Implementation of Product Carbon Emission Standards

An analysis of barriers and opportunities for start-ups

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1   The potential of applying product carbon emission standards in start-ups

Due to climate change and growing sustainability expectations, companies are obliged to have an overview of their carbon emissions along the supply chain (SC) to gain competitive advantage (Aivazidou et al., 2014). The approach of carbon accounting is a fast evolving area of sustainability management and comprises a variety of methodologies. Entrepreneurs are urged to take measures against climate change and to transform SCs into low-carbon ones in order to reduce the Product Carbon Footprint (PCF) of a company (Cojoianu et al., 2020; He et al., 2019). Especially multinational companies start to implement reporting practices to track their emission performance along the value chain as a result of diverse internal and external pressures (Comyns, 2018).

For startups however, it is more demanding to standardize their accounting and reporting.

A definition of start-ups is given by Röhl & Engels (2021) who describe those as "[…] young companies that were founded within the last ten years and that use an innovative technology or use a new business model, pursuing high growth." (p.382). Their climate performance and the development of their business performance often are not synchronized and reveal further obstacles (Leendertse et al., 2020). So far, large companies have been the focus of research on Product Carbon Emission Accounting (PCEA), which is due to a lack of standardized assessment processes and a lack of relevance of supranational regulations for small and medium-sized enterprises (Hendrichs & Busch, 2012).

It can be concluded that founders are largely aware that economic goals must be combined with ecological goals. Nevertheless, they are only limited in their ability to perform a PCF assessment which presents an essential measurement of climate performance. As this lack of ability is likely to hinder the positive development of newly founded start-ups and their market position in tomorrow's competition, reasons for this must be identified (Shin & Searcy, 2018).

This leads to the following research questions (RQ):

RQ 1: Which are barriers and opportunities for start-ups when trying to assess the carbon footprint of their products?
RQ 2: What is necessary to drive start-ups to continuously report their products' carbon emissions?

This paper intends to showcase barriers and opportunities in implementing emissions standards. By providing an overview, actions and necessary business conditions can be derived to improve carbon emission reporting processes in start-ups. This is meant to drive start-ups establishing Product Carbon Emission Standards (PCES) in their regular accounting processes. Identifying expected barriers and potentials of PCF, supports the adaptation of existing processes and strategies to strengthen sustainability in line with standards.

2   Product carbon emission standards - A managerial solution for emerging challenges

A variety of different standards has been set on national and international levels during the last years. PAS 2050, the GHG Protocol and ISO 14067 are three relevant standards with an individual guideline for product emission assessment and are widely applied on an international level (Cordero, 2013). The standards' formats imply that PAS 2050 and ISO 14067's objectives were to standardize carbon footprint accounting systems, but the **GHG Protocol** aspires to offer comprehensive assessment and reporting guidelines. With a basic version first announced in 1998, the GHG Corporate Accounting and Reporting Standard introduces methods to calculate and disclose an inventory of GHG emissions and removals related to a particular product or company (Greenhouse Gas Protocol, 2016). This concept was created for businesses and organizations of all sizes and from all industries. The Product Life Cycle Accounting and Reporting Standard emphasizes the complete life cycle assessment of products whereas the basic Corporate Standard is on an organizational level representing a company's emission inventory. PCFs are calculated by help of three scopes. Scopes 1 (direct emission under the control of the reporting company) and 2 (emissions from purchased energy) account for less than 25% of the total direct and upstream footprint, respectively. Scope 3's indirect emissions from acquired and sold goods contribute to a more comprehensive approach (Cordero, 2013).

3   Methodological approach

This paper contributes to the research by analysing the hurdles that start-ups in particular face when introducing PCES. A **triadic qualitative approach** allows three different perspectives on the topic. A literature review forms the basis, which is completed by eight expert interviews and action research in form of a product emission analysis of a toothpaste. The **state-of-the art literature** on implementation barriers and opportunities is presented by help of category systems. Regarding implementation barriers four categories could be identified: Data barriers, barriers associated with carbon emission standards, barriers associated with knowledge and management related barriers. Besides implementation barriers, numerous opportunities associated with the implementation of emission standards are identified in the literature. The following main categories could be identified: Opportunities regarding optimization, opportunities associated with the market position and opportunities regarding social cohesion. To conclude, the performed literature review exposes that although the topic is not entirely new, there is still a need for further research. Barriers and opportunities are mostly raised regarding special products or the CO2 record of countries. As Hendrichs & Busch, 2012 note, mainly large companies have been investigated with regard to barriers, but problems of start-ups have been overlooked.

