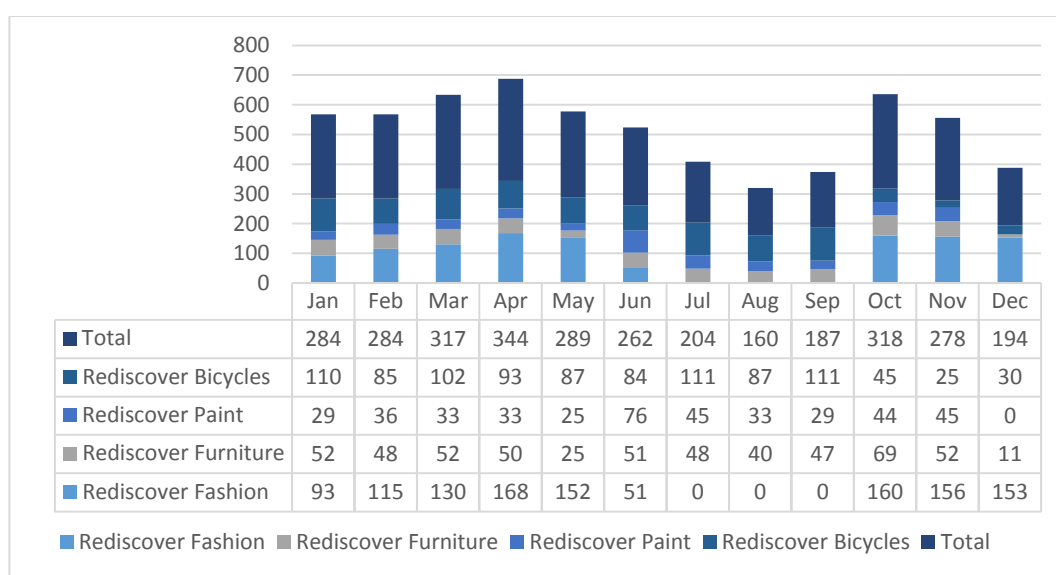Table 7 below shows recorded social indicator data recorded at the RDC during 2015 and Table 814translates these outcomes into a monetary value based on the proxies established in Section 7. While this value will provide a good proxy for the social impact of training places, average values are based on UK databases. To consider the values relevant in an Irish context the recommendations of the Organisation for Economic Co-operation and Development (OECD[4]) on which the calculator is based could be transposed for Ireland.

REF	Indicator	Value	FTE/PTE/Vocational Training
SCO20	Number of enterprise employment/training places	13	13 PTE
SCO21	Number of people/schools provided with free training	20	20 Vocational Training
SCO22	Numbers of people engaged in company activities	35	10 FTE, 25 PTE
SCO32	Number of participants for internal courses delivered	92	92 Vocational Training

Table 7 - Social Indicator Data

	Value per Outcome	Number	RDC Social Value
Full-time employment	€28,120	10	€281,200
Part-time employment	€1,585	38	€60,230
Vocational training	€1,450	112	€162,400
Total			**€503,830**

Table 8 - Social Indicator Monetary Value

This shows that the social and economic impact of the Rediscovery Centre's activities through providing employment, training and education is very significant, amounting to €503,830 per annum. Although further analysis on the year impacts is required to ensure that values are accurately reported, this shows a very positive social and economic benefit.

This analysis does not include the positive effect through general awareness raising and behavioural influence on customers and other parties interacting with the Rediscovery Centre. A customer survey carried out by the RDC (see Appendix 2) showed a very strong displacement rate of new products at 80% for customers purchasing products from the RDC as well as very positive impacts on environmental consciousness.

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[4] http://www.oecd.org/

A number of methodologies for carrying out full life cycle assessments were reviewed. Such an assessment required detailed activity data (such as rates of displacement and details on material composition of products) which is neither available nor realistic for a community reuse organisation to collect. It was therefore concluded that a full life cycle assessment was not appropriate for the sector, indeed this was never the intention of the project. Studies detailing the life cycle impacts of the targeted projects were reviewed to determine appropriate conversion factors for environmental benefits. The outcome of different studies is sensitive to assumptions on boundaries, factors such as displacement rates and final disposal routes and product composition. Notwithstanding this, consistent and robust conversion factors were established for tonnes of CO_2 avoided through reuse.

