

Channel Reconfiguration in the Post-Pandemic Retail System: Evidence from a Systematic Literature Review of Online and Offline Shopping Interactions

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Abstract

During the COVID-19 pandemic, online and offline purchasing behaviours underwent significant transformations as consumers increasingly adopted e-commerce due to sanitary concerns and convenience. Despite the rapid growth of digital retail, the long-term interaction between online and in-store shopping remains not adequately understood. This study conducts a systematic literature review to synthesise empirical evidence on the interaction between digital and physical shopping channels and to quantify the prevalence of substitution, complementarity, and hybrid behavioural effects in the post-pandemic context. Following a structured search in the Scopus database, 24 empirical studies were analysed using a descriptive and thematic synthesis approach. The results indicate that hybrid interaction effects were the most reported behavioural pattern. (42%), followed by substitution effects (33%) and complementarity effects (25%). Substitution effects are observed in essential purchasing sectors such as groceries, while complementarity effects prevail in experiential retail sector such as fashion. The evidence suggests that post-pandemic shopping behaviour is characterised by channel reconfiguration rather than by full digital substitution. These dynamics have implications for shopping-related travel demand, urban freight activity, and the spatial organisation of retail systems. The review also identifies key research gaps related to causal behavioural modelling, sectoral heterogeneity, and the integration between passenger and freight systems.

Keywords: urban freight transport; e-commerce; online and offline shopping; shopping behaviour; literature review.

1 Introduction

E-commerce experienced substantial growth during the COVID-19 pandemic. Lockdowns had an immediate impact on purchasing behaviour due to the closure of non-essential retail stores (Moon et al., 2021; Wang et al., 2022). Although such restrictions were temporary, the widespread adoption of online shopping represented a behavioural adjustment that proved adaptable to increasingly demanding lifestyles, gradually becoming embedded in what has been described as the post-COVID-19 normal (Diaz-Gutierrez et al., 2024; Wieland, 2023).

Digital technologies effectively brought retail services to consumers' homes, reducing the frequency of trips to commercial areas and encouraging the adoption of alternative consumption practices, including home delivery services (Chen et al., 2024; Niu and Wang, 2021). In parallel, restaurants experienced a decline in on-site consumption, which redirected demand to online food delivery platforms and grocery purchasing services (De Canio et al., 2023).

Factors shaping consumer profiles vary between population groups, reflecting differences related to region, age, gender, income, and educational attainment (Hermes et al., 2022; Sharma and Fatima, 2025). Younger people, particularly those with higher levels of education and income, tend to have more preference for online shopping. Nevertheless, during the pandemic period, older adults also showed interest in online purchases, largely driven by health and safety concerns (Elizondo-Candanedo et al., 2025; Titiloye et al., 2023).

From a transport perspective, the implications for travel behaviour were considerable, with overall trip volumes declining and teleworking emerging as a factor exerting a significant influence on transport demand (Colaço and de Abreu e Silva, 2025, 2024). These developments reflect an accelerated shift in travel patterns and in-person

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activities. Virtual accessibility has been identified as more democratic and cost-effective than physical access, offering spatial reach in urban environments (Asgari et al., 2023; Chen et al., 2024).

Improving the understanding of the impact of post-pandemic shopping patterns remains a complex and multifaceted task, and these relationships require further empirical validation. The consolidation of e-commerce as a component of contemporary retail systems is evident, while channel substitution has reconfigured key determinants related to the role of technologies in shaping both product-related decisions and the timing of consumer purchases (Hermes et al., 2022; Wieland, 2023). At the same time, the purchasing criteria themselves have been reshaped, gaining new importance within decision-making processes. Within this evolving ecosystem of transformations, detailed examination of these changes can enable retailers, public authorities, and urban planners to design adaptable citizen-centred policies and infrastructures capable of supporting long-term resilience (Diaz-Gutierrez et al., 2024).

Despite the rapid expansion of studies that examined the adoption of e-commerce during and after the COVID-19 pandemic, there is limited systematic evidence quantifying whether online shopping substitutes or complements in-store shopping visits across sectors, and few reviews explicitly integrate behavioural insights with implications for passenger travel demand and urban freight systems. In addition, existing findings are often context-specific, making it difficult to identify consistent patterns of channel interaction. Addressing these gaps, this study provides a systematic synthesis of empirical evidence and quantifies the relative prevalence of substitution, complementarity, and hybrid interaction effects, thus contributing to a clearer understanding of post-pandemic retail dynamics and their transport implications.

