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SUSTAINABILITY AND RESILIENCE

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Cover image: The TWO ELEVEN commercial project in Cremorne. (Source: David Taylor)

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RESEARCH

CIRCULAR ECONOMY IN THE MANAGEMENT OF CONSTRUCTION AND DEMOLITION WASTE

DISCOVER HOW THE CIRCULAR ECONOMY CAN SUPPORT GREATER RESOURCE EFFICIENCY BY THE REUSE, REMANUFACTURE AND RECYCLING OF MATERIALS.

Sustainable, green building. (Source: Canva)

The Architecture, Engineering, and Construction (AEC) industry are generally low in resource efficiency worldwide.

This poor performance has resulted in serious negative environmental impacts caused by the high rate of construction and demolition waste generation, greenhouse gas emissions, air and water pollution, and forest degradation.

The AEC industry is estimated to be responsible for:

- approximately 40% of energy consumption;
- 30% of CO2 emissions; and
- 40% of total solid production waste globally.

The AEC industry is a large contributor to Australia's gross domestic product (GDP). It is estimated by the Australian Industry and Skills Committee that the industry generates over:

- A$360 billion in revenue;
- contributes a 9% share of the country's total GDP; and
- features a projected 2.4% growth rate in the next five years.

An analysis of government and industry reports shows that the Australian AEC industry suffers from low resource efficiency to an extent exceeding the global average. The National Waste Report (NWR) 2020 indicates that Australia generates 27 megatonnes (mt) of construction and demolition waste annually, a 61% increase on the figures recorded in 2006-2007.

Currently, this waste stream, with more than 44% and 47% generated and recycled, respectively, is the largest source of waste. Furthermore, greenhouse gas emissions in the industry have been quoted by a publication from the University of Adelaide as being higher than in most other regions of the world.

In Australia, GHG emissions per capita are estimated to be three times the global average; Australia is constantly reported as the worst-performing country on climate policy.

To address these issues, one avenue for Australia is to move towards a circular economy that supports a sustainable AEC industry. Indeed, across the Australian landscape, the drivers for a circular economy have gained ground with the increasing consciousness of the fundamental importance of environmental sustainability in uninterrupted growth.

WHAT IS THE CIRCULAR ECONOMY MODEL?

The circular economy (CE) model, as a comprehensive strategy for sustainable development, has already spread throughout the world. This model has been conceptualised as a system that is restorative by design with a core strategic focus on reframing and reorganising materials, and information and energy flows to achieve greater resource efficiency by the reuse, remanufacture and recycling of materials.

Its key premise is that waste minimisation can act as a new source of value for the business. Fundamentally, the concept of the circular economy model encapsulates the tension between limits and growth, advocating for a shift from linear to circular patterns of resource use and management.

Long-established sustainability principles, such as cradle to cradle (C2C) are being reconfigured through this lens. The growing prominence of circular economy frameworks and their associated discourses represent increasing interest in the more specific guiding principles of maintaining sustainable economic systems through retaining, for as long as possible, the added value in products.

No single definition has been universally agreed upon for the term circular economy.

The Ellen MacArthur Foundation's definition of the circular economy as "an industrial economy that is restorative or regenerative by intention" is, however, widely accepted and used by the scholarly community, industry experts and government officials.

The idea of a circular flow for materials and energy is not new, appearing as early as 1966 in a book by Kenneth E. Boulding in which he explained that we should be in a "cyclical" system of production.