The stakeholder consultation phase of the project was characterised by high levels of interest in the development of sustainability indicators or the sector with good levels of participation and engagement from the community reuse sector. The importance of indicators for reporting the impacts and benefits of the sector and organisations within the sector was highlighted by all organisations. A set of indicators was agreed and tested over a 12 month period within the four social enterprises of the Rediscovery Centre. The results were collated in a data set. A survey of community reuse organisations again showed a high level of interest in the development of indicators for measuring sustainability and a reasonable level of confidence that raw activity data to support the development of the indicators is available or could be collected.

Due to low levels of feedback on the detailed data survey it was not possible to confirm a definitive framework of sustainability indicators for the entire sector, although the proposed set of indicators agreed through consultation provide a good starting point for data collection. In retrospect, it is probable that the data questionnaire was excessively complex considering the scale of most community reuses organisations and that this complexity was a barrier to reporting data. The success of the pilot with the Rediscovery Centre however proves that data collection was possible at an operational level and relatively issue free.

The Rediscovery Centre case study examined the practicalities of collecting data for the sustainability indicators. Where possible monitoring was amalgamated with established operational practice. This resulted in revised operational procedures being developed to allow for the added work. The project also resulted in a new receipt book for donations being established to collect data relating to materials donated to the project. This had previously not been accurately measured.

Social and economic impacts were evaluated through direct metrics such as employment and training rates, revenues and costs and also through ascribing a monetary value to social and environmental benefits. The principal method for monetising benefits was to develop appropriate proxies primarily based on the UK Social Return on Investment (SROI) and Social Value Bank models.

The outcome is that the Rediscovery Centre's product reuse activities directly lead to savings of 39.2

TCO$_2$ –eq per annum and social and economic benefits of €503,830 per annum as shown in Figure 13.
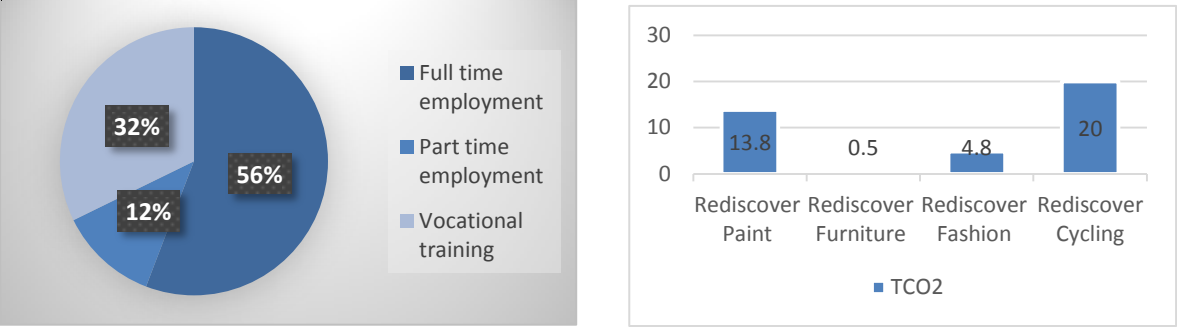