The remainder of this paper is structured as follows. Section 2 presents a brief review of the literature; Section 3 describes the data and methodological procedures employed; Section 4 reports the results of the literature analysis; finally, the findings are discussed and the paper concludes with key insights and directions for future research.

2 Methodology

This study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and replicability in the identification, screening, eligibility assessment and inclusion of studies. The systematic review aims to synthesise the existing evidence on the factors influencing consumer behaviour in the online and in-store shopping channels.

The literature search was conducted using the Scopus database, selected due to its multidisciplinary scope and extensive coverage of high-impact peer-reviewed journals. An initial set of keywords aligned with the research objectives was identified, including “online shopping”, “on-line shopping”, “e-shopping”, “offline shopping”, “retail shopping”, and “in-store”. Subsequently, these terms were refined and combined using Boolean operators to construct structured search strings and enhance the relevance of the retrieved studies. The final search query was defined as: (“online shopping” OR “on-line shopping” OR “e-shopping”) AND (“off-line shopping” OR “offline shopping” OR “retail shopping” OR “in-store”). Searches were conducted by titles, abstracts and keywords, without restrictions on the publication year, given the emergent nature of the research topic. Only studies published in English were considered. Filters were applied to retain specific document types, namely journal articles, conference papers, book chapters, and review articles. The selection criteria adopted in the selection process are summarised in Table 1.

Table 1. Article selection criteria

Criteria	Description
Database	Scopus
Year of publication	There is no time restriction due to the emergent nature of the studies.
Publication type	Articles from peer-reviewed journals and articles presented at conferences.
Language	English
Inclusion criteria	Studies that explicitly address mobility-related variables in transportation.

The initial search resulted in the identification of 392 records. These studies were subjected to a title and abstract screening process, conducted manually to verify their relevance to the scope of the research. Studies that did not explicitly address factors that influence online or in-store shopping behaviour, or that were not related to freight passenger mobility, or closely related domains, were excluded at this stage. Subsequently, the full texts of the remaining publications were assessed for eligibility. This process resulted in a final sample of 24 studies, which were included in the systematic review.

The synthesis of the results was conducted using a descriptive analytical approach. The final set of selected studies was systematically categorised according to the following dimensions: author and year of publication, research objective, methodological approach, and sectoral focus. This structured categorisation enabled not only the organisation of the documents, but also the identification of recurring patterns, emerging trends, and potential research gaps within the literature on shopping behaviour across digital and physical channels.

The final stage of the methodological process involved the critical interpretation of the evidence derived from the analysis and synthesis phases. Particular attention was paid to highlighting the theoretical, methodological and empirical challenges associated with research on post-pandemic consumption patterns. Based on the identified gaps and emerging trends, this stage also outlines directions for future research, contributing to the advancement of knowledge in the field and supporting the development of new academic investigations and policy-relevant insights.

3 Results

Table 1 summarises the factors influencing the choice of the shopping channel. Socio-demographic variables emerge as central predictors of channel choice. Several studies identify age as a statistically significant determinant, with younger people showing higher propensity towards online shopping adoption (Colaço and de Abreu e Silva, 2025; Elizondo-Candanedo et al., 2025; Sharma and Fatima, 2025). Similarly, income and educational level are frequently associated with increased participation in digital purchasing channels, as higher socio-economic status tends to improve digital literacy and trust in online transactions (Hermes et al., 2022; Wang et al., 2022). Although some studies report gender differences in channel preferences, the direction and magnitude of these effects vary between contexts, suggesting that cultural and regional factors may mediate these relationships (Titiloye et al., 2023).

