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Opportunities and limitations of carbon footprint calculators to steer sustainable household consumption – Analysis of Nordic calculator features

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ABSTRACT

The current patterns of household consumption are environmentally unsustainable, especially in wealthy societies such as the Nordic countries. Globally, housing and energy use at home, travel, food, and the consumption of other goods and services contribute to roughly 60–70% of greenhouse gas emissions. Online footprint calculators have been introduced as a soft policy measure in order to raise public awareness of the carbon footprint of ordinary living. We examined ten calculation tools and interviewed six calculator hosts to study calculator features and hosts' expectations and experiences on engaging people to use calculators and to steer consumption. Our findings show that knowledge intensive calculators are designed to support a rational reflection of lifestyle and activities from an environmental perspective. Tips and pledges are presented in calculators to support taking action. However, engaging people to use calculators, especially more than once, is often considered to be challenging. We further discuss our findings with a framework based on practice theories and point out how features of calculators hold potential for further development, as well as have limitations. The limitations should be taken seriously in considering the role of calculators in policy-mixes to steer household consumption. We also propose that future studies on calculators would benefit from practice approaches in order to further explore patterns of calculator (non)use and how calculator use is (dis)connected from the practices they aim to change, and to avoid over emphasising the role of knowledge in reconfiguring practices.

1. Introduction

The unsustainability and inequality of current household consumption patterns is evident (Hoekstra and Wiedmann, 2014), and the Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) are among the wealthy societies with high consumption-based footprints (Hertwich and Peters, 2009). The consumption-based perspective, in addition to the territorial approach, has been recognised to be relevant in the climate change mitigation policies and measures (Creutzig et al., 2018; Girod et al., 2014; IPCC, 2014; Nissinen et al., 2015; Peters and Hertwich, 2008). Roughly, 60–70% of global greenhouse gas (GHG) emissions can be traced to household consumption (Hertwich and Peters, 2009; Ivanova et al., 2016; Seppälä et al., 2011) and household consumption is considered to be an important driver of GHG emissions (Druckman and Jackson, 2016).

The development of databases and calculation methodologies, such as environmentally extended input-output models, has allowed the introduction of consumption-based per capita indicators and their use in policies (Kokoni and Skea, 2014; Wiedmann, 2009). The consumption-based indicators are valuable as they take into account international trade flows and illustrate per capita differences between nations (Hertwich and Peters, 2009) and sub-national populations (e.g. Wiedenhofer et al., 2017). Ivanova et al. (2016) highlight the potential of household footprints in helping to understand the social determinants of environmental impacts, and responding to a lack of information at a household level on required changes in consumption. Consumption-based emission data have been used for informing policy making, individuals and persuading consumers to take responsibility for consumption (Kokoni and Skea, 2014). I.e. consumption-based

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policies are often related to soft-measures, compared to numerical targets and binding policies related to territorial emissions. In addition to top-down estimations, databases and methods can be applied to bottom-up calculations, e.g. using individual consumption patterns to calculate a personal footprint.

The negative environmental impacts of consumption are often invisible in our everyday lives (Røpke, 2009). To illustrate the impacts, carbon, and other environmental footprint calculators have been introduced by research and non-governmental organisations, and companies. The overall purpose of the calculators is similar, to illustrate invisible impacts and steer sustainable consumption. However, detailed definitions on what to include and exclude from the footprint calculation vary from one calculator to another. Often, calculators focus on consumption patterns and choices: how we arrange our housing (the size and type of home, the type and amount of energy consumed); every day and long-distance travel; the type and amounts of food we buy and consume; the purchase of goods and services, including e.g. electronic devices, clothing, cultural and recreational services.

The existing literature on calculators for citizens is limited. Consulted literature provide two perspectives: One approach focusing on calculation methodologies (Birnik, 2013; Čuček et al., 2012), and inconsistencies of calculators (Padgett et al., 2008). This stream of literature has concluded that transparency, consistency and data quality should be greatly improved, because calculators influence behaviour and policies. Following this line of thinking, papers describing the methodologies of calculations, such as Matuštík and Kočí, 2019, and Nahar and Verma, 2018, are greatly welcomed. The other approach focuses on calculator use in empirical studies that aim to change household and individual consumption patterns. So far, empirical studies on carbon or other environmental footprint calculations, and on calculators used in sustainability interventions and campaigns, show varying results in changing self-reported consumption patterns or footprints (Hunter et al., 2006; Sutcliffe et al., 2008; Bartiaux and Salmón, 2012; Laakso and Lettenmeier, 2016; West et al., 2016; Salo et al., 2016). Major limitations of the empirical studies on calculators and their impact on the change of consumption patterns include: a limited number and diversity of participants (possible biased environmental awareness), the quality of self-reported data, and a lack of a long term follow-up. Both of the above mentioned streams of literature build on the assumption that the information provided by the calculators leads to a change in consumption patterns or policy.

