How Asset Management Can Enable the Circular Economy

The Institute of Asset Management

Version 1 | November 2022

Executive Summary

The circular economy is an economic and societal shift towards sustainability and regeneration. It does this by maintaining and rebuilding natural and social capital stocks. The maintenance and rebuilding of these stocks can be greatly accelerated through the deployment of systems thinking, where sustainability and regeneration are the product of the interaction of the circular economy parts. By way of example and within an asset management context, organizations can make existing assets last longer, design products that can be refurbished over multiple life cycles, shift operations to service models, create syndicates, networks, or value chains that offer greater sustainability and regenerative outcomes compared to their competition.

The adoption of circular economy strategies and principles can be seen as a response to Climate Change Action Planning. There is a clear opportunity for the discipline of asset management to be more widely recognized as one of the key enablers in significantly reducing the impacts of climate change, supply chain delays, and creating regeneration through the deployment of circular economy principles.

Many existing asset management practices focus on a continuous cycle of procuring assets that are utilized to maximize their performance. When they reach the end of their useful life, they are often scrapped or recycled because this is historically the cheapest, easiest, and quickest method of disposal. This practice contradicts the sustainability goals, such as cutting the use of natural resources, minimizing carbon, and reducing waste.

By moving away from the linear asset life cycles of take-make-waste that our economies are currently built on and instead working towards a future economy that is regenerative and circular by design, asset managers can become champions of environmentally sustainable systems (and subsequently, overarching asset sustainability) in their organizations, and develop the circular economy as a means to address the organization's sustainability, carbon reduction, and long term economic challenges.

Circular economy principles eliminate the notion that an asset has an 'end-of-life'. This shift from a linear economy challenges asset managers to adapt their products, operations, and services toward opportunities for new types of businesses and changes to business models. This can include the development of new partnerships, reducing, reusing, remanufacturing, repurposing, and recycling, to name a few. This way of thinking and working moves away from linear asset life cycles into a closed-loop system where fewer new resources are needed, and little waste is generated.

The future circular economy needs asset management to define and support the management of multiple asset life cycles and harness and unlock additional value streams that the assets enable.

Currently, there is limited evidence that asset management strategies incorporate circular economy approaches unless the business's vision, goals, and stakeholders dictate that it should. The Institute of Asset Management is, therefore, keen to understand how to accelerate the drive toward regeneration and sustainability and is looking to develop and embed circular economic principles more deeply into the practice of asset management.

This white paper aims to outline how asset management can embrace circular economy principles and highlight the opportunities for enhancing value that this can offer. This is important for organizations working on their circular economy transformation and identity. Drawing upon good asset management practice, the organization's leaders and asset managers will need to understand the relative strengths of their existing asset management capability and how these systems can evolve and adapt, supporting a future circular economy. We invite comment and discussion on this white paper for potential next steps to be taken in promoting the circular economy within asset management. Next steps and opportunities may include the development of guidance documents (including those related to the IAM's white paper, *Climate Emergency Action Planning – Guidance for asset owning organizations* published in 2021), incorporation into international standards, the IAM SSGs, tools and techniques to measure readiness for the circular economy, linking to climate change initiatives and sustainability within the organization's context, or even influencing future regulatory requirements.

'The Institute of Asset Management is keen to understand how to accelerate the drive toward regeneration and sustainability and is looking to develop and embed circular economic principles more deeply into the practice of asset management.'

1 Asset Management and the Circular Economy

Traditional asset management practices generally follow a linear take-make-waste philosophy, where resources are taken as raw materials and made into new assets. Those assets are then utilized to maximize their performance and then disposed of, making them waste. This cycle is then repeated to fulfill the business need using new assets.

Historically, this has been a convenience for linear global economies, where the negative impact on externalities is almost invariably not counted (e.g., the negative impact of climate change, our societies, and the environment). This has called into question the suitability and effectiveness of linear economies and the businesses that operate within them that have supported the asset life cycle as we know it.

Moreover, asset managers will now be only too familiar with the existing and looming crisis associated with interruptions in global supply chains, the increased degradation of assets due to climate change, and the increased demand for limited resources. The concept of a future with an uninterrupted or abundant supply of new and replacement assets within a take-make-waste way of working will become unsustainable for some industries.

To reduce the impacts of climate change, organizations (and subsequently, asset managers) are focused on understanding their assets' carbon emissions (and, increasingly, environmental impact). By looking to the future, they aim to measure and reduce these overall limits, to meet net-zero targets and commitments. However, when applied to the traditional take-make-waste business model, these objectives can often contradict, prioritizing the generation and consumption of new assets when practiced alongside relatively novel sustainability goals. Meeting net-zero targets should not be constrained by a purely sustainability or environmental view but must also include economic opportunities driven by innovation. This view should also be enacted beyond the asset's operational life to consider its prospective impact across elements such as the asset's production, supply chain, and disposal.