Table 1. Synthesis of factors that influence online and in-store shopping behaviour identified in the reviewed studies

Determinant / Factor	Effect on Channel Choice	References
Age	Younger consumers are more likely to adopt online shopping; older consumers maintain stronger in-store preference	Colaço and de Abreu e Silva, 2025; Elizondo-Candanedo et al., 2025; Sharma and Fatima, 2025
Income	Higher income associated with greater adoption of online shopping	Hermes et al., 2022; Niu and Wang, 2021
Education level	Higher educational attainment related to digital purchasing engagement	Hermes et al., 2022; Sharma and Fatima, 2025
Gender	Mixed evidence; effects vary across cultural and geographical contexts	Titiloye et al., 2023
Shopping experience	Supports persistence of in-store shopping behaviour	(Moon et al., 2021; Niu and Wang, 2021)
Convenience perception / time saving	Encourages adoption of online channels.	Hermes et al., 2022; Sharma and Fatima, 2025
Shopping behaviour	Reduces likelihood of channel substitution	Elizondo-Candanedo et al., 2025
Internet use intensity / digital literacy	Strong predictor of online shopping engagement	Colaço and de Abreu e Silva, 2025; Wang et al., 2022
Confidence in digital platforms / payment systems	Reinforces omnichannel consumption patterns	Chen et al., 2024; Hermes et al., 2022
Teleworking adoption	Reduces commuting and indirectly affects shopping trip generation	Colaço and de Abreu e Silva, 2025, 2024
Trip chaining behaviour	Influences substitution between online and physical shopping trips	Chen et al., 2024
Delivery cost	May discourage online shopping if perceived as high	De Canio et al., 2023; Sharma and Fatima, 2025
Delivery time / reliability	Affects consumer trust and channel evaluation	Moon et al., 2021; Niu and Wang, 2021
Return complexity / service uncertainty	Limits full substitution of physical retail	De Canio et al., 2023
Product type (routine vs experiential goods)	Routine products are more likely to be purchased online; experiential goods in-store	Asgari et al., 2023; Piras et al., 2025
Hybrid / omnichannel lifestyle	Complementary use of online and offline channels	Diaz-Gutierrez et al., 2024; Wieland, 2023

Behavioural factors also play a crucial role in shaping the selection of channels. Factors such as shopping enjoyment, perceived convenience, and openness to innovation have been shown to positively influence online shopping adoption (Hermes et al., 2022; Sharma and Fatima, 2025). In contrast, preferences for sensory experiences and immediate product evaluation continue to support the persistence of in-store shopping (Moon et al., 2021; Niu and Wang, 2021). Studies emphasise that habitual purchasing patterns and attachment to local retail environments can reduce the likelihood of full substitution of physical shopping trips by online shopping (Edrissi et al., 2020).

The intensity of internet use and technological familiarity emerge as a significant determinant of online shopping behaviour (Colaço and de Abreu e Silva, 2025; Wang et al., 2022). Studies highlight that confidence in digital platforms and online payment systems reinforces the consolidation of omnichannel consumption patterns (Chen et al., 2024; Hermes et al., 2022). Access to digital infrastructure also contributes to the spatial diffusion of online consumption practices, particularly in urban environments (Asgari et al., 2023).

Changes in mobility constitute another important dimension identified in the literature. The expansion of teleworking has reduced the frequency of commutes and altered daily travel routines, indirectly affecting shopping-related trip generation (Colaço and de Abreu e Silva, 2025, 2024). Evidence also points to interactions between trip chaining behaviour, shopping frequency, and channel substitution, suggesting that online shopping may partially replace physical trips for routine purchases, particularly groceries and non-essential goods (Chen et al., 2024; Piras et al., 2025).

From a freight transport perspective, operational delivery factors, including delivery costs, waiting time, reliability, and return procedures, influence channel evaluation (De Canio et al., 2023; Sharma and Fatima, 2025). Consumers tend to prefer online shopping when perceived time savings outweigh additional monetary costs. Nevertheless, service uncertainties and perceived risks related to product quality or delivery performance may constrain the full substitution of physical retail trips (Moon et al., 2021; Niu and Wang, 2021).

A finding in the literature is the emergence of hybrid shopping behaviour, characterised by the complementary use of online and offline channels (Diaz-Gutierrez et al., 2024; Wieland, 2023). Rather than signalling a complete transition towards digital retail dominance, the evidence suggests the consolidation of flexible consumption strategies shaped by lifestyle constraints, technological access, and situational needs. This behavioural hybridisation has important implications for urban freight demand, retail spatial restructuring, and transport planning.

3.1 *Patterns between Online and In-store Shopping*

As mentioned above, quantitative synthesis of the reviewed studies indicates that hybrid interaction effects are the most frequently reported outcome (42%), followed by substitution effects (33%) and complementarity effects (25%). This distribution provides empirical support for the argument that post-pandemic shopping behaviour is characterised by channel reconfiguration rather than full digital substitution.