Figure 13 – Breakdown of key environmental and social & economic indicators
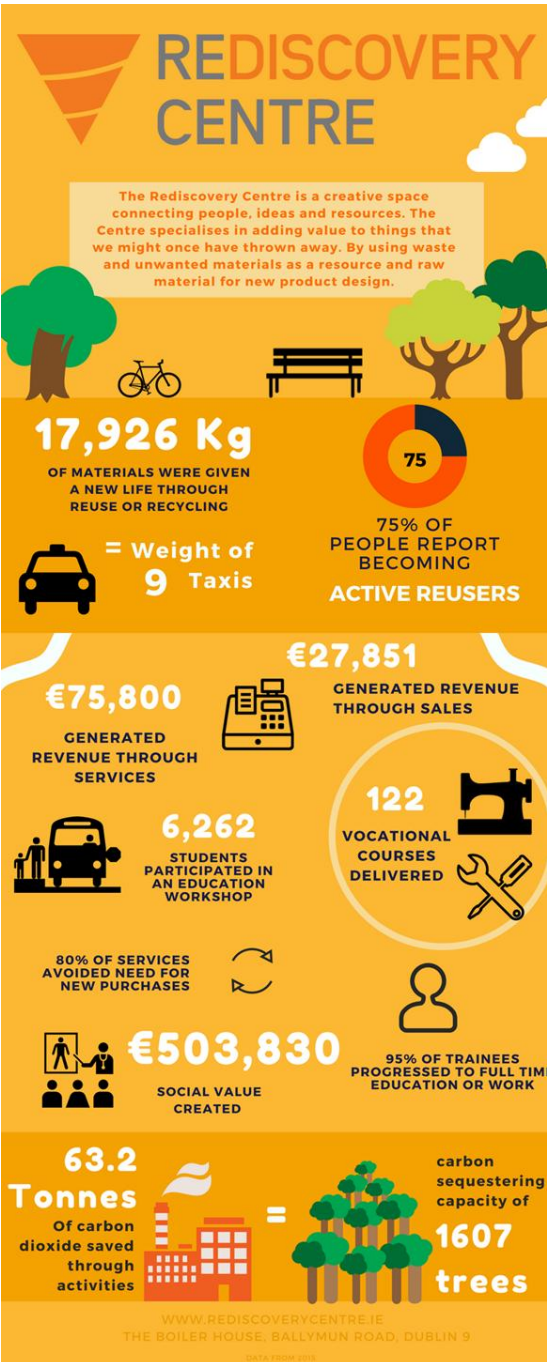

Figure 14. Infographic developed highlighting key sustainability impact for the Rediscovery Centre

CONCLUSIONS & RECOMMENDATIONS

One of the challenges of measuring sustainability impact is identifying indicators that can be easily monitored and will, in due course, provide data relevant to communication goals. With such a wide variety of choice and no uniform framework or metrics in place, it is difficult to measure sustainability uniformly or to compare organisational performance accurately.

This project identified a set of indicators suitable for use within the reuse sector. It recommended a database framework for data collection however in the absence of a legal obligation and given the complexity of the data requirements, it is anticipated the uptake in practice will be low. This was evidenced by the low levels of response in relation to the data collection framework as compared to the initial indicators questionnaire with the same focus group.

The framework developed was applied to the Rediscovery Centre's operations during the twelve months of 2015 and a set of metrics gathered. The data was used to communicate progress in relation to social, economic and environmental impact through the production of an infographic shown above in Figure 14 . The pilot study showed that it is highly doable for businesses to implement a sustainability framework which results in the provision of accurate data however it is envisaged that capacity building will be an important step in the implementation of business sustainability.

In addition to capacity building the project highlights that it is unlikely organisations will voluntarily develop a sustainability framework given that only 2 out of the 14 organisations approached were able to complete the dataset for their organisation unaided. In conclusion it is felt that for collective reuse impact monitoring to be successful and the data collection framework adopted, the data collection would need to be simplified and incentives such as those established for recycling, or legal obligations will most likely be necessary.

In conclusion, the following table, table 15 is proposed as a suitable tool for gathering key data on reuse as a initial starting point. The indicators are selected having regard to

1) their potential to communicate sustainability impact,
2) their anticipated ease of collection based on the Rediscovery Centre pilot and
3) the assumed capacity of the reuse sector based on the study.

Indicator	Value	Breakdown, method used & assumptions made
Total quantity of materials collected	*Kg*	*Kg per category (ie furniture, bric a brac, clothing)*
Quantity and type of materials reused	*Kg*	*Kg per category (ie furniture, bric a brac, clothing)*
Quantity and type of material recycled	*Kg*	*Kg per category (ie furniture, bric a brac, clothing)*

Number of FT & PT employees	*No FT* *No PT*	*Male/Female*
Number of FT & PT enterprise employment, training places (indicate TUS, CE, CSP and hours of work)	*No FT* *No PT*	*Breakdown = no. of TUS, No of CE, No of volunteers, No of Other*
No of internal vocational training courses delivered to trainees	*No of*	*Course type and duration and no of participants*
No and type of external training or education courses delivered	*No of*	*Course type and duration and no of participants*
Value of products sold/exchanged	*€*	*Sales and services revenue*
No and type of items sold or exchanged	*No of*	*Breakdown ie. Furniture (tables, chairs etc.,)*
No of customers purchasing or exchanging items	*No of*	*Number of customer*

