The Impact of Information Campaigns and Regulations on the Adoption of Reusable Packaging Systems

A Large-Scale Field Data Analysis of Intervention Effects in the Circular Economy

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Background and problem

The current production and consumption systems that underpin the current state of economic value creation and wellbeing is placing increasing stress on planetary boundaries, threatening economic and ecological stability (Lazarevic et al., 2022). As a response, the circular economy is recognized by policymakers, industries and scholars as a promising approach to decouple economic growth and wellbeing from resource depletion and environmental degradation (Bressanelli et al., 2022). The transition towards a circular economy depends upon the adoption of circular business models on a micro-level, thereby altering the rationale of how an organization creates, delivers, and captures value to close, narrow and slow material loops (Bocken et al., 2018). Product-service-systems are considered the most suitable business model archetype to foster a circular and resource-efficient economy (Roci and Rashid, 2023). These systems are characterized by businesses shifting focus from selling products as commodities to offering their functionality to fulfil customers' needs, thereby incentivizing product lifetime extension and product take-back (Henriques et al., 2023). In the packaging sector, shifting from single-use to reuse models via product-service-systems offers a major opportunity to reduce plastic pollution, virgin material use, greenhouse gas emission and water consumption (EMA, 2023). Since 2017,

several startups in Europe have adopted this business model archetype by introducing packaging-as-a-service (PaaS) systems for takeaway food and beverages. PaaS systems provide reusable takeaway food containers, facilitating a model of temporary, non-ownership consumption for both restaurants and consumers (Ratay, 2023). Despite their environmental potential, these models have seen limited uptake with only 0.74% of takeaway food in Germany being served in reusable containers in 2022 (Schüler et al., 2023). This indicates that the widespread adoption of such circular business models is significantly lagging behind expectations. Although existing research on circular business models has highlighted the crucial role of user acceptance for transitioning towards a circular economy (Kirchherr et al., 2018), a clear understanding of the drivers behind adoption remains insufficient (Vidal-Ayuso et al., 2023). These limitations have led to ineffective behavior change interventions in the context of reusable food containers (Whitmarsh et al., 2021).

Research objective and methodology

To address this research gap, this study aims to study the impact of two distinct intervention strategies on (a) user adoption and (b) the diffusion of PaaS systems, thereby investigating both consumers and restaurants of two-sided platform business models. First, this study evaluates informational strategies designed to prompt behavioral shifts by delivering targeted information and education (Novoradovskaya et al., 2021). Despite the prevalent use of such strategies to facilitate behavioral change (Gatersleben et al., 2023), their application to specifically promote the adoption of reusable food containers remains underexplored (Novoradovskaya et al., 2021). Therefore, this research examines the impact of three distinct information campaigns initiated by municipalities and PaaS systems. The most extensive campaign with a budget of 1 Mio. Euro utilizes a total of 2,205 advertising spaces in Berlin, Hamburg, Munich, Cologne, Frankfurt, and Düsseldorf. Second, this study examines the impact of the so-called "Mehrwegangebotspflicht," a law enforced by the German government from January 1, 2023. This regulation mandates that food outlets must provide an alternative to disposable packaging by offering reusable containers for take-away foods and drinks. While existing research underscores the importance of viable alternatives in promoting pro-environmental behavioral changes (Poortinga and Whitaker, 2018), empirical evidence regarding the regulation's effectiveness remains scant (Schüler et al., 2023). Thus, this research aims to thoroughly investigate the regulation's influence on both (a) user adoption and (b) the diffusion of PaaS systems.

The outcome variables for analyzing user adoption of PaaS system are (a) the number of new users and (b) frequency of system use. For this purpose, this paper leverages an extensive field data set from Vytal, the world-leading digital-native reusable PaaS system (Recker et al., 2024), capturing over 15 million container transactions from 550,000 registered users across 15 countries from 2019 to 2023. The field dataset recorded each transaction with a unique user ID, restaurant ID, restaurant location, and the transaction

timestamp. The effect of the interventions on the diffusion of PaaS systems is measured by participating restaurants at the three largest PaaS systems in Germany as outcome variable. A comprehensive panel dataset, encompassing 25,981 restaurants participating at the PaaS systems Vytal (6,532), Recup (17,314), or Relevo (2,135), serves this analysis. The study employs a 'difference-in-differences' methodology to discern the interventions' impacts, comparing the trends of each outcome variable in affected regions before and after the interventions against those in unaffected control regions.

Preliminary results and contribution

My preliminary results indicate that the impact of the new regulation requiring restaurants to provide reusable food containers significantly influences the spread of PaaS systems, however, with minimal impact on consumer uptake. Such outcomes suggest a need to revise regulation specifically to increase consumer engagement.

The empirical approach of this study leverages an extensive field dataset from the globally leading PaaS system for take-away food container to overcome methodological limitations of previous studies and thereby enrich the scientific discourse in two significant ways. First, meta-studies on the effect of behavioral interventions show that many studies were conducted over a too short period, typically ranging from a day to a few months (Nisa et al., 2019). To determine whether an intervention has caused a lasting change in behavior, longitudinal studies over longer periods are crucial (Maki et al., 2019). Second, numerous studies measure pro-environmental behavior through self-reported behavior or merely intentions (Allison et al., 2022), underscoring the need to assess actual behavior to provide robust results (Gatersleben et al., 2023). Furthermore, these findings contribute to a better understanding of the effectiveness of existing interventions on user adoption and the diffusion of PaaS models. Policymakers and other stakeholders can leverage the evidence of the study to effectively promote reusable PaaS systems, thus, dramatically reducing the use of single-use plastic packaging for take-away food.

To conclude, this study contributes to the NBM Conference in 2024 by increasing the knowledge of factors influencing the adoption of circular business models. This research connects to *exploring theoretical and methodological foundations* and conference track 4.2 by evaluating the impact of interventions on engaging users with reuse circular business models.

Keywords

Product-service-systems, Packaging-as-a-service, Consumer behavior, Interventions, Difference-in-Difference

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