Moreover, eight **interviews** were conducted covering different industries such as fashion, body care, material development or food. The procedure for examining the content of the interviews follows Mayring's method. After determining the material and its characteristics, source context, areas of analysis and questioning techniques, Mayring's descriptive design of an analysis was applied (Mayring, 2010). For a qualitative content analysis, specific subject areas are formed deductively in terms of coding, contextualization and evaluation on the theoretical basis of the RQ. The transcribed interviews were reviewed, adapted and categorized systematically. Subsequently, the results obtained from confirming or refuting the categories are used to answer the RQ.

The Berlin start-up *truemorrow* selling sustainable body care products, was central object to **action research**. According to Kotzab et al., 2006, action research helps to explore the full potential of a subject by active participation of the researcher. This method is very suitable for implementation topics because future learnings can be derived from own experiences. Throughout the research process in-depth knowledge is built as an in-field data collection is performed. This data collection process was carried out by action research to obtain a PCF for toothpaste as a new portfolio product.

4 Results and discussion

4.1 Barriers of product carbon emission accounting

BARRIER DISTRIBUTION

- B1 - Data
- B2 - Carbon emission standards
- B3 - Knowledge
- B4 - Management

B1 - Data 14%
B2 - Carbon emission standards 25%
B3 - Knowledge 25%
B4 - Management 36%

- B1-1 - Lack of data — 32%
- B1-2 - Lack of database access — 14%
- B1-3 - Quality of data — 21%
- B1-4 - Comparability — 21%
- B1-5 - Lack of calculation accuracy — 12%

- B2-1 - Lack of uniformity — 58%
- B2-2 - Incompleteness — 23%
- B2-3 - Methodological complexity — 10%
- B2-4 - Information overload — 9%

- B3-1 - Lack of awareness — 35%
- B3-2 - Lack of expertise — 28%
- B3-3 - Lack of credibility — 37%

- B4-1 - Internal management structure — 29%
- B4-2 - Communication — 10%
- B4-3 - Financial burden — 29%
- B4-4 - Time and capacity effort — 18%
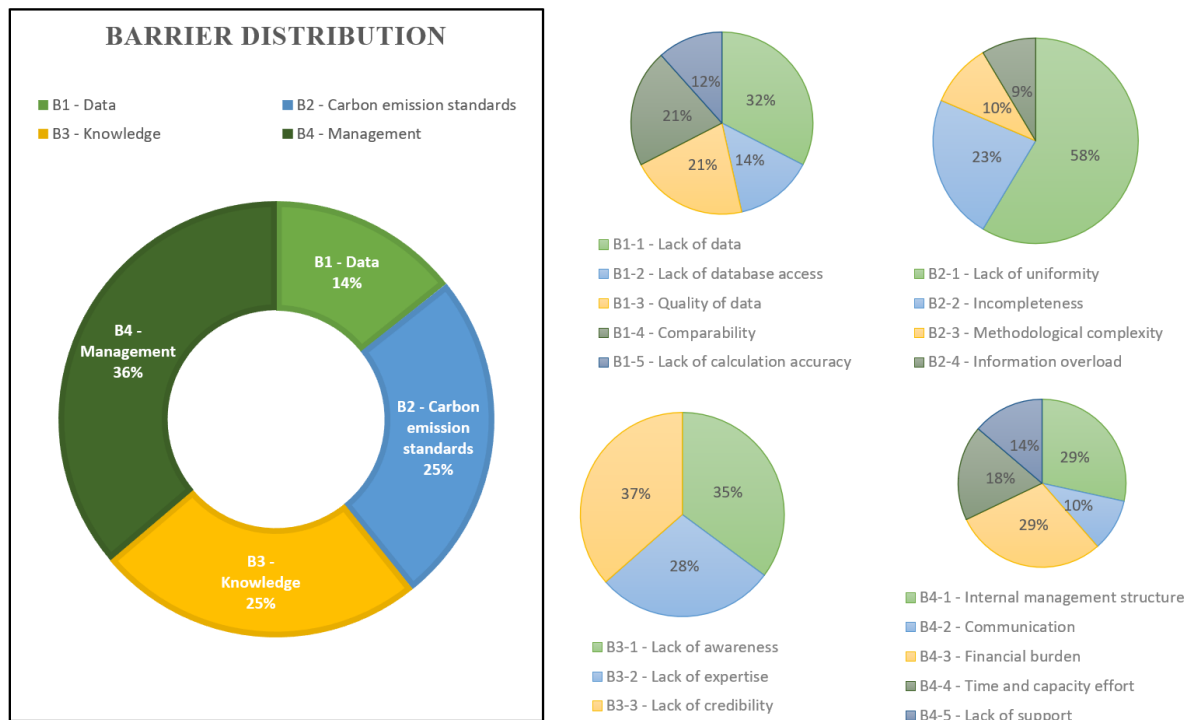- B4-5 - Lack of support — 14%