The emerging circular economy will call upon the discipline of asset management to design and deploy asset systems that are regenerative by design, innovate to increase asset resilience, reduce reliance on global supply chains, and create the need to grow strategic, local, and regional capabilities, whilst also meeting or exceeding organizational and global sustainability targets.

The circular economy is a strategy that engages systems thinking, enabling organizations to link together important drivers and networks of actors, stakeholders, and value chains that, when combined, create greater value than the sum of its parts. And in so doing, it delivers regeneration, seeking to accelerate the reduction of carbon (and is sustainable by definition).

The future challenge for asset managers will be, given the organization's transition towards a circular economy, what can we already capture that we are doing now in our asset management systems that is going to add value and how can we exploit asset management further given the organization's revised strategy and purpose?

2 Developing Circular Economy Systems Thinking

If we initially view a traditional take-make-waste model (Figure 2-1, see page 6), the asset life cycle is very much a linear process. For example, during the system or asset design stage, a cost reduction or value engineering review may be carried out to identify where savings can be made, enabling the same function at a lesser cost. In many respects, whole life cost only considers the cost of replacement, not the wider impact that that replacement has on externalities. This may support cost reduction in the short term, but if the organization is transforming towards a circular economy, those externalities become important. Those previous design decisions may have been made to the detriment of the asset within a circular economy context limiting the ability for the life of the asset to be extended through repair or remanufacture. That said, it is likely that asset managers utilizing this model already include some form of activities related to the circular economy. For example, life extension activities look at expanding the asset system utilization boundary. We already carry out work to determine how we can extend the life of assets far beyond their design life where organizations have already taken the move to incorporate aspects of the circular economy within their operating model:

Caterpillar already offers a discount on replacement engines if the damaged engine is returned in reasonable condition (Caterpillar, 2022). Primary benefits of this include Caterpillar's opportunity to reuse its own parts with minor refurbishment at a reduced cost (compared with procuring/manufacturing new assets). Secondary benefits also include ownership of any data generated during operation and an increased understanding of asset performance which allows for more effective design iterations. Moreover, if conditions are built into the asset's as-a-service contract, which ensures it must be returned to a certain standard for returned payment, this may shape user behavior to promote better asset stewardship.

So why don't we design assets with that expectation in mind? The question then becomes: how do you expand your boundary to further increase asset and resource utilization (and performance), and what tools and processes do you subsequently develop to enable this?

