Methodology to Assess the Circularity of Industrial Processes

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Abstract : Circular economy is a popular concept used in many companies nowadays. Some industries are better forwarded to this reality than others, but the textile industry is a sector that needs bigger attention due to the lack of recyclability and second use of its products, as well as the industrial effluents generated by the manufacturing processes. For these reasons, the zero-waste goal and the European objectives are further from being achieved. In this context, a need arises to provide an effective methodology that allows to determine the level of circularity of textile companies. Regarding the complexity of the circular economy concept, few factories have a specialist in sustainability to assess the company's circularity or that have the ability to implement circular strategies that could benefit the manufacturing processes. Although there are several methodologies to assess the circularity in companies and in specific industrial sectors, there is not an easy go-to methodology applied in factories aiming for cleaner production. Therefore, a straight-forward methodology to assess the level of circularity, in this case of a textile industry, is presented and discussed in this work, allowing any company to measure the impact of their activities. The methodology developed consists in calculating the overall circular index (OCI) by evaluating the circularity of four key areas – Energy, Material, Economic and Social – in a specific factory. The index is a value between 0 and 1, where 0 means a linear economy, and 1 is a complete circular economy. Each key area has a sub-index, obtained through Key-Performance Indicators (KPIs) regarding each theme, and the OCI reflects the average of the four sub-indexes. Some fieldwork in the appointed company was required in order to obtain all the necessary data. By having separate sub-indexes, one can observe which areas are more linear and which ones are more circular. Thus, it is possible to work on the most critical areas by implementing strategies to increase the circular index. After these strategies are implemented, the OCI is recalculated to check the improvements made and if any other changes in the remaining sub-indexes occurred. As such, the methodology in discussion works through continuous improvement, constantly reevaluating the circularity of the factory and improving it. The methodology is also flexible enough to be implemented in any industrial sector, by adapting the KPIs. This methodology was implemented to a selected Portuguese Small and Medium-sized Enterprises (SME) textile industry and proves to be a relevant tool to measure the circularity level of the factory. It was witnessed that it is easier for non-specialists to evaluate circularity and identify possible solutions to increase its value as well as learn how one action can impact their environment. At the end, energetic and environmental inefficiencies were identified and corrected, increasing the sustainability and circularity of the company. Through this work, important contributions were provided, helping the Portuguese SME to achieve the European and UN 2030 sustainable goals.

Keywords : circular economy, circularity index, sustainability, textile industry, zero waste
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