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The Need for Standardization and Harmonization in Product Carbon Footprints for Accurate Accounting

Zaid Thanawala

Sustainability Scientist, San Francisco, CA

Introduction

Reducing greenhouse gas emissions is important for companies that want to lessen the effects of climate change and meet global sustainability goals. Companies are also under increasing pressure to comply with international agreements such as the Paris Agreement, which sets targets for reducing carbon emissions. (Seroka-Stolka & Fijorek, 2020). Many companies see the value in cutting their carbon footprint, not just to follow regulations but also to boost their social responsibility and stay competitive in the market. Reducing GHG emissions is a critical component of corporate social responsibility, as it demonstrates a company's commitment to environmental stewardship and sustainable development (Rogowska & Wyrwa, 2021). Research has also shown that companies that proactively reduce emissions can gain a competitive edge by appealing to environmentally conscious consumers and investors (Lee & Kim, 2021). Furthermore, implementing energy-efficient practices and reducing emissions can lead to significant cost savings in the long term, as seen in the optimization of manufacturing processes (Cai et al., 2019). While it is clear that reducing greenhouse gas emissions has many benefits, companies often encounter difficulties when trying to implement these strategies (Lika & Jeremić, 2014). High upfront costs, limitations in technology, and the complicated nature of supply chains can create major obstacles to effective carbon management (Clery et al., 2021). Furthermore, the absence of standardized methods for measuring and reporting emissions can make it hard to track progress and compare results across different industries (Laila & Jusoh, 2018). Despite these challenges, the increasing focus on sustainability and the growing demands from stakeholders mean that companies need to make emission reductions a key part of their long-term planning and strategy.

Methods to quantify emissions

Life Cycle Assessment (LCA)

Life Cycle Assessment (LCA) provides a methodological pathway in order to report and subsequently reduce emissions. It offers a clear way to assess the environmental effects of a company's activities, products, and services over their entire life span. This method helps companies find areas where they can improve and develop effective plans to reduce emissions.LCA provides a detailed analysis of emissions across the entire life cycle of a product or service, from raw material extraction to disposal (Meinrenken et al., 2020). By identifying the stages with the highest emissions, LCA helps companies target specific areas for improvement, such as the use of recycled materials in asphalt production to reduce emissions (Huang, 2007). LCA aids in making informed decisions about technology and process optimizations, as demonstrated in the petrochemical industry where different LCA approaches can lead to varying emission outcomes (Bajdur et al., 2016). While LCA is a powerful tool for reducing GHG emissions, it also presents challenges. The complexity of assessing interlinked industries and the need for comprehensive data can make LCA implementation difficult (Mungcharoen et al., 2021). Companies must balance the depth of analysis with practical considerations, such as the availability of data and resources, to effectively utilize LCA in their sustainability strategies.

Product Carbon Footprint (PCF)

The concept of a Product Carbon Footprint (PCF) and Life Cycle Assessment (LCA) are both integral to understanding and managing the environmental impacts of products, but they differ in scope and application. A PCF specifically measures the greenhouse gas (GHG) emissions associated with a product throughout its life cycle, expressed in terms of carbon dioxide equivalents (CO2e). A PCF is defined as the total GHG emissions associated with a product throughout its life cycle, from raw material extraction to disposal. It is a measure of the product's contribution to global warming potential (Song et al., 2016). PCFs are increasingly used as a business indicator, especially in industries like automotive and electronics, where regulatory requirements and consumer preferences are driving the need for transparency in carbon emissions (Reid & Rout, 2020). In contrast, LCA is a broader methodology that assesses multiple environmental impacts of a product, including but not limited to carbon emissions, across its entire life cycle. The distinction lies in the focus of PCF on a single impact category—carbon emissions—while LCA encompasses a wider range of environmental factors. PCF can be seen as a subset of LCA, focusing specifically on carbon emissions. It is often used as a starting point for companies to improve sustainability by targeting the most significant impact category—GHG emissions (Song et al., 2016). Both PCF and LCA are used to inform decision-making in product design and supply chain management. (Meinrenken et al., 2020).

Issues that need addressing

There are significant gaps in the data related to PCFs within companies and in LCA databases (Dieterle & Viere, 2021)
(Finkbeiner et al., 2014). Additionally, there is a lack of experience and knowledge on how to prepare and share this data consistently. The aim of this paper is to outline the main challenges and needs, including issues with data formats, quality, confidentiality, and comparability of PCF data. The paper also seeks to provide practical suggestions to support ongoing efforts to improve the exchange of PCF data along supply chains, focusing on methods that align with industry needs.