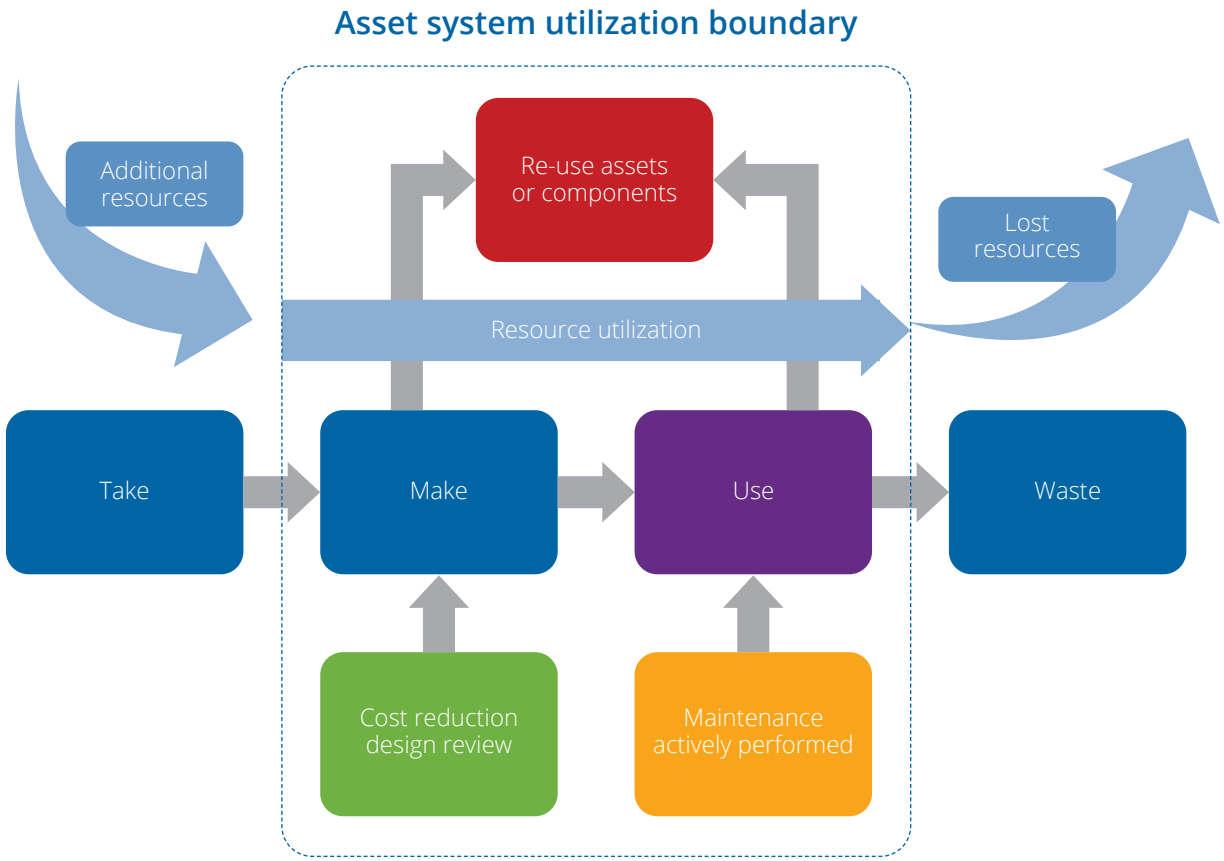

Figure 2-1: Asset resource utilization boundary within a traditional take-make-waste management model.

The vision is an asset management system that is restorative and regenerative by design and aims to keep products, components, and materials near their highest utility and value at all times. The asset life cycle is a continuous positive development cycle that preserves and enhances natural capital, optimizes resource yields, and minimizes system risks by managing finite stocks and renewable flows (Ellen MacArthur Foundation, 2013), such as in a closed-loop asset management system (Figure 2-2, see page 7).

A framework based on the circular economy promotes the exploration of different services or business models. It can bring groups of organizations together to support each other in symbiosis. This enables the concept of circular economy syndicates, a strategic network of organizations or value chains that collaborate to optimize value from the circular economy. However, this reflects the challenge of defining where the asset system resource boundary is and who has responsibility for it.

Many of the principles of circular economy could, and should, belong as intrinsic building blocks of asset management practices. However, applying them more formally challenges asset managers to adapt their products, operations, and services, unlike the traditional linear take-make-waste philosophy. Hence, the challenge becomes understanding where to draw your systems boundary to maximize your asset's value through the principles of the circular economy, and what additional tools and processes you develop to then enable this.

Hence, what are the different entry points to developing an asset management system based on the circular economy, and what respective tools and processes can help feed into each of these points of the system?