Figure 15. Indicators recommended for use to collect key sustainability data from reuse sector

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Appendix 1 – Data Collection and Indicators from the Rediscovery Centre

	Indicators	Internal reporting & engagement research notes
Environmental Indicators	
env 1	Contribution to climate change - Carbon equivalent avoided	Calculated through review of all reported indicators
env 2	Energy (MWh) avoided	Simple enough calculation once energy bills and related information was on hand when required. This was not always the case and in one case energy bills were being sent to the wrong address, and this had to be sorted with the old bills being requested for our records.
env 3	Net energy consumed / generated	N/A to us at present
env 4	Van fuel spend (€)	The change over from a basic petty cash system to a company van fuel card account has made significant improvements in reporting company van fuel spend and litres consumed, as we get monthly detailed statements. There are potentially additional features provided through this fuel card account which we could utilise further if additional reporting was required in the future.
env 5	Van fuel used (Litres)	As above.
env 6	Van mileage (miles)	Van mileage was recorded at the beginning of each month. The challenge here was to remember to do it on the first working day of each month. The online work calendar was very helpful in this regard. It was decided to record van mileage in miles as the van milometers was in miles anyway. This reporting could change to Km's and certainly should be done if a new van was purchased.
env 7	Mileage expenses claimed (Km's)	Staff mileage expenses was taken from staff expenses claims and were done in KM's as this is how it was reported within the expenses sheets.
env 8	% of eco produce / consumption	A new green procurement reporting metrics and assessment spreadsheet was developed for this indicator. See methodology on green procurement
env 9	% of local / fair trade consumables/products	As above.
env 10	Litres of water used & saved through processing improvements	As there was no mechanical means in place to measure water usage, we had to calculate this more on time spent using water and the processes and/or machines involved.
env 11	Total general waste in KG's	Getting buy in with respect to this task was a challenge. Bins had never been weighed before and this was seen as additional work for staff as they had to try and encourage team members to engage with the process. Incentives are being explored to see if it can be encouraged.
env 12	Total dry recycling in KG's	As above.
env 13	Total compostable waste in KG's	As above.
env 14	Total non-general waste from reuse activities in KG's (e.g. empty paint tins to recycle centres, WEEE, Charity shops, clothes banks, etc.)	Generally this is a very low percentage of material throughput - eg small amounts of rubber or metal which is weighed and reported as part of its treatment, therefore comprehensive records already existed. The difference now was that they were collated in once spreadsheet, so trends and patterns could possibly be accessed.
env 15	Tonnage diverted from disposal through sales (indicate whether litres or kg)	Key area in our business model and relies on existing research on average weights etc. It is also time consuming, as each items sold has to clearly detailed in the cash receipt book on top of the normal items expected in a receipt (eg number of products, type of product, possible brief description, etc) and then

