

## **Embracing Circular Economy: a journey seen through the perspective of Sustainability Maturity**

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### **Abstract**

Circular Economy has been progressively acknowledged as a promising and consistent approach to maximizing value by increasing resource productivity, while minimizing resource consumption and related waste. Manufacturing companies operating on a linear fashion are faced with a wealth of potential business benefits derived from a circular economy. However, this transition requires a systemic change mindset, encompassing a wide array of organizational processes and functions: from strategy and business models to take-back and end-of-life management. With a view to supporting the transition of manufacturing companies towards Circular Economy, this article presents a maturity-based approach that supports manufacturing companies to develop and implement strategic roadmaps and action plans for the transition. An analysis of twelve key management practices to manage the transition towards Circular Economy is presented and briefly discussed. Industrial applications of the proposed maturity approach indicate that the maturity approach can effectively strengthen companies' abilities to embrace the beneficial prospects of the Circular Economy.

**Keywords:** circular economy, sustainability maturity, resource productivity

### **1. What is Circular Economy?**

Several corporate and governmental organizations are currently perceiving Circular Economy as a means to unlocking value through increased resource productivity and minimized consumption and waste generation. The potential business benefits of Circular Economy implementation in the European continent alone were recently estimated to be at around €1.8 trillion annually, leading to a number of long-term outcomes, ranging from increased industrial and regional competitiveness to economic growth and job creation (Ellen MacArthur Foundation, 2015b).

Circular Economy is defined by the Ellen MacArthur Foundation as “*an economy that provides multiple value creation mechanisms, which are decoupled from the consumption of finite resources*” (Ellen MacArthur Foundation, 2015b). Clearly in contrast to the traditional linear concept and mindset of ‘take-make-consume-dispose’, the Circular Economy approach pursues the safeguard of the planetary boundaries (Steffen & Stafford Smith, 2013). This is mainly achieved through an increased share of renewable and/or recyclable resources, coupled with a drastic reduction in the consumption of raw materials and energy (EEA, 2016).

## **2. How to make the transition to a Circular Economy?**

The transition towards a Circular Economy entails fundamental changes across the entire collection of processes within the value chain, going from innovation, product design and production to end-of-life strategies, new business development and consumption (EEA, 2016; Nakajima, 2000).

In the pursuit of the potential business benefits derived from the Circular Economy, manufacturing companies are actively engaging in the transition from linearity to circularity (Nordic Council of Ministers, 2015; Tukker, 2015). Several examples of reuse, remanufacturing and recycling initiatives are currently being tried out and streamlined, emphasizing the implementation benefits, charting the main challenges, and disclosing the barriers to be overpowered.

Within such context, several action areas are gathered on a common Circular Economy framework named “ReSOLVE” (Ellen MacArthur Foundation, 2015a), which also includes recycling perspectives. The framework’s acronym stands for **R**egenerate, **S**hare, **O**ptimize, **L**oop, **V**irtualize and **E**xchange. In particular, within the “loop” action area, several efforts are proposed – from remanufacturing of products and components to recycling of materials and extraction of biochemical compounds from organic waste (Ellen MacArthur Foundation, 2015a).

With a view to supporting manufacturing companies’ successful and systematic transition towards Circular Economy, this article presents a maturity-based approach. This approach supports the consistent development and implementation of actionable strategic roadmaps. These roadmaps are developed on top of a gap analysis between a company’s current maturity profile (i.e. “snapshot” of the company’s current situation) and the defined ambition levels towards circular economy (i.e. vision for the company’s future situation), providing a step-by-step guide for companies to manage and measure the transition.

The results offer an indication of how the maturity-based approach can support a structured and successful Circular Economy transition, which can effectively support companies to mature their abilities to embrace the Circular Economy.

## **3. Identifying the key practices for Circular Economy**

In order to support the identification of the key practices for a transition to a circular economy, the following three steps were carried out:

### Step 1: Comprehensive analysis of the main components of Circular Economy

Analysis of the Circular Economy main characteristics and success factors, including business model innovation and service strategies; development of “circular” products, services and solutions; operations and maintenance with optimized lifetime; and strategies for closing the material loop, with a focus on the “four R’s”: remanufacturing, refurbishment, reuse and recycling.