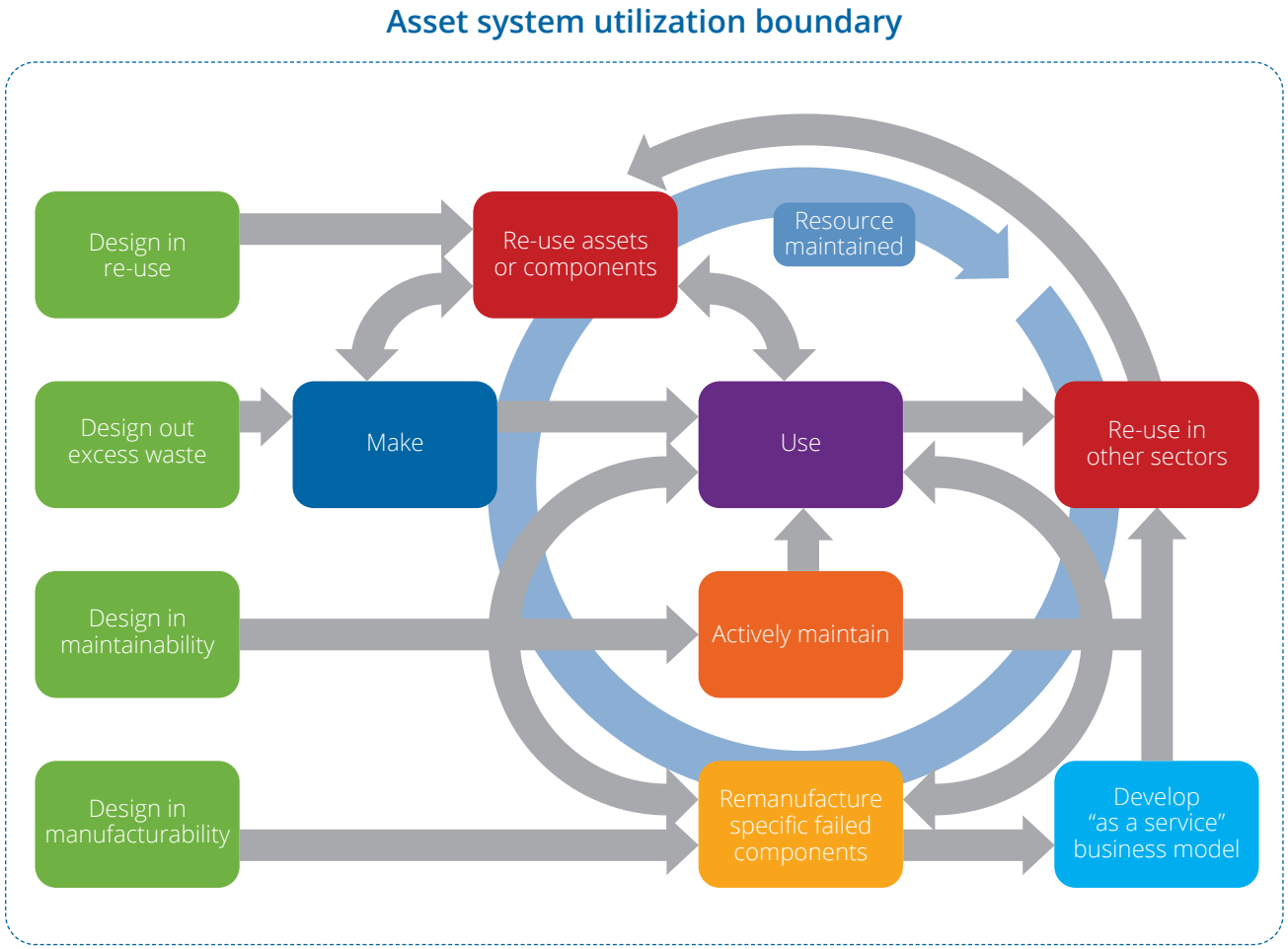

Figure 2-2: Asset resource utilization boundary within a closed loop circular economic model.

3 Creating Value through the Circular Economy

Figure 3-1 illustrates three entry points as an example for asset managers to understand where to start creating value for the circular economy within their asset management systems. Starting with the assets at the center, the first viewpoint is the here and now, where we can positively affect assets that already exist and are in everyday operation. In general, an effective way of minimizing the environmental impact of assets may be to extend the asset's life. Asset managers are already good at this.

Next, considering the asset life cycle boundary more widely, we have the before and after, where we can intervene on how the assets are initially designed or renewed.

Finally, the widest boundary to consider are the overarching practices, which influence how assets are used, and the value (e.g., the externalities) that the assets enable. Value management needs to be applied, but its application should extend beyond the asset and the asset creation project. It's what externalities the asset enables that matter. Those externalities that the assets enable must be tied back to the organization's purpose and the value that organizations create. Asset managers need to work continuously at all three entry points.

Creating value from circular economy can start at one, or all, of the entry points at the same time. Each entry point creates its own opportunities and is interdependent of the others. The objective, therefore, should be to identify interventions that combine into an interlinked system which gives value greater than the sum of its parts.