		accessed and a weight allocating weight per item.
env 16	Tonnage diverted from disposal through services (indicate whether litres or kg)	This was not always reported previously and has to be calculated through analysis of receipt books – the value of this data is queried by the team – as not all materials would be thrown out of not repaired
env 17	Tonnage figures from donations (Kg's) [collated from receipt books]	Again a key area, and again relies on existing research on average weights etc. It is also time consuming, as each items donated has to clearly detailed in the cash receipt book or donation receipt book (eg number of products, type of product, possible brief description, etc) and then accessed and a weight allocating weight per item.
env 18	Tonnage figures from one-off collections (Kg's) [collated from receipt books]	New receipts books have been designed to ensure all material donations are captured. These will be used in Q 3 –Q4 2015
env 19	Tonnage figures from collections from civic amenity sites and other partnership agreements (Kg's) [collated from receipt books]	As above. However in some cases weigh bridges exist whereby our vehicle can be weighed to calculate the collected material tonnage figure. These figures are printed out and made available to the company.
Social Indicators		
soc 20	Number of enterprise employment/training places	These are relatively small numbers and easy to collate via analysis of induction forms etc.,
soc 21	Number of people/schools provided with free training	As per our service level agreement with DCC, we are required to give a certain amount of free workshops and training to the community.
soc 22	Numbers of people engaged in company activities	Difficult to assess what engaged is
soc 23	Number of paid employees	Simple accounting of paid employees within the company, not accounting for any external consultants on projects
soc 24	Number of enterprise employment/training placements	As above
soc 25	Number of other placement positions	As above
soc 26	Employee benefit and feedback survey	A survey is currently being designed for roll out in Q3 Q4
soc 27	Numbers of local people accessing services	This consisted of the service of products to locals and the numbers were gathered through established relationships with some frequent customers, van receipts (if the product was picked up or dropped off at a customer's house) and through the customer survey that was developed
soc 28	Numbers of local people attending courses	The data for this indicator consisted of the number of people at courses in the local community.
soc 29	Information/Festival Event days - Number of people in attendance	Because of the large number of people in attendance at these events, it makes it difficult to get completely accurate data so it is often estimated
soc 30	Success in attaining a social standards award	None achieved at RDC
soc 31	Number of internal courses delivered	Simple recording of how many courses at each workshop is delivered
soc 32	Number of participants for internal courses delivered	At each course delivered in the workshops, the number of participants is recorded by the leader of the course and then the total number of participants is collected at the end of each month
soc 33	Number of external courses delivered	Simple recording of how many courses are delivered outside of the workshops
soc 34	Number of participants for external courses delivered	At each course delivered outside the workshops, the number of participants is recorded by the leader of the course and then the total number of participants is collected at the end of each month
soc 35	Numbers of research projects participated in	Relatively easy to calculate within small organisations
soc 36	Positive behavioural	This was attained through questions on the customer

	change - Numbers of people reporting changed habits	survey. As with other data collected from the customer survey, the uptake by programme managers has been difficult.
<td colspan="3" align="center">**Economic Indicators**</td>
ecn 37	Number of jobs created	This accounts only for paid jobs created within the company during any given month.
ecn 38	Numbers of Full time employee equivalents	As above
ecn 39	% amount of overheads covered by grant funding	Easily calculated from annual accounts
ecn 40	Increase turnover	Easily calculated from monthly finance reports
ecn 41	Increase in surplus	As above annual accounts
ecn 42	Increase in profit	This was a simple percentage change calculation from month to month to get the change (whether increase or in some cases decrease) in profits for each enterprise. It was noticed that this was quite volatile because of the nature of the work and how seasonal it can be.
ecn 43	Numbers of business units/activities	The number of enterprises, currently consisting of: Company, Fashion, Furniture, Paint, Bikes, and Education
ecn 44	Numbers of services offered	This is the number of main services each enterprise does.
ecn 45	Increased website activity	Using google analytics this is data is collected and analysed
ecn 46	Increased social media interactions (FB, friends, LI/twitter followers)	As above
ecn 47	Increased standard in job applicants	This proved difficult as RDC does not recruit CE participants. Trainees access services via third party but receive trainees
ecn 48	Success in attaining grant funding for particular project	
ecn 49	Monetary donations and awards	
ecn 50	Number of Facebook posts	Each enterprise is required to have several posts per month onto the company Facebook page to update the public on events and products. To limit the extra work this can create, a designated person has been set to help with posting to social media outlets
ecn 51	Number of blogs	Each enterprise is required to post frequently to the company blog on the website. One challenge with this is that it is time consuming and often was left to a designated person responsible for social media to do rather than each programme manager. Another key challenge needed to be addressed is that neither the website nor the blogs had a timestamp making it difficult to go back and review when each post was made.
ecn 52	Number of other media citations	A search was conducted for times when RDC had been mentioned in all platforms of media. The effectiveness of this process cannot be relied on completely as citations are often missed,
ecn 53	Number of customers/clients/visitors (total)	Each day, programme managers tallied footfall for each different enterprise which then recorded and added up at the end of the month for each different enterprise giving the total number of customers/clients/visitors
ecn 54	Revenue generated through sales	The current accounts for each enterprise was reviewed and any cash flow in that was recorded as a sale of an original product of the company was added up for each month and listed as revenue generated through sales
ecn 55	Revenue generated through services	As above, the current accounts for each enterprise were reviewed. Alternatively, any cash flow in that was recorded as a service on a customer product was added up for each month and listed as revenue generated through services
ecn 56	Progression rate of employees	Calculated from exit discussion or interviews where conducted.

