

CIRCULAR ASSESSMENT TOOLS: ASSESSING CIRCULARITY IN OLIVE OIL MILLS

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ABSTRACT

In the last few years, since the implementation of circular economy (CE) is necessary for the transition to a sustainable food system, academics and practitioners have paid increasing attention to the CE concept. CE evaluations today have not demonstrated satisfactory results to meet the context of CE, as most of the indicators are focused on resource efficiency, waste disposal and recycling rates, or a particular stage of the product or process, ignoring the system perspective. In spite of the research community's extensive work, an effective tool to measure circularity in the agri-food industry has not yet been developed.

This study aims to highlight the CE tools, based on scientific literature and practice, so as to identify those that could assess circularity in olive oil mills. Due to the uncontrolled disposal of waste from olive oil mills, the Mediterranean countries that produce the majority of olive oil have to cope with major environmental issues. Therefore, the assessment of circularity in order to identify the transition to CE in this sector is of great importance for these countries.

Keywords: *circular economy in olive oil mills, circularity assessment, assessment tools of circular economy in olive oil mills*

1. INTRODUCTION

The concept of CE has recently gained tremendous attention from both academics and practitioners. CE sets the foundation for sustainable development (SD), involving technology advancements as well as cultural, behavioral and systemic changes (Chrispim et al 2023). During

the last few years, there has been a rise in empirical studies that examine SD and CE goals. In order to objectively measure and compare results, effective models and techniques must be employed. Thus, bad practices could be identified and the action plan of each country could be adjusted at the appropriate time (Skrinjaric 2019). Hence, it could also be used to drive policies on the topic and achieve a higher level of sustainability (Rocchi et al 2021).

In spite of the increasing popularity of the CE, there is still no established tool widely used for assessing companies' circular economy-related aspects. Existing CE assessment tools are not always definite about how metrics or indicators were chosen (Sacco et al 2021).

Agri-food industry, one of the most important sectors politically and economically, has a significant impact on human capital employment, nutritional security, and environmental sustainability, since it consumes an enormous amount of resources. CE is thus necessary in the agri-food sector, since the adoption of sustainability and CE models can reduce environmental burdens and enhance resource efficiency (Silvestri et al 2022).

This study, based on scientific literature and practice, focuses on identifying CE tools aiming to ascertain those that can be used to assess circularity in agri-food sector and more specifically in olive oil mills. Since olive oil production is a vital economic activity that poses huge environmental problems in regions, such as Mediterranean that produces the majority of the global olive oil production, the assessment of circularity in order to identify the transition to CE is imperative.

2. CIRCULAR ASSESSMENT TOOLS

Though several tools have been developed to measure CE recently, they lack a systemic approach. There is also often an inconsistency in the form and content of CE metrics and indicators, causing misunderstanding (Corona et al., 2019), since they focus primarily on indicators related to recycling rates, waste disposal and resource efficiency (Parchomenko et al., 2019), and not on a specific stage of the process or product (Chrispim et al 2023).

Various tools are available to measure organizations' circularity. Nevertheless, they were only launched a few years ago, and most of them were launched in the 2020s, and thus they are not widely used yet by organizations. Several of these tools were developed as a response to recent sustainable policies at the European level (renewable energy, waste reduction, repair, and recycling). It should also be noted that most of these tools are available online for free, making them useful for increasing sustainable awareness within organizations and their employees (Valls-Val et al 2023).

3. METHODOLOGY

A review of the CE evaluation methods has been conducted using databases such as Google Scholar, ResearchGate and Scopus. Initially the keywords used were “circular economy assessment tools in olive oil industry”, “circularity assessment tools for olive mills”, “circularity measurement tools for olive oil industry”, “circular economy assessment tools in the agri-food sector” and “circularity measurement tools in agri-food industry”. And then since the search results were poor, a search was made with broader keywords such as "circularity tools" and "circular economy measurement tools".

4. CIRCULAR ASSESSMENT TOOLS IN AGRIFOOD INDUSTRY AND OLIVE OIL INDUSTRY

As part of their collective efforts to accelerate the transition to CE for the food system, corporate and government leaders have set objectives, identified barriers, and suggested solutions. In most

cases, however, the focus is on the theoretical and qualitative analysis of supply chains in isolation, without providing a holistic, quantitative analysis of supply chains as a whole (Baratsas et al 2022).

While CE research in the agri-food sector has a wide range of application, from the scientific literature it has been revealed that, when it comes to supply chain stages, there is no single leading tool (e.g., LCA) or variables selected to quantify the impact (Esposito et al 2020). Therefore, studies cannot be compared or reproducible, which leads to a lack of comparability and reproducibility. It would therefore seem more appropriate to adopt an approach that incorporates the results of previous scientific research into the entire food supply chain system, resulting in a comprehensive understanding of priorities to be addressed and challenges to be overcome (Fassio et al 2022).

Developing assessment tools requires identifying barriers to adopting CE measurement approaches so that mitigation measures can be developed. Financial resources, time availability, high level of method complexity (Pigosso and McAloone, 2021), and staff skills are among the barriers (Chrispim et al 2023). Thus, the suggested tools in Table 1 were chosen to be free (although some require previous user registration) and easy to use.