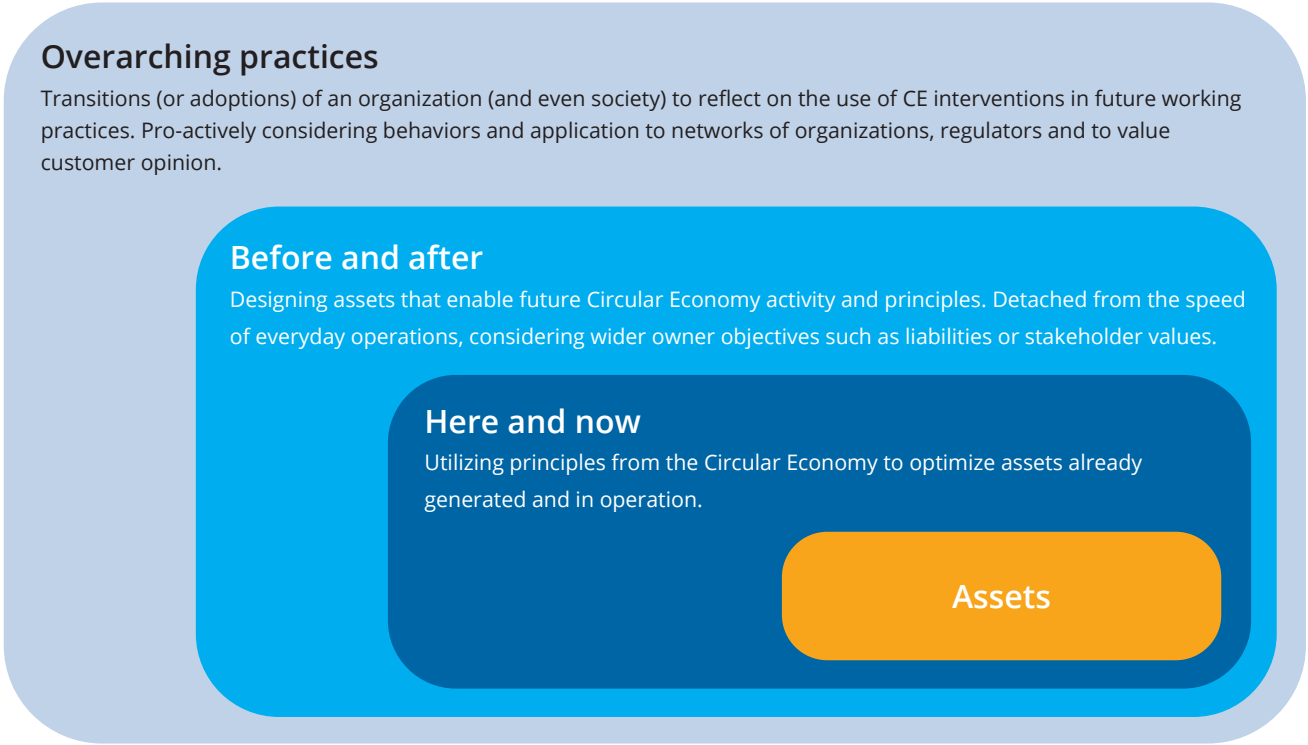

Figure 3-1: The three entry points to creating value through circular economy utilizing a systems-based approach.

3.1 Here and now

For organizations wanting to start their circular economy transformation and asset managers looking to start adopting circular economy practices, one of the most effective interventions is either to extend the life of current assets or develop alternative practices that make the need for new assets redundant. Within an asset management context, the asset management system is no longer running the asset down toward the end of its life. Instead, it determines in more detail using a circular economy lens how asset life could be extended, considering options beyond those currently considered. Good asset management already considers this by considering, for example:

1. Different areas (beyond those already being considered) of asset criticality (i.e., how much additional risk are you willing to accept on your asset's condition) to prolong the asset's useful operation

2. New asset breakdown structures (i.e., components and sub-components) to enable the retention of parts that have a longer life than the whole asset system or sub-system.

Activities asset managers can undertake in this area can include:

- Develop tools and processes that extend the life of assets you already own (e.g., component replacements that ensure longer life and less maintenance)
- Develop tools and processes that enable you to have a greater understanding of your asset's condition (such as through utilizing the Internet of Things (IoT) or digital twins to enable condition-based monitoring (CBM))
- Evaluate the risks and opportunities of the status quo against any interventions, including the potential added value that can be created (such as multiple life cycle costs and the inherent benefit of carbon reductions).

'... one of the most effective interventions is either to extend the life of current assets or develop alternative practices that make the need for new assets redundant.'

The here and now *- There are already many asset operators incorporating CBM into their asset management processes. This includes capitalizing on the recent advances in digital connectivity and sensors to enable live data capture and decisions to be made on real-time asset condition.*
This technology has been available for some time, and its exploitation has recently been prioritized because of the need to extend asset life and minimize asset failures. One example of this is within the power sector, where the distribution networks collaborated to produce a standardized "Network Asset Indices Methodology" (Ofgem, 2021) framework to aid with assessing and managing assets based on their health (or condition). This basic philosophy is already embedded in good asset management and these practices can be exploited further during the organization's circular economy transition.

Moreover, Eversholt Rail and Vivarail have signed an agreement aimed at developing battery power and range extension to the class 321 'Renatus' fleet. This proven and reliable fleet is an excellent fit in terms of characteristics, fleet size, and availability for conversion to a battery electric multiple unit (BEMU). Vivarail, as the designers and manufacturers of the UK's only battery and hybrid trains currently in passenger service, are well positioned to progress this development. They commented:

"We will be working together to develop a design to integrate battery technology to provide between 20 to 30 miles of self-propulsion. Enabling the fleet to operate on non-electrified or partly electrified routes would offer the opportunity to increase the range of modern, low-carbon options to accommodate passenger demand; to enable fleet cascades; to improve the passenger experience; and to bring air quality and decarbonization benefits to local areas."