Creating reliable LCAs requires effort from all parts of the value chain. Most dependable information is only accessible to the company managing the specific process, and knowledge about related processes is often limited. These external processes usually have the most significant impact on the overall footprint. Therefore, companies that operate in isolation struggle to produce PCFs with a high level of data accuracy (Logaras, 2008). Current LCA results and PCFs depend on many assumptions, estimates, and various data sources, which often reflect general industry averages instead of specific supply chain details. This uncertainty makes it difficult for both consumers and companies to make informed decisions based on these indicators (Lasvaux et al., 2015).To address this issue and create clear footprint information, sharing reliable data among industry participants is essential. This paper aims to present a viable method for sharing trusted PCF data. First, the paper dives into outlining the current situation regarding the different guidance documents for PCF assessments and the challenges that come with them. Following that, the paper describes a future approach for PCF sharing, focusing on key factors that can build trust while still protecting confidential information.

Existing Standards and Methods

The management of sustainability information and the calculation of carbon footprints are governed by a variety of standards and guidelines, each with its own methodologies and focus areas. These frameworks aim to provide consistency and transparency in reporting environmental impacts, yet they often differ in their approaches, leading to challenges in harmonization. The ISO 14000 family, including ISO 14001, 14040, 14041, 14043, and 14064, provides comprehensive guidelines for environmental management systems and carbon footprint calculations. These standards emphasize LCA and are widely used for assessing the environmental impact of organizations and products (Aristizabal & Manosalva, 2021) (Loyarte-López et al., 2020). Additionally, documents like the Environmental Footprint (EF) method and the Pathfinder framework have been released (Pelletier et al., 2014). The European Commission introduced the EF to enhance the accuracy and consistency of environmental performance assessments and to enable sharing results through a digital product passport. The World Business Council for Sustainable Development (WBCSD) developed the Pathfinder to improve the methods for evaluating and sharing product carbon footprint data. However, the reliability of reported sustainability information is a concern, especially when data is not standardized or comparable across organizations. This issue is exacerbated by the lack of mandatory information content in disclosures (Tóth et al., 2021). There is a need to harmonize the existing guidelines since the comparability of assessment results is not assured. This requires industry stakeholders to work together to create these rules within a structured framework (Minkov et al., 2020).

Data Exchange Options

Existing Options

Sharing information about LCAs is crucial for promoting sustainability and transparency within supply chains. The successful implementation of LCAs hinges on the availability of high-quality, reliable data. Significant initiatives such as the Product Environmental Footprint (PEF) and Environmental Product Declaration (EPD) programs, along with collaborative projects like Catena-X and the World Business Council for Sustainable Development's (WBCSD) Pathfinder initiative, underscore the importance of establishing a robust data foundation. A major challenge these projects face is the need to standardize data exchange protocols to facilitate future LCAs effectively. LCAs can be categorized by varying levels of detail in the data they utilize, which can significantly influence the consistency and acceptance of the findings among all stakeholders involved (Lesage et al., 2018). At the most granular level, unit processes provide comprehensive insights into specific processes, offering a detailed view that can enhance the accuracy of assessments. However, this level of detail can also pose risks, as it may inadvertently expose sensitive business information, including intellectual property, which companies are often reluctant to share due to concerns about maintaining competitive advantages. Conversely, aggregated processes condense essential information necessary for conducting Life Cycle Impact Assessments (LCIAs) but lack the granularity that unit processes provide. While this aggregation helps safeguard sensitive details, it can complicate LCIA calculations if the data is not adequately aligned or matched (Gerber et al., 2011). The most straightforward form of LCA data consists of calculated indicator results. These figures are typically easy for non-experts to interpret and carry a lower risk of disclosing confidential information, thereby fostering a willingness to share data throughout the supply chain. However, the simplicity of these results can come at a cost; the lack of detail may impede transparency, which is vital for fostering effective collaboration among stakeholders (Okrasinski et al., 2012). While the sharing of LCA data is essential for advancing sustainability efforts, balancing the need for detailed information against the necessity of protecting sensitive business data remains a complex challenge. Finding a middle ground that allows for both transparency and confidentiality will be key to enhancing collaboration and driving meaningful progress in sustainable supply chain practices (Kuczenski, 2019).

