



MI-ROG

Measuring circular economy performance — suggestions for infrastructure organisations

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Preface



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Many organisations are looking to the United Nations' Sustainable Development Goals (SDGs) to help define and prioritise their sustainable development aspirations towards 2030. The SDGs call for worldwide action among governments, business and civil society to end poverty and create a life of dignity and opportunity for all, within the boundaries of the planet. Goal 12, with its focus on responsible production and consumption, provides an anchor for infrastructure organisations developing circular economy strategies and performance monitoring.

In this, the second of our MI-ROG White Papers series, we ask infrastructure operators to consider how they will measure progress in implementing their circular economy strategies. We focus on measuring success at the organisation level, rather than at asset, project or programme level and suggest a twin track approach of addressing both enabler and outcome metrics. This recognises that ways of tracking institutional strengthening, governance and procurement related shifts can be just as important as hard outcomes in the early days of our transition to a circular economy.

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The Circular Economy and MI-ROG

MI-ROG, the Major Infrastructure – Resource Optimisation Group, was set up four years ago as a forum for infrastructure owners and operators in England to share best practice and to facilitate opportunities for collaboration across their organisations, programmes and projects.

In the sense we are using in this paper, infrastructure is understood to include transport (road, rail, airports and ports), utilities (energy, water and telecommunications) and flood protection – with major implications for resource use and sustainability more generally. The principles of the circular economy closely align with MI-ROG’s purpose; the circular economy aims to:

- keep resources in use for as long as possible
- extract the maximum value from resources while in use
- recover and regenerate products and materials at the end of life
- keep products, components and materials at their highest utility and value at all times.

But the question arises, how does an organisation know how well it is doing in meeting these aspirations for the circular economy? BS8001 says that ‘Organizations should determine what success would look like for them and how this is to be measured over time.’ So what would be an appropriate measure of success for an infrastructure operator or maintainer’s circular economy approach?

In this short paper we suggest some possible pathways to measuring success.

A note on Scope

MI-ROG’s approach in this paper is focussed on developing organisation-level performance indicators. This is in contrast to other initiatives looking at specific materials and components deployed at the asset/project and programme level.

Challenges

One of the challenges with the circular economy, along with other principles which promote whole life approaches, is that actual value may only be realised many years into the future. Hence, monitoring both outcomes and enablers is gaining credence.

In other words, it can be difficult to create the right environment for circular economy outcomes to be realised as important as measuring actual impacts. The following suggested metrics explore ways to measure both enablers and outcomes.

Impact-based metrics

There are a range of metrics that are currently being used at both infrastructure project/asset and organisational levels (to greater or lesser extents), which could be considered as proxies to circular outcomes:

- ✓ energy use and/or energy-related carbon emissions
- ✓ water use
- ✓ waste generation
- ✓ landfill diversion
- ✓ material use and/or material-related carbon emissions
- ✓ proportion of recycled content ¹
- ✓ natural capital accounts

A number of these are also used for other organisational-level reporting purposes. For example, the Global Reporting Initiative Standard Disclosures cover greenhouse gas emissions, material use, waste generation etc. which could give added value to these metrics being captured if organisations are not already using them.

The limitation of these metrics is that they are always retrospective. They will have most impact when tracked against forecasts. This would help attribute reductions to specific circular economy interventions.

Productivity-based metrics

Another limitation of pure impact-based metrics is that they do not provide any context to the impacts generated. An alternative to this is considering the impacts relative to the value created.

An example of this is one of the primary indicators in the Ellen MacArthur Foundation Growth Within report of GDP generated per unit of net virgin finite material input. Whilst GDP is not applicable to infrastructure organisations, the concept of units of net virgin finite material input relative to the output of an organisation could be a useful metric. For infrastructure providers, however, the measure of success could be related to the function they are providing whether this is kWh of power, fresh water supplied or passenger km enabled. In the near future, the Infrastructure Planning Authority will develop cost and performance benchmarks for infrastructure, which may help provide a level of consistency.

Therefore a high-level organisational level metric that could be considered is total value created over resource inputs, which takes into account the service and utility aspects of value created. Resources could be finite materials used as in the EMF indicator, but could also be many of the other impact-based metrics described earlier.