3.2 Before and after

The circular economy provides an opportunity to fundamentally challenge traditional business models through a drive to design assets that can extend their useful life, develop components that can be reused and remanufactured, and utilize new materials that can then later be reclaimed, all while facilitating new business models that promote the continued development of the circular economy. For example, the assets-as-a-service business model where organizations lease their assets to operators, which are then returned at their end of life. In this case, the asset is worth more to the manufacturer because the manufacturer will have already planned its remanufacture or will upgrade to the next generation of the asset.

Although technically everything can be shared, repaired, reused, or recycled, there are constraints in how the circular economy can create value from asset management systems (for example, due to intellectual property protection blocking reuse designs from becoming widely adopted or legislative barriers preventing the life extension of certain assets due to increased risk). This is where and how the value of deploying systems thinking counts (which is central to good asset management practice) – by allowing asset managers to adopt and develop a circular economy that enables the design and management of closed-loop asset management systems for their specific assets, taking into consideration the different barriers to widespread deployment.

Activities that could be considered in this area include:

- The adaptation of business models that work towards assets as-a-service
- The development and strengthening of strategic partnerships and links with relevant markets and sectors that enable secondary re-use or other circular economy activities
- Modelling multiple life cycle costs of an asset that utilizes circular economy activities (e.g., remanufactured parts vs. new)
- New commercial frameworks that establish circular economy syndicates involving the client and a network of circular economy actors and stakeholders working within the supply chain
- Redesign of assets so that they are:
  - Designed for life extension interventions (i.e., designed for repair)
  - Designed for remanufacturing
  - Designed for reuse
  - Considering innovative materials which enable all the above.

3.3 Overarching practices

As organizations move away from the take-make-waste way of working and move toward being part of (and supporting) closed-loop asset management systems, demands for new types of business and opportunities that specifically enable the circular economy will increase. These changes will be used to transition an organization (or network of organizations) from current working practices to necessary future working practices adopting potentially new business models. Some of these may be temporary, replaced, or phased out by new ways of working as part of the organization's future position on the circular economy. This is where systems thinking is beneficial.

For example, in the manufacturing sector, there is the opportunity for asset managers to develop in-house refurbishment and reconditioning centers, support the growth of local small to medium-sized enterprises (SMEs), or new technologies and industries that specialize in assured asset systems upgrades. This can have the knock-on effect of creating employment by re-developing the skills and capabilities that were previously lost - therefore supporting wider societal benefits.

It is also worth reflecting that changing climate, regional instabilities due to conflict, and more may affect future global supply chain security, including materials and resource availability. Hence, supply chain volatility can be mitigated by returning the production and manufacture of goods to companies' in-house manufacturing sites or perhaps delivered through trusted local suppliers.

There may also be drivers to increase value from the circular economy by external stakeholders. For example, there may be demands for evidence of circular economy credentials in the future. In some sectors, there is already a move towards this, with evidence in emerging policy, strategy, and future demands. Furthermore, 'the circularity' of an organization's value proposition may be considered and compared against others. Contracts may no longer be awarded on upfront price alone. New, non-monetized values that address the changing priorities of individuals, communities, industries, and regional and local governments that want to be part of the circular economy future will have to be identified. Hence, it may soon become important to measure how developed your circular economy system is compared to your competitor.

***Overarching practices** - Network Rail's sustainability strategy is committed to reuse, repurpose, or redeploy all surplus resources and embed circular economy thinking into the rail industry by 2035 (Network Rail, 2022). In the future, Network Rail's procurement decisions will consider factors other than price alone. Circular economic value will play a part in that decision making process.*

Moreover, the Ellen MacArthur Foundation has already developed its "circulytics" tool, which allows companies to assess their circularity across their organization; something which has already been done by over 1250 businesses including Unilever, ABB, Volvo and Arup to name a few (Ellen MacArthur Foundation, 2022).

3.4 Creating Value from the Circular Economy with Systems Thinking

Building upon the previous sections, the IAM's asset management conceptual model provides a good starting point to develop an approach to creating value from a circular economy using systems thinking. Figure 3 2 highlights how organizations can respond to, and create value from, the circular economy across and beyond the asset management spectrum.