## Appendix 2 – Data Collection and Indicators from the Rediscovery Centre

A total of 60 people were contacted by phone to see if they would participate in this survey as there was little uptake by customers in our workshops. Out of this 60 people contacted, 15 people completed the survey, and some of the key results relating to the EPA sustainability indicators project are shown in graphs below.
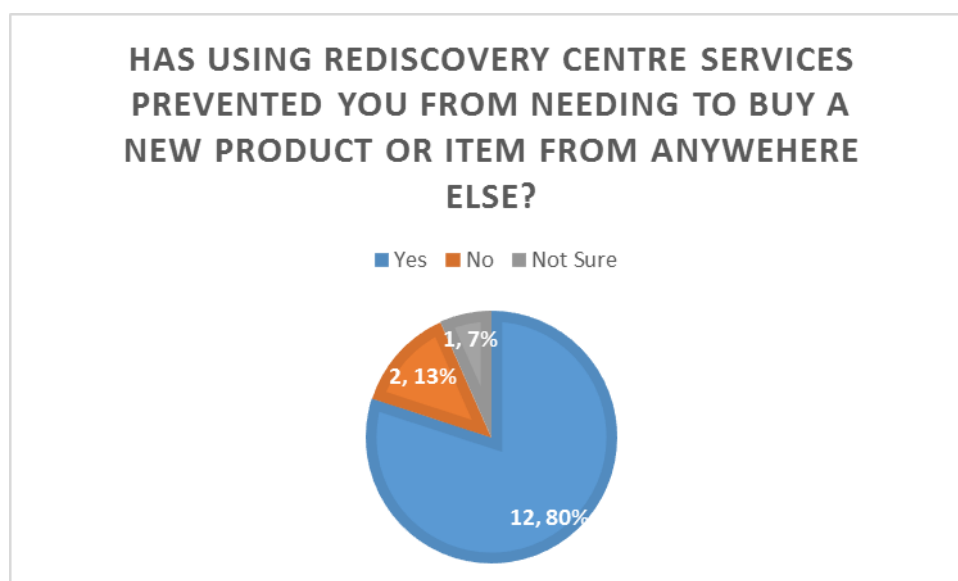
HAS USING REDISCOVERY CENTRE SERVICES PREVENTED YOU FROM NEEDING OR WANTING TO DISPOSE OF THE PRODUCT OR ITEM?

Legend: ■ Yes ■ No ■ Not Sure

Yes: 80%
No: 13%
Not Sure: 7%
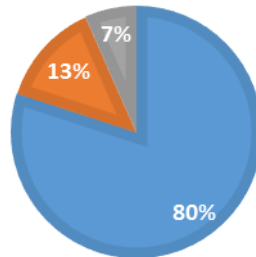
As a result of engaging with the Rediscovery Centre, how likely are you to reuse and recycle more items in the future?

Response	Count
1 Not likely	0
2	0
3 Possibly	2
4	3
5 Most likely	10
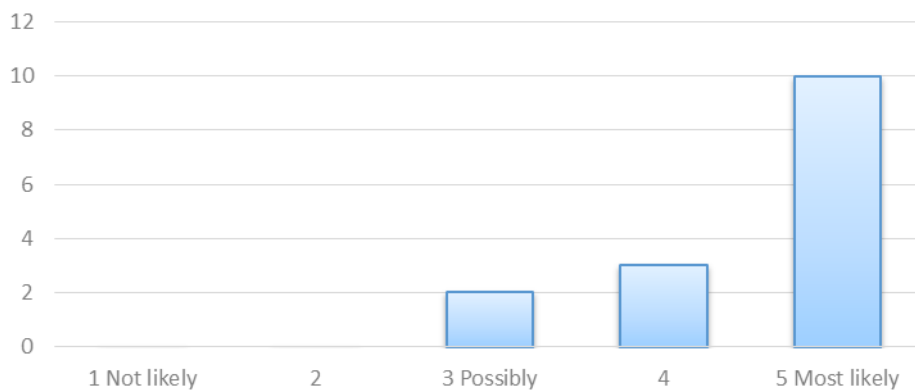
As a result of your engagement with the Rediscovery Centre how likely are you to be more environmentally and socially concious when shopping?