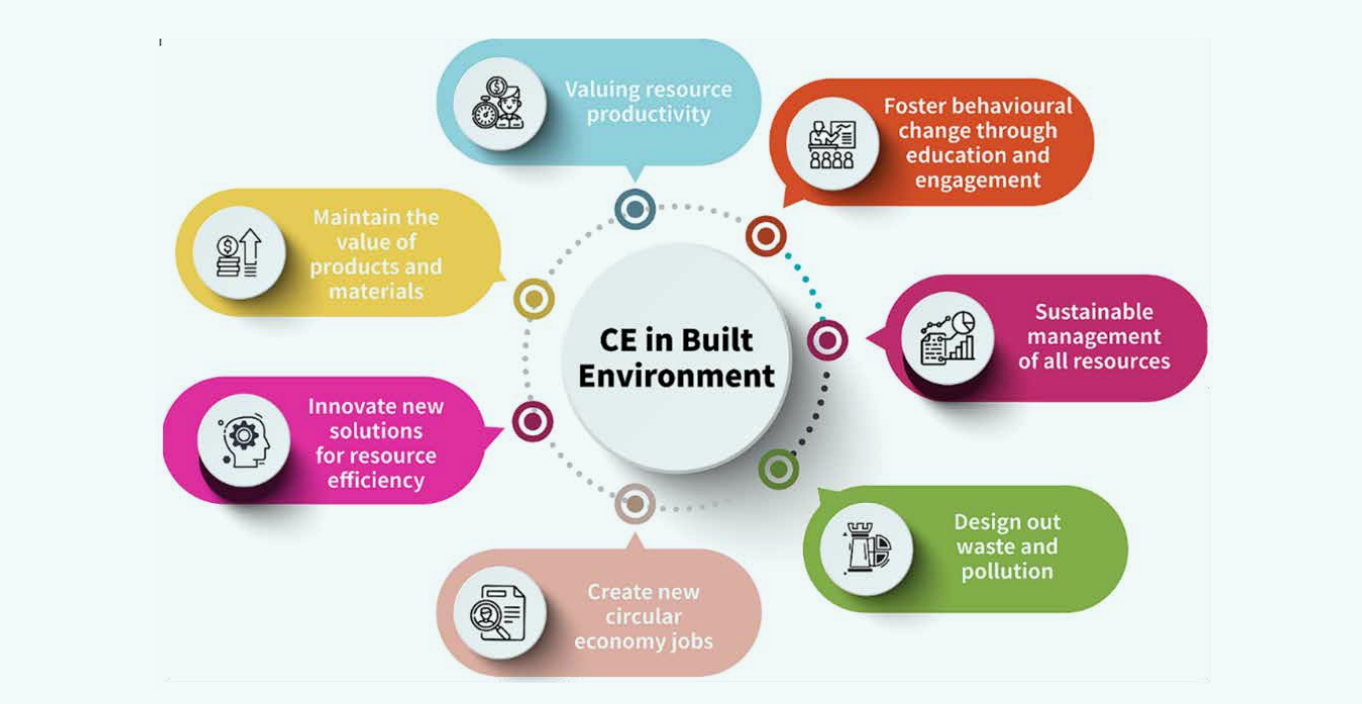
The term circular economy appeared for the first time in 1988 in an article by Allen V. Kneese titled *The Economics of Natural Resources.* This notion was developed further following three major events:

- the explosion of raw material prices between 2000 and 2010;
- the Chinese embargo on rare earth materials; and
- the arrival of the 2008-2009 Global Financial Crisis.

KNOWLEDGE AND THEORETICAL FOUNDATION AND CIRCULAR BUSINESS MODELS

Several sources provide principles for the circular economy that underpin organisational decision making and planning. While having some general overlaps, such as waste recycling, the various circular economy principles are differently defined. A circular economy is underpinned by several principles as depicted below.

More specific guidelines with a focus on the adoption of a circular economy in the AEC industry, however, provide a clearer picture.



Major components of a circular economy in the AEC industry (Source: NSW Government, 2019)

Life cycle stage	Circular economy (CE) practices
Project Design	• Design and use of modular buildings • Design for disassembly of building structures • Design for adaptability of existing buildings • Use of a scale to analyse the level of implementation of CE practices in the company • Use of a simulation in a Building Information Modelling (BIM) model early in the project to analyse the reuse potential of the materials in different types of designs • Use of life cycle analysis to find the benefits of reusing different types of materials in the design stage • Use of materials stock data to help with the reuse of materials in a new building • Anticipation of changes in requirements
Manufacture	• Change of use of materials, by giving ownership to manufacturers to reuse materials after the end of life of the first building • Reuse of secondary materials in the production of building materials • Development of material passports
Construction	• Reuse of building materials in a new construction • Waste reduction • Off-site construction • Prescribing in procurement contracts that waste should be separated on site to facilitate recycling • Favouring of construction systems that incorporate CE thinking • Conserving, updating and sharing information so it can remain valid and relevant during the whole life cycle of the building
Operation	• Use of a tool to evaluate the state of materials during the life span and end of life of a building • Use of water management practices • Minimising recuperative maintenance through preventive maintenance
End of Life	• Analysis of the potential for reuse or recycling of existing materials and whether their use is feasible compared to using new materials • Management of demolition waste • Use of a circularity tool to evaluate existing buildings, thus giving the best possible solutions to refurbishment • Deconstruction of building structures and parts • Requesting detailed information from providers and designers on products, materials and building design

(Source: Adopted from Benachio et al, 2020)

For instance, the European Commission listed eight circular economy principles for building design with a suite of key actions to implement each principle.

Drawing on the previous graph, the table above identifies how the application of a circular economy can achieve value for the AEC industry and identifies priority practices during five stages of a construction project life cycle.

These practices contribute to resource and energy efficiency, reuse of materials, efficient use of spaces and reduced quantity of C&D waste.

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Have a project that you would like our project community to know about?

Do you have a project insight you believe needs to be shared?

Our next theme is CULTURE AND LEADERSHIP and we would love to hear your article ideas. Email communications@aipm.com.au with the subject line 'Paradigm Shift article contribution' and tell us what you have in mind before Friday, 8 October 2021. Our next issue will be out in December 2021.

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