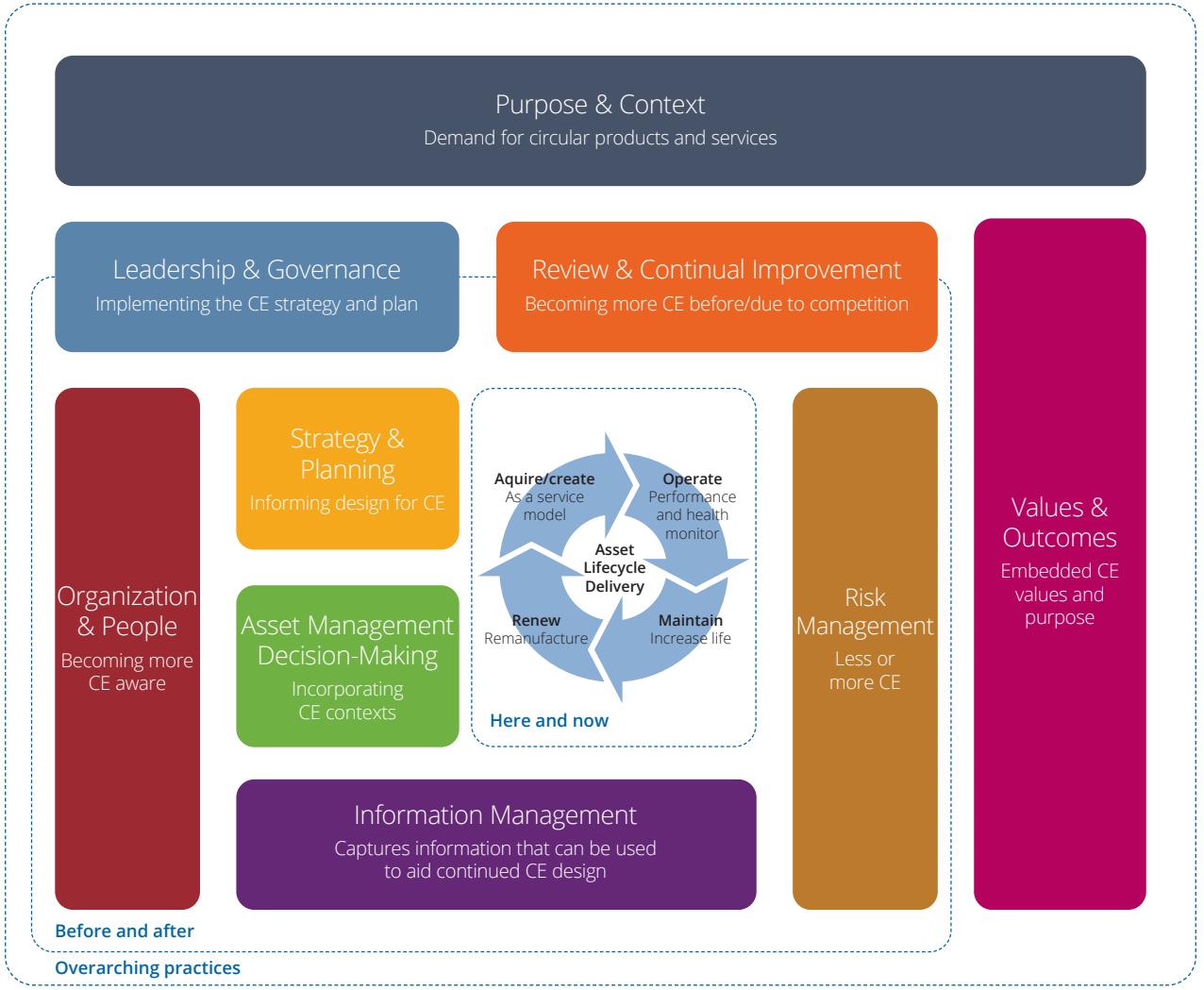

Figure 3-2: Circular Economy Alignment with the IAM's Asset Management concept model (Management, 2022).

Some questions for asset managers are, therefore:

- Where are you in your systems thinking? Have you considered all possible entry points? What does your 'circular economy asset management system' look like? Which network of actors and stakeholders do you need to be part of to leverage the circular economy? If the network doesn't already exist, can you create one?
- What value from the circular economy are you already creating which is currently going unnoticed and needs to be captured? Is there a way to capitalize on this and create more?
- What more can you be doing within each of the entry points? What are the opportunities and barriers to creating more value from the circular economy for your assets in each of these areas?
- What is unique to your organization and the assets it manufactures or manages? Are there opportunities to adapt the business operating model and overarching practices which may enable the creation of future value from the circular economy?
- What opportunities do you have for creating additional value, i.e., strategic relationships and partnering, by combining various circular economy activities across a network which results in greater value than the sum of their parts?