Table1. The proposed assessment tools

Tool	Developed by	Indicators	Type	Level of application	information
Non-Academic					
CIR Celligence	Boston Consulting Group	scale:0-100	Qualitative and Quantitative	Company	...founded on five key principles, the tool consists of qualitative, quantitative, visibility, and transparency. The plan can be tailored to the specific needs of any company (BCG 2023).
Circulytics	EMF in collaboration with 13 Strategic Partners and member companies	37 across 11 themes scale:0-100/A-E	Qualitative and Quantitative	Company or sub-unit	..a Qualtrics platform tool which supports a company's transition towards the CE, irrespective of its size, complexity or industry. ..assesses a company's circularity across its entire operations, beyond products and materials flows (EMF 2023)
Circular Transition Indicators (CTI Tool)	World Business Council for Sustainable Development and Circular-IQ	9 scale: 0–100	Qualitative	Company Business Unit Product	..can use the tool to structure data and calculate outcome indicators, enabling to take concrete steps towards their circularity goals. (CTI Tool 2023).
Circularity Calculator	IDEAL & CO Explore.				..developed as part of a four-year EU-funded project, ResCoM - Resource Conservative Manufacturing
MCI (Material Circularity Indicator)	EMF and Granta Design	1 scale: 0–100	Quantitative	Company or Product	..is part of ‘Circular Indicators Project’ ...companies can measure the circularity of their material flows for selected products ... support decision-making on product design and material procurement at a company level
Circular	Evans and		Qualitative	Product	Website, 33 questions across life

Economy Toolkit (CET)	Bocken 2013				cycle stages (CET 2023)
The Circular Canvas	Circulab			Company	Ensure economic viability, ecosystem health and sustainability by embracing systems thinking (Circulab 2023).
Academic Tools					
MAking the Transition to a Circular Economy (MATChE Readiness Assessment)	Tool developed by the Technical University of Denmark.	9 (scale: 1-5)	Qualitative	Company	...an eight-dimensional framework developed for manufacturing companies (Organization, Strategy and Business Model Innovation, Product and Service Innovation, Manufacturing and Value Chain, Technology and Data, Use, Support and Maintenance, Takeback and End-of-Life Strategies, and Policy and Market) (Pigosso and McAlóone 2021;TUD 2023)
Circularity and Maturity Firm-Level Assessment Tool (CM-FLAT)	Sacco et al 2021	19 (scale:0-100)	Qualitative	Company	...developed after a comprehensive collection of CE metrics and a systematic literature review (Sacco et al 2021)

For the needs of this paper, the tools that apply to a company or product level were selected. It is important to note that all of the tools above are free of charges and open-source. The only exceptions are CM-FLAT and MCI (in Excel format), which currently do not have an online interface. In general, English has been chosen as the predominant language, though some tools offer a more diverse range of languages. A further observation is that Circulytics and CIRCelligence are hybrid tools (include both quantitative and qualitative questions), while MCI and CTI Tool are quantitative tools that require input from an organization, and the others are qualitative tools that require responses to qualitative questions (Valls-Val et al 2022). Circulytics (more than 1250 businesses have already signed up to complete the assessment) and CTI Tool (over 2000 accounts in 94 countries, teams of every size, shape and industry have already made the CTI Tool) are the most commonly used tools in organizations, perhaps because of their affiliation with internationally renowned organizations (CTI 2023).

Admittedly, there are clearly differences between all the tools in several parts. Due to the differences in tool types (qualitative or quantitative) the results cannot be compared. Furthermore, there are significant dissimilarities among the tools, such as the number and the type of indicators included, or the way they are presented. Moreover, not all tools include a global or total CE indicator, owing to a lack of standardisation in this area (Vals Val et al. 2023).

It is evident that both researchers and practitioners have made significant efforts in the past few years to develop CE assessments, which is reflected in the existence of a number of independent instruments whose validity, however, is questionable because methodology and theoretical bases are not transparent. A company's CE performance can be measured efficiently using online valuations, but no references to their scientific reliability are available (Sassanelli et al 2019). Corporations or large companies have developed (or used) CE assessment tools based on Circulytics for example, such as Coca Cola (Sacco et al 2021), and Sovena, a Portuguese company, leader in seed and olive oils that used CTI to assess its transition to CE (CTI Tool 2023).

5. CONCLUSION

This paper indicates a variety of evaluating tools that differ significantly at many points, which may lead to redundancy and make comparison difficult. Although academic debates on the subject have intensified, and attention from practitioners and policymakers has grown significantly, the field of CE lacks standardization and uniformity. This lack of harmonization may lead to limited acceptance of CE assessment approaches.

This study provides a good starting point, but no other research has investigated the usefulness and application of the tools reviewed. Therefore, this research should continue by applying the tools to multiple case studies in order to compare the results more thoroughly, observe how supply and demand are converging, and observe how the tools are applied to agriculture.

As a result, it is essential to create a standardized evaluation tool that addresses all the topics and areas discussed, takes into account the specificities of agri-food industries, is simple to use, and delivers accurate and comprehensible results. The tool should include both qualitative and quantitative elements of the assessment. It would be equally beneficial to create a simple-to-use standardized tool for companies in the agri-food sector, and specifically in olive oil industry, that assesses their level of circularity and provides improvements to move towards more sustainable practices.

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