Looking Ahead

One way to improve transparency in sharing calculated indicator results is to create a data exchange system for PCFs. This system would ensure quick and secure data transfer. Ideally, it would connect with internal accounting systems, enabling effective performance tracking, consistent calculations, and reporting, as well as supplier engagement and certification. Such systems require clear interfaces and data exchange formats, including unique identifiers for specific products. This setup would allow for an accurate data mapping and ensuring that data points are directly linked. This would facilitate smooth updates across supply networks, such as information on energy suppliers used throughout value chains. The data must adhere to standard formats for how it is grouped, the flow of emissions, and the methods used for impact assessment. Standards and product category rules should provide clear instructions to those modeling, using, and verifying PCFs. It is essential to include results and decisions regarding system boundaries, allocations, and other important parameters in a format that machines can read. This approach would allow the use of upstream PCFs as an emission factor in larger assessments. A reliable trust mechanism, which includes a certification process based on regular third-party audits, can improve transparency in sharing calculated results. A dedicated infrastructure for exchanging PCFs and verifying third-party audits would enable the easy use of supplier PCFs as emission factors in assessments.

Industry Efforts

In recent times, there has been a concerted push to enhance the dissemination of PCF information across the supply chain. A central challenge faced by stakeholders engaged with PCFs or emission factors from suppliers is the necessity for a consistent methodology and the effective utilization of this data. To address this, one promising strategy involves the establishment of stringent guidelines that curtail individual decision-making, thereby fostering a more uniform approach through the further standardization of methodologies. Notable initiatives such as Catena-X within the automotive industry, Together for Sustainability in the chemical sector, and the Pathfinder initiative spearheaded by the World Business Council for Sustainable Development (WBCSD) are actively pursuing this objective. Another viable strategy is to solicit from suppliers a more comprehensive and clearly defined set of metadata regarding their PCFs. This additional information can showcase the assumptions and methodologies employed, thereby empowering practitioners to make well-informed decisions about the inclusion of a supplier's PCF in their own calculations. By incorporating analytical indicators or quality metrics, practitioners can better assess whether the provided PCF aligns with their own methodological frameworks and quality benchmarks. While the first approach may initially appear more attractive due to its potential to ensure a high degree of compatibility within a singular PCF sharing scheme, the second approach offers the flexibility needed to integrate diverse schemes and leverage PCFs derived from established corporate programs and environmental product declarations. Striking a balance between these approaches, or finding an effective combination of both, remains an ongoing challenge. Recently, initial drafts of frameworks aimed at this goal have been circulated among relevant stakeholders. However, another significant hurdle lies in the secure and efficient exchange of PCFs and certifications throughout the supply chain, particularly through digital systems. Initiatives such as Catena-X, ESTAINIUM, and the AAS are concentrating their efforts on developing the necessary sharing infrastructure, while other initiatives are also exploring this critical aspect. Nevertheless, a comprehensive digital infrastructure plan that would dictate the ease with which PCFs can be exchanged and the level of trust that can be placed in them has yet to be unveiled. The certification processes for PCFs will play a pivotal role in shaping this exchange landscape and the requisite data formats. Although some Environmental Product Declaration (EPD) programs and industry-specific certification schemes have successfully validated a substantial number of footprints, the current scale of these efforts falls short of establishing a robust trust mechanism applicable across entire supply chains spanning multiple industries. Several initiatives are actively engaged in addressing this gap, working towards a future where reliable and standardized PCF sharing can be seamlessly integrated into supply chain operations.

Conclusion

The increasing demand for transparent and consistent Product Carbon Footprint (PCF) data has emerged as a crucial concern among regulators, investors, and consumers alike. This increased interest underscores the necessity for detailed, specific data rather than relying on generalized industry averages, which can obscure the true environmental impact of individual products. As stakeholders recognize the importance of accurate PCF data, various initiatives are being undertaken to enhance its quality and establish a more interconnected framework for sharing this vital information. To facilitate meaningful comparisons across products and industries, it is imperative to learn from the diverse initiatives currently in progress. Developing compatible data formats and standardized methodologies will enable entities to effectively communicate their carbon footprints, fostering a culture of transparency and accountability. Achieving this goal requires collaborative agreements on technologies for data sharing and verification processes, which will simplify the exchange of information and ensure its reliability. Research institutions have a pivotal role to play in this landscape, serving as mediators or overseers of industry initiatives. Their expertise can help bridge gaps between different sectors and promote best practices for data collection and reporting. Moreover, the collaboration between the industry and policymakers is essential to establish common objectives that are equitable and applicable to both large corporations and small enterprises across various sectors. By working together, these stakeholders can create a robust framework that not only enhances the quality of PCF data but also drives meaningful progress toward sustainability goals on a broader scale.

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