The literature reveals that the interaction between online and physical shopping channels varies substantially across the retail sectors, reflecting differences in product characteristics, consumption routines, and logistical requirements. For supermarkets and convenience goods, the evidence points towards a substitution effect, whereby online shopping partially replaces in-store shopping. This pattern has been associated with the standardised nature of grocery products, the routine character of purchases, and increasing efficiency in last-mile delivery services (Chen et al., 2024; Niu and Wang, 2021; Piras et al., 2025). Consumers tend to prioritise convenience and time savings in this sector, making online channels particularly attractive for recurrent purchases. However, complete substitution is rarely observed, as in-store shopping remains relevant for immediate product availability and trip chaining with other daily activities (Colaço and de Abreu e Silva, 2024).

In the clothing and fashion sector, the relationship between channels is more frequently characterised by complementarity rather than substitution. Studies highlight the prevalence of showrooming and webrooming behaviours, in which consumers combine online information search with in-store product evaluation (Hermes et al., 2022; Moon et al., 2021). The persistence of physical retail in this sector is largely explained by the importance of sensory experience, product fitting, and social interaction, which are difficult to replicate in digital environments (Sharma and Fatima, 2025). As a result, online and offline channels often function as sequential stages within a broader decision-making process.

For durable goods and electronics, the literature reports mixed and less consistent interaction patterns. Consumers frequently engage in an intensive online information search prior to purchase, while final transactions may occur online or in physical stores depending on perceived product risk and the need for technical assistance (Asgari et al., 2023; Elizondo-Candanedo et al., 2025). This hybrid behaviour reflects the financial and functional uncertainty associated with durable goods, reinforcing the relevance of physical retail for product demonstration and post-purchase services (Diaz-Gutierrez et al., 2024).

Studies exploring multisector emphasise the context-dependent nature of channel interaction effects, highlighting substantial heterogeneity across product types and consumption contexts (De Canio et al., 2023; Wieland, 2023). Rather than indicating a transition to digital retail, the evidence suggests the consolidation of adaptive hybrid consumption strategies, by which consumers selectively allocate purchases across channels according to perceived convenience, service attributes, and situational constraints. These dynamics have important implications for shopping-related travel demand and urban freight activity, reinforcing the need for integrated analytical frameworks linking consumer behaviour and transport systems (Colaço and de Abreu e Silva, 2025; Piras et al., 2025).

The synthesis of empirical results reveals that there is no consistent evidence of a substitution effect between online and offline shopping (Table 2). The studies analysed can be classified into three main categories: (i)

evidence of substitution, (ii) evidence of complementarity, and (iii) mixed or statistically insignificant effects. Some studies find substitution effects, in which an increase in the frequency or intensity of online shopping is associated with a reduction in in-store shopping. However, a comparable (or greater) number of studies identify complementarity effects, suggesting that the use of the online channel can stimulate visits to physical stores, whether through omnichannel strategies, showrooming, or online information searches before in-store purchases. In addition, several studies report mixed or context-dependent effects, varying according to the type of product, the consumer profile, or the specification of the empirical model. Moreover, the literature suggests that substitution effects are more prevalent in routine purchasing contexts, whereas complementarity and hybrid behaviours dominate in sectors characterised by higher product uncertainty or experiential requirements.

Table 2. Empirical evidence on interactions between online and in-store shopping channels