Attribute metrics

The Ellen MacArthur Foundation Growth Within report also suggests secondary metrics that could be used to describe different circular attributes:

- ✓ Product utilisation (average utilisation across all products)
- ✓ Product depreciation/lifetime (average lifetime of products)
- ✓ Material value retention ratio (value of recovered material, such as energy recovery, recycling, and remanufacturing/value of net virgin materials plus value of materials embedded in net product import [rolling net average over the last five years])

The indicators of product utilisation and depreciation/lifetime are likely to be more applicable to individual assets rather than an infrastructure organisation as a whole, although it may be possible to aggregate these in some organisations. Product utilisation in particular may be beneficial in demonstrating the efficiencies achieved through sharing assets either within an organisation, or across different organisations.

¹ Recycled content as a KPI should be used with caution as using recycled materials can in some instances result in increased environmental impact.

The final indicator of material value retention ratio could be utilised at both an asset and organisational level and is linked to the concept of residual value. Residual value would consider the value of the components and materials and their potential for reconditioning and repurposing once they have been extricated from the infrastructure of which they formed a part. This would need to consider retained value for their original purpose (or re-purpose), or remanufacture over their value as 'scrap'. This can be challenging to promote within infrastructure organisations as the majority of assets are designed with long design lives of 100 years or more, with the intention of there not being an end-of-life. There are, however, many examples of assets being decommissioned or replaced, not because they have reached end of life, but because their functional use has been overtaken by service demand, capacity requirements and newly available technology. Considering residual value in whole life value analysis can identify approaches which help to increase the value realised from an asset and/or reduce the costs of preparing the asset for sale or disposal if or when it is no longer required.

Enabler-based metrics

An alternative or complimentary approach to monitoring the outcomes of adopting circular economy approaches is to monitor aspects of an organisation that should encourage circular outcomes. Examples of enablers that could be monitored include:

- ✓ proportion of procurement activities which incorporated circular economy requirements
- ✓ number of circular economy innovation initiatives implemented
- ✓ number or proportion of procurements/projects that incorporated whole life carbon footprinting
- ✓ number or proportion of procurements/projects that incorporated whole life costing
- ✓ number or proportion of assets and/or asset components that have end-of-life/adaptability plans
- ✓ number or proportion of assets and/or asset components that are using condition-based monitoring and maintenance
- ✓ number or proportion of assets and/or asset components that have climate change adaptation plans

Maturity model

Building upon the idea of creating an organisation that allows for transition towards a circular economy, a final option could be to map progress against a maturity model. A maturity model would allow organisations to demonstrate their progress against different attributes recognised to be pivotal to achieving a more circular economy. While this would not give quantifiable metrics in the same way as the other options, it could be a useful management tool as it would give organisations a more broad understanding of their progress and a path for continual improvement.

Whole Life Asset Management

There is a close relationship between a circular economy approach and best practice Whole Life Asset Management and its focus on extending the life of assets, not just the materials and components in them. Organisations may already have metrics or key performance indicators as part of their Asset Management System around whole life cost, asset health etc. Where these exist they will be useful in demonstrating the impact of adopting more circular approaches.

Conclusions and Recommendations

A range of potential measures has been presented, each with merits and limitations in relation to being a useful metric for an organisation's progress to a circular economy. Impact-based metrics are readily available and already used and understood by many organisations but are retrospective and may not directly represent an organisation's circularity.

Enabler-based metrics and maturity models give a much better idea of an organisation's capacity to deliver circular outcomes, but it may be difficult to capture the data and only be of use for a limited time during the transition towards a circular economy business model.

To be effective, infrastructure organisations must be able to use the proposed measures to demonstrate and communicate value to various internal and external stakeholders. For this to happen, the measures need to be aligned to the organisation's objectives. In addition, measures need to use data that is already being captured for other purposes and/or use data that adds value to several parts of the organisation. This will be different for each organisation depending on their specific function and the maturity of their current reporting on other topics.

Recommended measures for primary metrics

1. It is proposed that **productivity-based metrics would be a good basis for a measure of actual performance relating to the circular economy.** Until standardised performance measures are developed, however, it is anticipated that impact-based metrics will be used. The majority of organisations already report waste generation and landfill diversion.

2. In addition to these, it is proposed that **net virgin finite material input is also captured.** Many organisations may choose to use **carbon-productivity as a proxy** to align with current data availability. Where this is the case, scope 3² emissions associated with material use and waste management should be included.

3. As data availability increases, this **material use metric should be complemented by a measure of residual value within an organisation's assets.** This will be increasingly useful for maintenance activities where it can be shown that preventative maintenance is increasing the retained value of the assets.

These primary metrics would be most suitable for conversation with senior and external stakeholders as they will be relative to an organisation's objectives (if productivity-based) and use relatively simple concepts of material use and monetary value.