### Step 2: Analysis of success stories and steps taken by manufacturing companies

Analysis of success cases and reports issued by large manufacturing companies and small and medium enterprises (SMEs). These documents were particularly focused on

describing the fundamental steps taken in the transition from a Linear to Circular Economy mindset. The documents had a European focus, but were not limited to this geography. The gist of this step's analysis was the identification of crucial elements which enable companies' prosperous transition to circularity.

#### Step 3: Cross-content analysis between the Circular Economy key elements and the EcoM2 sustainability management practices

Composed of a cross-content analysis between the characteristics, success aspects and key elements of the Circular Economy identified in Steps 2 and 3 with the 77 management practices of the maturity model for Sustainable Innovation (EcoM2). The maturity model uses a triple-bottom line (Elkington, 1997) mindset, covering environmental considerations, social innovation aspects and new business opportunities (economic/financial facets).

### **4. Key practices for the transition towards Circular Economy**

The performance of three steps previously described led to the identification of twelve key sustainability management practices to support the transition to Circular Economy. The twelve sustainability management practices are:

- 1) Engage relevant people from functions across the company to support Sustainable Innovation: key internal stakeholders in the company are to be engaged towards enabling and supporting Sustainable Innovation, representing different functions across the board (e.g. marketing, manufacturing, supply chain etc.);
- 2) Ensure commitment, support and resources to conduct the activities related to Sustainable Innovation: a transition to a Circular Economy entails significant changes in the business processes (e.g. business model, product innovation, supply chain management, etc.) – therefore, commitment, support and resources from top management are success factors;
- 3) Develop skills and expertise for integrating a service value stream: employees across the total service value stream (end-to-end) should be properly trained with relevant skills to performing activities related to Sustainable Innovation;
- 4) Ensure alignment among strategic and operational dimensions concerning Sustainable Innovation: companies should make sure that the strategic drivers are accurately deployed into actionable operational activities in order to carry out improvements and change;
- 5) Create economic value in a way that also creates value for society by addressing its needs and challenges: several social needs and challenges may present companies with unprecedented opportunities for capturing value through new offerings;
- 6) Enhance active stakeholder engagement, acceptance, cooperation and collaboration to aid co-creation for social innovation: joint programs, partnerships and co-creation efforts should be devised in order to aid a thorough and consistent implementation of social innovation across the value chain;
- 7) Search for value proposition opportunities throughout the entire product life cycle: companies should systematically search for value creation mechanisms

from a lifecycle perspective – spanning from raw materials and manufacturing, to use and end-of-life;

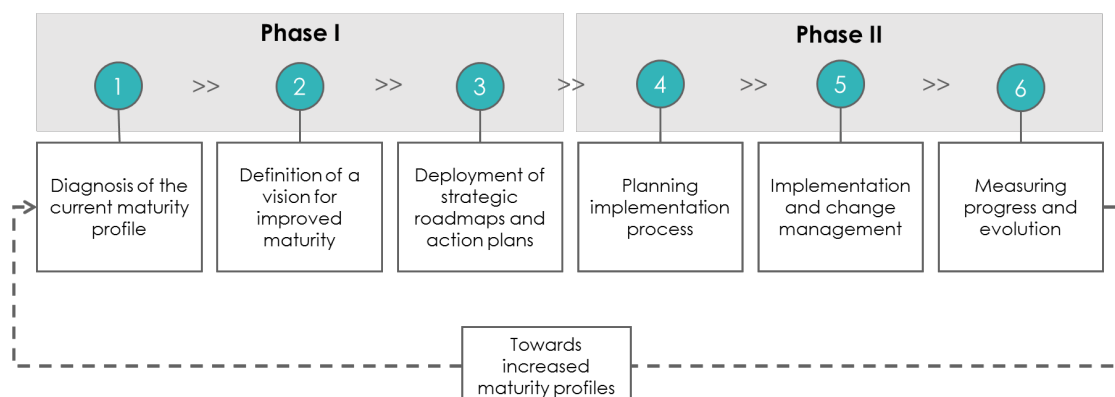
- 8) Define the end-of-life and reverse logistics strategies since the early stages of business and product development: strategies for end-of-life management and reverse logistics should be built, ranging from take-back policies and engagement models to logistic operationalization;
- 9) Scale-up innovation initiatives to embrace a system-change – view problems and their solutions through a systems perspective: a systems perspective should be constantly and systematically sought in order to derive innovative solutions to complex and densely interconnected social problems;
- 10) Measure and communicate the business benefits of Sustainable Innovation: companies should develop structured mechanisms to capture and measure the business benefits gained from Sustainable Innovation in order to ensure continued commitment, resources and buy-in;
- 11) Monitor the product sustainability performance during use/operation and end-of-life: the product's sustainability performance – covering the triple bottom-line aspects – should be constantly monitored in order to provide companies with rich data regarding use and end-of-life. This mechanism can serve internal purposes (feedback into the innovation processes) or external ones (communicate performance and recommendation to customers);
- 12) Strategically consider Sustainable Innovation in company portfolio management: innovative companies should move away from incremental, stand-alone projects to a consistent implementation of Sustainable Innovation considerations across the entire company's portfolio of products and services.