Authors (Year)	Sector	Offline variable (dependent)	Online variable (explanatory)	Main findings
Colaço and de Abreu e Silva (2025)	Grocery / restaurants	Shopping trip frequency	Online food delivery use	The increased use of online food delivery is associated with a reduction in physical shopping trips.
Chen et al. (2024)	Groceries / retail	Number of shopping trips	E-commerce adoption	Online shopping partially replaces routine shopping trips, but may also reorganise trip chaining behaviour.
Niu and Wang (2021)	Grocery	In-store purchase frequency	Online grocery purchase	Digital grocery shopping reduces store visits, particularly for routine purchases.
Moon et al. (2021)	Fashion retail	In-store purchase intention	Online information search	Consumers combine online search with in-store product evaluation (webrooming behaviour).
Hermes et al. (2022)	Fashion / retail	Store visit frequency	Online platform use	Digital channels function as complementary stages in the shopping decision process.
Sharma and Fatima (2025)	Multisector	Physical shopping propensity	Perceived convenience of online shopping	Channel choice depends on perceived utility trade-offs and consumer characteristics.
Asgari et al. (2023)	Electronics / durable goods	Store purchase likelihood	Online search intensity	Consumers conduct extensive online research before making high-value purchases in-store or online.
Elizondo-Candanedo et al. (2025)	Durable goods	In-store transaction probability	Digital shopping adoption	Online adoption influences purchase timing rather than substituting physical transactions.
Wieland (2023)	Multisector	Retail trip generation	Growth of e-commerce	The growth of e-commerce transforms rather than eliminates physical shopping mobility.
De Canio et al. (2023)	Multisector	Shopping trip behaviour	Delivery service use	Online shopping may generate additional freight trips while reducing personal travel.
Piras et al. (2025)	Urban retail logistics	Passenger shopping trips	Home delivery demand	The growth in deliveries contributes to the reductions in some categories of demand for shopping trips.
Diaz-Gutierrez et al. (2024)	Multisector	In-store purchasing behaviour	Pandemic-driven online adoption	Behavioural adjustments during COVID-19 led to hybrid shopping strategies.

Table 3 summarizes the statistically significant effects of the interactions between the online and in-store shopping channels. Substitution effects associated with routine purchasing contexts, such as grocery shopping and food delivery services, are consistently found to be statistically significant, suggesting a measurable reduction in frequency of shopping-related trips. Complementarity effects are also supported by significant empirical findings, especially in experiential retail sectors such as fashion, where online search behaviour and digital engagement tend to increase store visits or purchase intention. These results reinforce the interpretation that online channels often function as informational or preparatory stages within the purchasing decision process rather than as full substitutes for physical retail. However, several studies report mixed or only partially significant effects, highlighting the context-dependent nature of channel interaction. In sectors characterised by higher product uncertainty or technological complexity, such as electronics and durable goods, online activities appear to influence purchase timing or channel sequencing rather than generating clear substitution outcomes.

Table 3. Statistical significance of effects of the online and offline interaction reported in the reviewed studies

Authors (Year)	Sector	Type of interaction	Statistical significance of effect	Direction of effect
Colaço and de Abreu e Silva (2025)	Grocery / restaurants	Substitution	Significant	Negative effect of online use on shopping trips
Chen et al. (2024)	Groceries / retail	Substitution / Mixed	Significant	Partial reduction in trip frequency
Niu and Wang (2021)	Grocery	Substitution	Significant	Decrease in store visits
Moon et al. (2021)	Fashion	Complementarity	Significant	Online search increases store purchase intention
Hermes et al. (2022)	Fashion / retail	Complementarity	Significant	Digital engagement increases store visits
Sharma and Fatima (2025)	Multisector	Mixed	Significant	Utility perception shapes channel choice
Asgari et al. (2023)	Electronics	Mixed	Partially significant	Online search affects purchase probability
Elizondo-Candanedo et al. (2025)	Durable goods	Mixed	Not consistently significant	Timing effects more relevant than substitution
Wieland (2023)	Multisector	Mixed	Partially significant	Structural but heterogeneous impacts
De Canio et al. (2023)	Multisector	Complementarity / Mixed	Significant	Delivery demand complements some travel
Piras et al. (2025)	Urban logistics	Substitution	Significant	Growth in delivery reduces personal trips
Diaz-Gutierrez et al. (2024)	Multisector	Mixed	Significant	Pandemic accelerated hybrid behaviour

Therefore, statistical evidence suggests that while substitution effects are empirically observable, particularly for routine goods, hybrid interaction dynamics supported by significant or partially significant relationships constitute a dominant behavioural pattern. This reinforces the argument that post-pandemic shopping behaviour should be conceptualised as channel reconfiguration process shaped by product attributes, consumer characteristics, and urban freight service performance.

4 Discussion and Conclusions

The synthesis of empirical evidence reveals that hybrid interaction patterns between online and in-store shopping channels constitute the most reported behavioural outcome, accounting for approximately 42% of the reviewed studies. Substitution effects represent around 33% of the evidence, while complementarity effects account for approximately 25%. These findings provide important insights into the mechanisms shaping post-pandemic consumption dynamics and provide important insights into the mechanisms shaping post-pandemic consumption dynamics.