Figure 1: *Barrier distribution based on interviews*

Most answers are **related to management**. With 29%, internal management structures in companies and additional financial costs are dominant for restraining CO2 assessments. Moreover, limited capacities in start-ups hinder implementation efficiency. Sustainability management systems are not yet existing and their implementation is underestimated and of low priority. Financial resources are scarce in small enterprises and cannot be used for PCF. Incentives and support from politics are perceived as lacking or too bureaucratic. The exchange with suppliers is characterised by mistrust and the need to keep company data secret. 50% of barriers are evenly distributed to **carbon emission standards and knowledge issues**. Missing awareness, expertise and credibility make up about a third of the category dealing with knowledge barriers each. About half of the respondents have a general understanding of carbon emission management, but no knowledge deep enough to implement standards immediately. There is no experience of PCER in companies. Absence of awareness applies equally to all SC stakeholders. A concrete standard must be developed for all companies, valid across countries, industries and products. The lack of binding force discourages companies from performing CO2 calculations. Furthermore, current standards are considered incomplete. The most commonly cited challenge is that PCES only looks at CO2. Environmental pollution, the water footprint, toxicity or air pollution are called for as additional important indicators. **Data-related barriers** account for the smallest overall share, but are nevertheless not insignificant at 14%. Lack of data represents the dominating obstacle with 32%. So far, only low-quality data is available. Often, only approximate assumptions can be made due to the lack of reliable data. Data has so far only been reviewed over a short period of time, so that a solid data basis is lacking. Lack of database access and lack of calculation accuracy contribute 14% and 12%, respectively. The surveyed companies indicate that they do not have access to primary and secondary data. Access to corresponding databases does not exist. Without this, emission data gaps result as retailers mostly depend on decentral data.

For the second approach in form of action research, the PCF of one tube of toothpaste has been calculated. One toothpaste produced for *truemorrow* equals 0,45 kg CO2. During the process of data gathering, **tool-specific, data-specific and management-specific issues** have been identified. To combine the findings of both approaches, it can be concluded that especially data and internal management are bottlenecks. Primary and secondary data is lacking or of insufficient quality. Weak data tracking leads to a high degree of assumptions and provokes errors. PCEA is a financial burden and of no priority. Coordination and reactivity in internal management is missing. Incomplete product-related guidelines hinder the acceptance of emission standards.

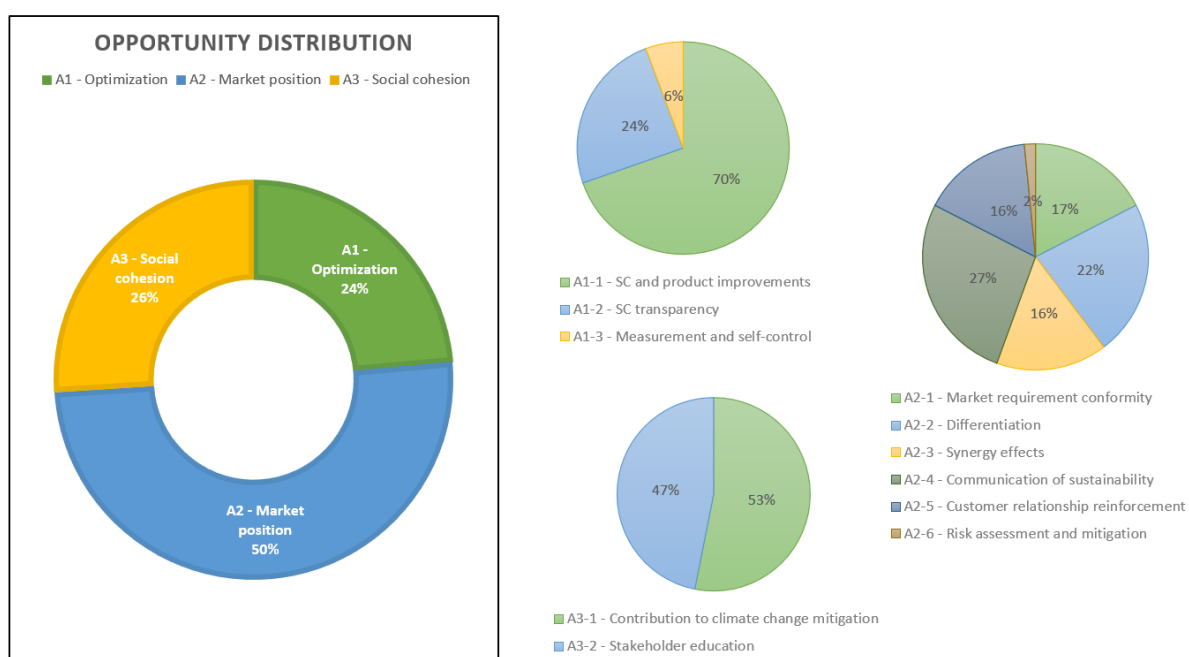## 4.2   Opportunities of product carbon emission accounting