3.5 Further Benefits of Circular Economy

The circular economy enables sustainability and regeneration. Asset management can play a crucial role in enabling the circular economy. Applying asset management in supporting the circular economy has several other potential benefits. The overarching practices section above touched upon ideas including supply chain security and employment. Others include:

- **Regeneration** – in the broadest context: identifying value. The positive impact on externalities that the assets and the organization, through business change, is enabling to put back
- **Monetary** - by maximizing the circular economy value of assets in operation and using them for as long as possible, less capital will have to be invested in replacing assets
- **Programme** - actively maintaining and reusing assets currently owned will reduce reliance on current lead times and potentially volatile global markets with regard to the creation of new assets
- **Availability** – understanding assets better will allow for an increased understanding of the state of all assets and operations, allowing for more confident decision-making in the design of new assets of the future
- **Performance** - through active maintenance and continued development to understand assets and make them more circular, overall asset performance, and the impact that performance has on externalities, will be understood in more detail.

4 Moving forward

This white paper aims to briefly explore how asset management can embrace circular economy principles, highlight opportunities, and realize greater value from assets. By aligning asset management and circular economy, organizations have the means to show how they impact sustainability, the environment, and regeneration which all contribute towards their ESG (Environment, Social, and Governance) credentials.

This is a new way to think about asset life cycles and will require both innovative thinking as well as strong leadership to select the right interventions at the right time, and at the right level. Throughout this white paper we have posed a number of questions, and we invite consultation and comment on them (or any portion of the paper), to enable the necessary next steps to be taken to help drive the integration of circular economy and asset management.

We see the way forward as being:

1. Consultation – engaging stakeholders to provide views on the Institute of Asset Management embracing circular economy principles more explicitly in asset management

2. The development of Institute of Asset Management guidance on adopting circular economy practices, similar to the Subject Specific Guidelines that the IAM already produces

3. Creation of a Circular Economy Readiness measurement framework, or possibly gap analysis method, which organizations could use to assess their ability to adapt to the circular economy future, helping them to target their priorities and activities.

5 References & Additional Sources of Information

Caterpillar. (2022).
Circular Economy.
Retrieved from:
www.caterpillar.com/en/company/sustainability/remanufacturing.html

WRAP and the Circular Economy.
Retrieved from:
www.wrap.org.uk/taking-action/climate-change/circular-economy

Ellen MacArthur Foundation. (2013).
Towards the Circular Economy: Economic and Business Rationale for an Accelerated Transition.
London: Ellen MacArthur Foundation.
Retrieved from:
www.emf.thirdlight.com/link/x8ay372a3r11-k6775n/@/preview/1?o

Ellen MacArthur Foundation. (2022).
Measure business circularity: Circulytics.
Retrieved from Ellen MacArthur Foundation:
www.ellenmacarthurfoundation.org/resources/circulytics/overview

Ellen MacArthur Foundation. (2022).
What is a circular economy?
Retrieved from Ellen MacArthur Foundation:
www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview

IPCC. (2022).
Climate Change 2022: Impacts, Adaptation and Vulnerability.
Zurich: Cambridge University Press.

Management, T. I. (2022).
Excellence & Maturity.
Retrieved from The Insititute of Asset Management:
www.theiam.org/knowledge/hot-topic-programs/excellence-maturity/

Network Rail. (2022).
Environmental Sustainability Strategy.
Retrieved from:
www.networkrail.co.uk/who-we-are/publications-and-resources/environmental-sustainability-strategy/

Ofgem. (2021).
DNO Common Network Asset Indicies Methodology.
Ofgem.
Retrieved from:
www.ofgem.gov.uk/sites/default/files/docs/2021/04/dno_common_network_asset_indices_methodology_v2.1_final_01-04-2021.pdf

Rolls Royce. (2012, October 30).
Rolls-Royce celebrates 50th anniversary of Power-by-the-Hour.
Retrieved from:
www.rolls-royce.com/media/press-releases-archive/yr-2012/121030-the-hour.aspx#:~:text='Power%2Dby%2Dthe%2DHour'% 2C%20a%20Rolls,per%2Dflying%2Dhour%20basis

The Institute of Asset Management. (2015).
Asset Management - an anatomy.
The Institute of Asset Management.

The Institute of Asset Management (2021).
Climate Emergency Action Planning – Guidance for asset owning organizations.
The Institute of Asset Management.

Acknowledgements

Acknowledgments

This How Asset Management Can Enable the Circular Economy document has been produced by the Institute of Asset Management (IAM) through the significant efforts of the following individuals and organizations, and the Institute would like to thank them for their contributions:

- Carl Waring, Chair, Circular economy knowledge group, Frazer-Nash Consultancy
- Katy Beardsworth, Network Rail
- Thomas Stuart-Delavaine, Frazer-Nash Consultancy
- Kate Jackson, ARUP

This document has been produced with thanks to our IAM Patrons, whose support is greatly appreciated.

With thanks to our IAM Patrons whose support is greatly appreciated

The Institute of Asset Management

the leading professional body
for the asset management community