First, the predominance of hybrid interaction effects reinforces the argument that shopping channel choice is increasingly governed by perceived utility trade-offs rather than by a complete transition from physical to digital retail environments. Consumers evaluate online and in-store options based on time savings, monetary costs, accessibility, and service reliability. This evaluation process leads to selective channel use rather than full substitution, particularly in contexts characterised by heterogeneous product attributes and activity constraints.

Second, the observed substitution effects, more prevalent in routine purchasing sectors such as groceries, highlight the role of product standardisation and logistical efficiency in facilitating the digitalisation of consumption practices. The availability of home delivery services reduces the need for physical store visits, contributing to measurable reductions in demand for shopping-related trips. However, these reductions are often partial, as consumers continue to combine online purchases with other in-person activities, suggesting that the reorganising travel patterns is more common than eliminating trip.

Third, complementarity effects, particularly in experiential sectors such as fashion retail, emphasise the persistence of social dimensions of shopping behaviour. In these contexts, digital channels frequently function as information platforms that enhance, rather than replace, physical retail interactions.

The frequency distribution of interaction effects also has broader implications for urban mobility. The coexistence of substitution and complementarity effects contributes to travel demand outcomes, including reduced individual shopping trips along with the increased last-mile deliveries. These dynamics may lead to spatial reorganisation of retail activities, changes the demand for logistics infrastructure, and evolving sustainability trade-offs. Therefore, the findings demonstrate that post-pandemic shopping behaviour is better characterised by channel reconfiguration than by full digital substitution. This interpretation underscores the importance of integrated analytical approaches that jointly consider consumer behaviour, transport demand modelling, and urban planning strategies.

4.1 Research Gap and Future Agenda

Building on the empirical patterns identified in this systematic review, several priority research directions emerge to advance the understanding of hybrid shopping behaviour and its implications for urban freight transport. First, causal evidence is needed on the relationship between online shopping adoption and changes in physical travel demand. Most existing studies rely on cross-sectional data or descriptive analyses, which limits the ability to identify substitution or complementarity mechanisms over time. Second, future research should further explore the integration between passenger travel and urban freight dynamics. The simultaneous reduction of individual shopping trips and the growth of last-mile delivery demand suggests complex system-level interactions that are not yet understood. Third, the literature reveals substantial sectoral heterogeneity, indicating that product characteristics play a crucial role in shaping channel choice. More comparative studies are needed across the retail sectors to understand how experiential value, purchase frequency, and perceived risk influence hybrid consumption patterns. Fourth, the role of the built environment and spatial accessibility in moderating online and offline interaction effects remains underexplored. Understanding how urban density, proximity retail, and logistics infrastructure influence shopping behaviour is essential to develop sustainable mobility policies. Finally, future studies would benefit from advanced methodological approaches, including panel data analysis, quasi-experimental designs, and integrated behavioural models capable of capturing dynamic channel choice processes and their feedback effects on spatial retail organisation.

4.2 Limitations

Despite the methodological rigour ensured by the PRISMA method, this study presents some limitations that should be acknowledged. First, the literature search was restricted to the Scopus database, which, although recognised for its multidisciplinary coverage and indexing of high-impact journals, may not capture all relevant publications available in other databases such as Web of Science or Transport Research International Documentation (TRID). Consequently, some potentially relevant studies may not have been included in the review. Second, the final sample comprised 24 empirical studies, reflecting both the novelty of the research topic and the strict eligibility criteria adopted. Although this allowed for a focused and in-depth synthesis, the relatively limited number of studies may constrain the generalisability of the findings. Furthermore, given the methodological heterogeneity of the selected publications, a formal quantitative meta-analysis or a standardised risk-of-bias assessment was not feasible. Instead, a qualitative evaluation of methodological robustness was conducted. Although this approach allowed for a contextualised interpretation of the results, it can introduce a degree of subjectivity in the evaluation process. Finally, as the literature on post-pandemic consumption patterns is still evolving, some behavioural trends identified in this review may represent transitional dynamics rather than long-term structural changes.

Acknowledgements

The authors thank CNPq for supporting this research.

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