## **5. How to implement the key practices and understand the gap?**

The maturity approach is based on the latest advancements of the Ecodesign Maturity Model (EcoM2) (Pigozzo, Rozenfeld, & McAloone, 2013), which has been developed over the past decade. The EcoM2 has also been successfully applied by manufacturing companies to support their systematic implementation of ecodesign and related strategies (Pigozzo, Grandi, & Rozenfeld, 2013; Pigozzo, Pattis, McAloone & Rozenfeld, 2014). More recently, the maturity model has been expanded to incorporate social innovation (Pigozzo & McAloone, 2015) and product/service-system practices (Pigozzo & McAloone, 2016), covering businesses processes at the strategic, tactical and operational levels across the company's value chain.

The approach is applied in continuous improvement cycles, which are organized in two phases, each one containing three steps, as displayed in Figure 1. The fundamental unit of analysis are the organization's business processes (e.g. business development, innovation, product development and related processes). The first step is a diagnosis of the current maturity profile, which enables the identification of strengths and gaps for sustainability maturity. Second step involves the definition of the vision, based on drivers and goals for Sustainable Innovation, which could be Circular Economy implementation, for instance. In the third step, the gap between the vision and the current maturity profile drives the development of a strategic roadmap, which supports the definition of improvement projects. Subsequently, the planning for the implementation of each project

is performed (step 4), which supports the actual implementation and change management (step 5). Finally, step six deals with the measurements of progress and evolution.



**Figure 1:** Overview of the maturity-based approach to sustainability implementation

Guided by the company's fundamental drivers, the approach enables adequate, aligned measurement and continuous enhancement of the company's sustainability maturity profile, at the business unit or organization levels. This approach connects the intentions and activities on the strategic, tactical and operational levels of the organization, by focusing on the integration of sustainability into both the business and innovation processes. The maturity approach has been developed over the past 10 years and is currently being applied in a large number of globally leading companies.

In addition to providing a way for measuring and enhancing sustainability integration according to a given business unit's sustainability drivers and goals, the approach supports benchmarking and harmonization of maturity profiles across business units and regional sites. On one hand, benchmarking enables solid knowledge sharing and universal growth, both within the organization and across sectors. On the other hand, harmonization across business units and product categories results in entire portfolios with consistent sustainability performances. Furthermore, regular and periodic measurements of sustainability maturity establish a clear picture of evolution over time, which can be readily communicated at all levels across the organization. New initiatives can be identified and prioritized, and the resources allocated to sustainability enhancement in the company can be optimized and coordinated across the organization.

## 6. Final remarks

This article introduced a maturity-based approach to supporting the Circular Economy transition within the manufacturing space. The approach was based on the full-fledged version of the Ecodesign Maturity Model (EcoM2) – a management framework that supports companies to achieve consistent implementation of environmental issues, social innovation and new business development. While the transition to Circular Economy remains a multi-faceted and complex endeavor, the maturity-based approach offers a systematic way to addressing the question. As it cuts through the complexity of selecting and prioritizing actions to be taken, the approach offers companies a research-backed body of knowledge, which secures a flat journey towards unlocking the wealth of benefits of Circular Economy models.

A similar maturity-approach based on diagnosis, vision and roadmap development based on a gap analysis can be employed to any other strategic drivers linked to

sustainable innovation at companies (e.g. compliance, Sustainable Development Goals, sustainability strategy, etc.).

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