There is a knowledge gap on effective ways to promote and support sustainable household consumption with communication measures and assessment tools, including calculators, and on the need to address the social and cultural embeddedness of routines and practices (Caeiro et al., 2012; Gram-Hanssen and Christensen, 2012). Some scholars take a more critical stance on the role of calculators in steering household consumption. Spaargaren (2011) claims that the calculators have increased the level of environmental awareness, but this does not translate to environmentally friendly behaviour. Indicators carry value positions (Lyytimäki et al., 2013), and individual footprinting is referred to as an example of the individualistic behaviour change approach (Spaargaren, 2011), which has been criticised for placing too much emphasis and responsibility on individuals (Shove et al., 2012). In other words, the underlying assumption of calculators that more or better information linearly leads to changes in consumption has been questioned (Shove, 2003, 2010). Practice theories are the basis for the critique of Spaargaren and Shove (ibid.) on calculators. While practice approaches have become popular in studying sustainable consumption (see Section 2), they are not yet fully harnessed to study the opportunities and limitations of the footprint calculators.

Footprint calculators seem to create an arena for opposing approaches on steering household consumption. On one hand, critique has been raised on the power and even the justification of focusing on individual footprints and responsibility. On the other hand, up-to-date methods enable one to estimate top-down and bottom-up carbon footprints per capita and the footprints can be seen as potential (soft) policy measures for sustainable consumption. We position our research as part of the discussion on how to steer household consumption patterns towards the goal of a sustainable per capita carbon footprint.

In this paper, we study the features of existing online footprint calculators and the expectations and experiences of calculator hosts on the use of calculators in sustainable consumption initiatives. By features, we refer to aspects of the calculator that (are intended to) serve a certain purpose. The concept of a feature is widely used in software development (e.g. Apel and Kästner, 2009). In this paper, we also consider the type of data input, the format of results or guidance on taking action as features of the calculators.

We reframe our findings on calculators and their use with practice theory approaches in order to discuss the potential of calculators in steering consumption. The research questions are:

1. What do calculator features tell about hosts' expectations on patterns of calculator use?
2. What kind of challenges have the calculator hosts experienced in using the calculators in sustainability initiatives?
3. From a practice perspective, what are the opportunities and limitations of calculators to steer consumption?

2. Sustainable consumption and theories of practice

The question of how to make consumption more sustainable has been addressed by various research traditions. The practice theory perspectives on sustainable consumption and production systems are often presented in contrast to established traditions. For instance, Geels et al. (2015) refer to socio-technical systems and practice approaches as the middle way in moving beyond established reformist (demand and supply of eco-efficient products, focus on incremental changes and technological solutions) and revolutionary (taking a critical stance on modern capitalism and consumerism with an emphasis on sufficiency and frugality) positions on sustainable consumption and production. Also, Keller et al. (2016) differentiate social practice theory from other research traditions on sustainable consumption, such as: individual behaviour change; behavioural economics; and technological change.

According to the theories of practice, our everyday lives are not (only) manifestations of carefully considered, individual, rational choices, but rather bundles of interlinked practices: a mix of routinised and conscious decisions on how to arrange our everyday life, within the given social and physical environment (Reckwitz, 2002; Warde, 2005; Shove et al., 2012; Spaargaren et al., 2016). Household practices are dominated by life-world rationalities, in contrast to different rationalities of production and processing (Spaargaren et al., 2012). Reckwitz (2002) describes how individuals are "… carriers of a practice, they are neither autonomous nor the judgemental dopes who conform to norms: They understand the world and themselves, and use know-how and motivational knowledge, according to the particular practice." The perception of agency of people is relevant from the calculator perspective, as it leaves space for, but without over emphasising, the role of reflective activity.

Reckwitz (2002:249) sees a practice to consist of interconnected