Response	Count
1 Not likely	0
2	1
3 Possibly	4
4	4
5 Most likely	6
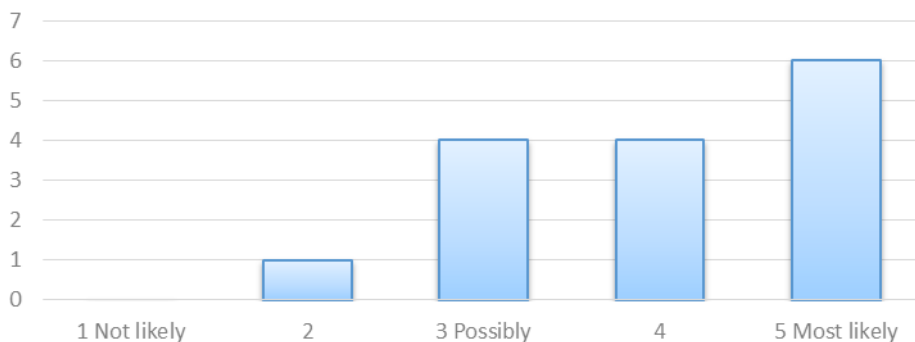
Insert Appendix 3 - Questionnaire

Please rank the **Availability** and **Priority - Usefulness** of the following data and metrics according to your view and organisational objectives and capacity. Please also provide any comment you feel might be useful. Scroll down for Economic and Social indicators.

Metrics calculated by life cycle assessment	
Data required for life cycle assessment	

Environmental indicators

Category	Metric (Performance indicator)	Potential Data Source	Type	Availability	Priority - Usefulness	Comment?
Contribution to climate change	**Carbon equivalent avoided**	LCA	Calculated Metric	Life Cycle Analysis	Please Select	
Energy - Life Cycle	**Energy (MWh) avoided**	LCA	Calculated Metric	Life Cycle Analysis	Please Select	
Reduce environmental impact by reuse	Total waste throughput	Tonnage figures on annual reports and collection receipts	Data	Please Select	Please Select	
	Breakdown of nput waste by source (drop off, collection, CA site etc)	Tonnage figures on annual reports and collection receipts	Data	Please Select	Please Select	
	Residual waste for disposal and recycling		Data	Please Select	Please Select	
Product Life Cycle	% displacement of new products	Customer survey	Data	Please Select	Please Select	
	Reuse product lifetime	Customer survey	Data	Please Select	Please Select	
	New product lifetime	Customer survey	Data	Please Select	Please Select	
Energy Consumption/generation	Net energy consumed	Energy Bills, metering	Data	Please Select	Please Select	
Increased environmental awareness	Number of courses delivered	Booking forms	Data	Please Select	Please Select	
	Numbers of research projects	Progress reports	Data	Please Select	Please Select	
	Numbers of visitors	Visitor log	Data	Please Select	Please Select	
Positive behavioral change	Numbers of people reporting changed habits	Online/SM Question	Data	Please Select	Please Select	
Water consumption	Litres of water saved through processing improvements	Water meters where used	Data	Please Select	Please Select	
		water harvesting processes	Data	Please Select	Please Select	
Transport	Van fuel efficiency	Fuel receipts and mileage	Data	Please Select	Please Select	
Procurement	% of eco produce/consumption	Accounting data	Data	Please Select	Please Select	