Recommended measures for supplementary metrics

The challenge with the above metrics is that they are retrospective and do not capture effort going in to activities to reduce material use and waste generation in the future. It may be possible to negate this by forecasting impacts before and after certain interventions and setting targets.

² For guidance on emissions scopes, consult: <http://www.ghgprotocol.org/>

This may work where forecasting is commonplace and could be incorporated into existing processes. These approaches can be unsatisfactory due to the significant assumptions that are required.

We therefore propose that the **material use and residual value metrics are complemented by a suite of enabler-based and asset management metrics** applicable to the functions and stage of an organisation’s transition towards a circular economy model.

Initially it is proposed that these would need to focus on embedding the right mechanisms to allow circular approaches to be adequately appraised and implemented, such as:

- proportion of activities that include whole life costing and whole life carbon footprinting
- proportion of assets that have end-of-life/decommissioning/ adaptability plans and/or materials passports
- proportion of procurement activities which include circular requirements

How proportions are defined will need to be reflective of each organisation’s function. For example it may be appropriate for these to be related to proportion of spend or proportion of service delivered, rather than proportion of discrete activities.

Finally, during an organisation’s transition to a circular economy approach, mapping progress against a maturity model can be useful as a guide of where to focus activities.

These supplementary metrics may be more useful for the internal management of activities as opposed to communicating with senior or external stakeholders as they are likely to be more qualitative and less directly linked to the organisation’s objectives.

Primary metrics

Net virgin finite material input

(normalised in relation to organisation’s performance where possible)

Residual value of assets

Supplementary metrics

Suite of enabler-based and asset management metrics applicable to the functions and stage of the organisation’s transition such as:

- proportion of activities that include whole life costing and whole life carbon footprinting
- proportion of assets that have end-of-life/decommissioning/ adaptability plans and/or materials passports
- proportion of procurement activities which include circular requirements

Mapping progress against a maturity model

About MI-ROG

Born out of the National Industrial Symbiosis Programme, AECOM founded the award-winning Major Infrastructure–Resource Optimisation Group (MI-ROG) in 2013 as a forum for the UK’s infrastructure operators to collaborate across the circular economy theme, meeting the challenge of major infrastructure delivery in a constrained economy. Members include Anglian Water, Centrica, Circular Peterborough, Crossrail 2, EDF Energy, the Environment Agency, Gatwick Airport, Heathrow Airport, Highways England, High Speed 2, the London Waste & Recycling Board, National Grid, Network Rail, Tideway, Thames Water and Transport for London. AECOM provides the secretariat and meetings rotate between member organisations, with five to six sessions per year. MI-ROG has a sister group, the Scottish Infrastructure Circular Economy Forum (SICEF), to cater for Scotland’s infrastructure organisations, which is also convened by AECOM. If you would like to learn more about MI-ROG or SICEF or contribute to the forum’s work as a guest speaker then please contact robert.spencer@aecom.com.

Disclaimer

The views expressed in this paper do not necessarily reflect those of the organisations named above.

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Mark is a chartered mechanical engineer and environmentalist specialising in resource efficiency and the circular economy in infrastructure. Mark is implementing a resource efficient low carbon approach into the expansion of Heathrow Airport which, includes exploring opportunities to apply the circular economy in the design, construction and operation of the scheme.



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Robert is Director of Sustainability Services for the Environment business at AECOM. Robert led the construction and utilities work of the National Industrial Symbiosis Programme in London and the South East from 2007–12 and helped divert 2 million tonnes of waste from landfill. During that time, he convened the London Materials Arisings Group, which worked to enhance use of the Thames and optimise materials across Thames Water, National Grid and the Crossrail projects, working with the Port of London and the LDA. In the last five years he has been an active member of the Research Council's Living With Environmental Change (LWEC)'s Business Advisory Board and InnovateUK's Resource Efficiency Steering Group. In 2013 he convened and now chair's the UK's first infrastructure circular economy forum, the Major Infrastructure — Resources Optimisation Group (MI-ROG). Robert is passionate about promoting the integration of natural capital and circular economy principles into infrastructure design and operations.

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Reference

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MI-ROG was founded in 2013 and is convened by AECOM. The Chairman is Robert Spencer. MI-ROG participants represent organisations including, EDF Energy, the Environment Agency, Highways England, HS2, National Grid, Network Rail, Heathrow Airport Ltd and Tideway. The views expressed in this thought piece are not necessarily the views of the organisations named.

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