Figure 2: Opportunity distribution based on interviews

Market position is the number one opportunity. As PCEA is voluntary for start-ups, sustainability can be credibly communicated to the public. It further provides access to internationally recognized sustainability certificates. Taking a pioneering role and extra responsibility presents a way to gain a market advantage over large companies. Attention is attracted and visibility of environmentally friendly measures is enhanced. Trust in companies increases through compliance with PCES, which in turn can create a loyal customer base. The commitment to science-based emissions targets may create the overriding possibility that more companies will also feel pressured to consider carbon emission management. Openness for cooperation and regular data exchanges can lead to a synchronization of product data along the SC. Tracking the product lifecycle provides a picture of the interfaces along the SC. Both sub-categories of **social engagement** are almost evenly split with 53% for contribution to climate change mitigation and 47% for **stakeholder education**. An intrinsic motivation to stop global warming is emphasized. Start-ups want to shape the transition to a market economy that functions in the long term driven by their perceived duty towards society. The last category **optimization** shows a clear majority of arguments for SC and product improvements with 70%. Specifically, the improvement of delivery routes, transport and packaging were mentioned as examples. Long-term cost savings, proactive product improvements and the expansion of local SC were named as motives. Products that

previously had poor carbon footprints can be converted and products with already reduced emissions can be further improved. Companies can monitor themselves and product emissions can be assigned to their place of origin which enhances **SC transparency**. In addition, PCF calculations provide a deep insight into company processes and improves operational understanding of suppliers. It can be summarized that all barriers have their justification and can largely be related to start-ups. Furthermore, it can be observed that barriers are interconnected. The frequently cited lack of credibility roots in a lack of information for customers especially. There is an equal lack of reliability when data is not consistently collected and calculations are weakened by estimations. This reinforces the lack of credibility of PCFs. Multiple aspects of RQ 1 could be found that fulfil the objective of this paper, the presentation of barriers and opportunities. At the same time, they are linked to RQ 2, as different measures can be assigned to the highlighted elements that lead start-ups to implement PCEA permanently.

5   Conclusion, limitations and outlook

This paper aims to provide an overview of barriers, opportunities and measures in start-ups to assess PCF, as well as a permanent implementation of PCES. This will address the question of why start-ups have so far hardly implemented a uniform reporting of product emission data. In the beginning, two RQ have been formulated, firstly regarding barriers and opportunities when assessing PCF, and secondly regarding crucial measures to drive start-ups to regularly capture PCF and implement PCES over the long term. In conformity to the purpose of this work, it could be found out that main barriers are the high complexity of methods, the difficult traceability of SC processes, risk caused by emission and energy dependencies, the need to react to varying stakeholder demands, changes in internal management structure and technological processes. These are mutually dependent and vary according to the start-ups individual background. The dominating opportunities are market differentiation, visibility of actions for climate change mitigation and business improvements among others. Those can be understood as substantial opportunities that, if implemented correctly, can have a major impact.

The performed investigation contributes to current research by compiling four essential measure types to improve current implementation intentions in start-ups. Financial, informational, structural and technological actions such as regular internal workshops, low-emission product funding and the integration of a separate emission management are recommended. These results contribute to answering the second RQ, in so far as not only several suggestions were made during the interviews, but also the most important ones could be abstracted from the individual assessment and applied to start-ups in general.

Still, the present paper shows limitations. The reasons are numerous, e.g. lack of access to adequate up-to-date documents, unavailability of first-hand data and previous PCF. Moreover, the conducted interviews were limited to German interview partners. The empirical study cannot sufficiently provide internationally applicable outcomes as the empirical results only cover the German start-up scene, the opinions and experiences of German founders or the business conditions of the German economy. Although it was possible to pick up multiple opinions on the topic, all interviewees are more or less part of the green industry. Start-ups without Sustainable Business Model could further enrich research. In addition, no large multinational companies were interviewed, which could have contributed to a better differentiation of barriers and opportunities of start-ups. The performed action research was limited to one single product so that differences between varying types of products have not been taken into account. Internal management structures within *truemorrow* could have influenced the process and expectations for results on PCF.

However findings and limitations can be used to identify future fields of research. Researchers can explore the optimal use of data and the design of PCEA programmes to support product assessments. Moreover, differences in PCES implementation under influence of company size, culture or state of development can be further investigated. Future research is needed to close mentioned research gaps and to implement PCES globally in all forms of business so that together climate change can be addressed and SCs remain performing and reliable in the future.