Economic Indicators

Category	Metric (Performance indicator)	Potential Data Source	Type	Availability	Priority - Usefulness	Comment?
Value to Economy	**Cost Benefit**	Calculated based on comprehensive activity data	Calculated Metric	Life Cycle Analysis	High	NA
Job creation	**Number of jobs created**	Employee register & payroll record	Data	Please Select	Please Select	Data needed for LCA assessment
Financial Independence	**Decrease of reliance on grant funding**	% amount of overheads covered by grant funding	Calculated Metric	Please Select	Please Select	Data needed for LCA assessment
Financial Viability	Increase in surplus/profit/turnover	Annual reports	Data	Please Select	Please Select	Data needed for LCA assessment
Increase business performance	Numbers of business units/activities	Annual reports	Data	Please Select	Please Select	
	Numbers of services offered	Annual reports	Data	Please Select	Please Select	
Increase reuse enterprise performance	Number of customers/clients (total)	Receipt books	Data	Please Select	Please Select	
	Revenue generated through sales	Receipt books and accounts	Data	Please Select	Please Select	
	Numbers of Full time employee equivalents	CE & employment register	Data	Please Select	Please Select	
Increased awareness and improved perception of Area due to presence of social enterprise	Number of external visitors using center services	Visitor log	Data	Please Select	Please Select	
	Positive media reports referencing Ballymun	Communications reports	Data	Please Select	Please Select	
	Number of local business positively impact upon	User behavior survey	Data	Please Select	Please Select	
Increase profile of the organisation	Number of media citations	Electronic media file	Data	Please Select	Please Select	
	Increased website activity	Statistics	Data	Please Select	Please Select	
	Increased social media interactions (FB friends, LI/twitter followers)	Social media statistics	Data	Please Select	Please Select	
			Data	Please Select	Please Select	
	Increased standard in job applicants	Obtained from CVs	Data	Please Select	Please Select	
Financial Award	Success in attaining grant funding for particular project or awards/donations	€ amount awarded	Data	Please Select	Please Select	

Social Indicators

Category	Metric (Performance indicator)	Potential Data Source	Type	Availability	Priority - Usefulness	Comment?
Increased local employment opportunities	Number of enterprise employment/training places	Annual reports	Data	Please Select	Please Select	
Environmental awareness programmes provided (FOC)	Number of people/schools provided with free training	Annual reports	Data	Please Select	Please Select	
Increase in training opportunities	Numbers of people engaged in company activities	Employment Register/Payroll	Data	Please Select	Please Select	
	Number of CE placements offered	CE Register	Data	Please Select	Please Select	
Personal development	Personal attainment survey	Employee satisfaction survey	Data	Please Select	Please Select	
Improve social integration	Numbers of local people accessing services	Visitor log	Data	Please Select	Please Select	
	Numbers of local people attending courses	Annual reports	Data	Please Select	Please Select	
Social procurement	% of local/ fair trade consumables/products	Accounting data	Data	Please Select	Please Select	
Information/Festival Event days	Number of people in attendance	Could also reflect % increase in numbers over the previous time event held	Data	Please Select	Please Select	
Social Standards Award	Success in attaining a social standards award	Report on progress of attainment	Data	Please Select	Please Select	

Appendix 4 composition of a typical and lightweight bike

Components	Material	Weight minimal	Weight average	Unit
Frame	Aluminium alloyed	1.5	2.50	kg
Handlebar	Aluminium alloyed	0.15	0.23	kg
Stem	Aluminium alloyed	0.15	0.23	kg
Seat Post	Aluminium alloyed	0.4	0.60	kg
Bearings	Stainless steel	0.4	0.60	kg
Wheels	Aluminium alloyed	0.2	0.30	kg
	Steel, alloyed	0.1	0.10	kg
Tyres	Wire	0.125	0.19	kg
	Rubber	0.375	0.56	kg
Pedals	Aluminium alloyed	0.2	0.30	kg
Seat	Plastic	0.02	0.03	kg
	Steel, alloyed	0.16	0.24	kg
	PU, flexible foam	0.02	0.03	kg
Chain	Stainless steel	0.1	0.15	kg
		0.2	0.30	kg
Crankset	Aluminium alloyed	0.56	0.84	kg
	Stainless steel	0.16	0.24	kg
		0.08	0.12	kg
V-Brakes	Plastic	0	0.14	kg
	Aluminium alloyed	0	0.28	kg
	Steel, alloyed	0	0.28	kg
Brakehandel	Aluminium alloyed	0.075	0.11	kg
	Plastic	0.075	0.11	kg
Sprokets	Steel, alloyed	0.35	0.53	kg
Derailleurs	Aluminium alloyed	0.1	0.15	kg
Derailleurs	Stainless steel	0.4	0.60	kg
Shifters	Plastic	0.45	0.68	kg
Cables	Wire	0.1	0.15	kg
Others	Plastic	0.2	1.00	kg
Others	Aluminium alloyed	0.1	2.00	kg
Others	Electronic equipment	0.1	0.50	kg
Others	Steel, alloyed	0	3.00	kg
Total		**6.85**	**17**	**kg**