ISSN 1611-1699 / eISSN 2029-4433

VILNIUS TECH
Vilnius Gediminas Technical University

JOURNAL of BUSINESS ECONOMICS & MANAGEMENT

2026
Volume 27
Issue 3
Pages 515–535

https://doi.org/10.3846/jbem.2026.26936

TRANSFORMATION OF CONSUMER BEHAVIOR POST-CRISIS: A QUALITATIVE MIXED METHODS APPROACH IN FOOD RETAIL

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Article History:
- received 22 July 2024
- accepted 16 March 2026

Abstract. Following successive global health, energy, and geopolitical shocks, this research investigates the persistent transformation of retail consumption patterns. While extant literature examines crisis-driven behavior, a methodological gap remains in synthesizing rich qualitative data with advanced computational techniques. This study addresses this gap by employing a mixed-methods design, integrating Principal Component Analysis (PCA) and Sentiment Analysis, to uncover the latent behavioral and affective dimensions of post-crisis decision-making.

Conducted in 2024 within the Romanian emerging market, the study utilizes focus group data to identify core drivers of behavioral change. Results reveal an accelerated adoption of retail technologies, a fundamental recalibration of purchasing priorities, and heightened expectations regarding the shopping experience. Sentiment analysis highlights significant variance in consumer adaptation, offering a granular perspective on emotional responses to the "new normal."

Theoretically, this work contributes to interdisciplinary scholarship on economic uncertainty and digital transformation. Practically, the findings provide actionable intelligence for firms to develop engagement and innovation strategies that align with emerging consumer needs in volatile environments. By bridging structural patterns with emotional dynamics, the paper offers a robust framework for understanding consumer resilience in the wake of systemic disruptions.

Keywords: emotion-driven consumer clusters, food retail, purchase behavior, post-crisis behavior, Principal Component Analysis (PCA), sentiment analysis, digital transformation, focus groups, technology adoption acceleration, shopping experience expectations.

JEL Classification: M30, C38, L81.

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1. Introduction

Recent global shocks, including the COVID-19 pandemic (Dabija et al., 2025), the 2021–2023 energy crisis (Lin et al., 2023), and escalating conflicts in Eastern Europe and the Middle East (Lucșan, 2024), have fundamentally recalibrated consumer priorities. These disruptions acted as catalysts, accelerating pre-existing trends (Bahn et al., 2025). Specifically, the pivot toward online retail reflects a profound shift in consumer perceptions of convenience and accessi-

bility (Imschloss & Schwemmle, 2024). Furthermore, the energy crisis and the war in Ukraine have disrupted agricultural supply chains and trade flows, exacerbating food insecurity and inflation (Coman et al., 2025; Food Security Information Network & Global Network Against Food Crises, 2025).

While existing literature examines behavioral shifts across the pandemic's timeline (Aruldoss et al., 2024; Dabija et al., 2025) and the energy crisis's impact on the food sector (Vo & Tran, 2024; Ključnikov et al., 2025), empirical research remains sparse regarding the integrated effects of these compounding crises on long-term consumer habits. Extant research has explored consumer responses to recent health, energy, and geopolitical crises (Aruldoss et al., 2024; Dabija et al., 2025; Singh et al., 2025). However, these studies rely heavily on survey-based data and descriptive analysis, often lacking the integration of advanced computational techniques. While specific tools like Principal Component Analysis (PCA), clustering, or sentiment analysis have been employed (Peter & Gupta, 2024), they are typically applied in isolation and within strictly quantitative frameworks. Consequently, there remains a significant gap in research that synthesizes qualitative insights, such as those from focus groups, with analytical modeling to uncover the latent structures of consumer behavior and emotional dynamics. To address this, our study investigates the extent of crisis-induced shifts in consumption habits. We employ a mixed-methods design that integrates PCA and sentiment analysis, revealing the underlying behavioral patterns and emotional expressions that drive decision-making in a post-crisis landscape.

The novelty of this work lies primarily in its qualitative oriented mixed methods approach, which allows an in-depth analysis of consumer-based data generated with the help of focus groups, which have relevance in business research (Lim et al., 2025). In analyzing qualitative data, the approach goes beyond traditional content analysis and relies on the application of modern natural language processing algorithms, combining qualitative analysis of data obtained through focus groups with advanced quantitative techniques: Principal Component Analysis (PCA) and sentiment analysis (Riandhi et al., 2025). The PCA method enables data dimensional reduction while maintaining as much variation as possible. By applying PCA, the research can identify underlying patterns and trends (Peter & Gupta, 2024) in consumer behavior that might not be immediately apparent. This offers a nuanced understanding of how different factors influence consumer decision-making following a crisis. Sentiment analysis adds another layer of depth by identifying consumers' emotional responses during focus group sessions. This method can reveal how feelings toward shopping experiences, as well as consumer expectations and concerns, have shifted due to the COVID-19 and energy crises, providing insights into consumers' buying motivations and reasoning. The findings generate actionable recommendations for the business environment. Understanding the current context enables companies to adjust marketing strategies, product offerings, and customer engagement practices in line with new consumer expectations, prepare for a profound and long-term transformation, rather than a temporary adjustment.

This study's novelty lies in its qualitatively driven mixed-methods framework, leveraging focus group data to provide the depth essential for contemporary business research (Lim et al., 2025). Moving beyond traditional content analysis, our approach integrates Natural Language Processing (NLP) algorithms with advanced quantitative techniques, specifically Principal Component Analysis (PCA) and sentiment analysis (Riandhi et al., 2025). PCA facilitates dimensional reduction to uncover latent behavioral patterns (Peter & Gupta, 2024) that escape conventional observation, offering a nuanced view of post-crisis decision-making. Concurrently, sentiment analysis captures the emotional granularity of consumer responses,

revealing how the COVID-19 and energy crises have recalibrated shopping motivations and expectations. Ultimately, these findings translate into actionable intelligence, enabling firms to transition from reactive adjustments to long-term strategic realignments in marketing, product development, and engagement.

The World Health Organization (WHO) designated COVID-19 as a Public Health Emergency of International Concern on January 30, 2020, and a pandemic on March 11, 2020. This period triggered unprecedented global socio-economic disruptions and public health interventions. The acute crisis phase concluded in May 2023, when the WHO declared the emergency over, signaling the transition of COVID-19 to an endemic state (Lundberg et al., 2024). Accordingly, this study identifies the period following May 2023 as the post-crisis era.

The remainder of this paper is structured as follows: Section 2 reviews the relevant literature, and Section 3 details the mixed-methods research design. Section 4 presents the results of the PCA and sentiment analysis, followed by a discussion of findings in the context of existing scholarship. Finally, the paper concludes with theoretical and managerial implications, limitations, and directions for future research.

2. Literature review

Contemporary society has navigated a decade of profound instability and structural transformation, driven by a succession of systemic crises (Pólya et al., 2024). These disruptions—ranging from persistent migration challenges (Aris Escarcena, 2024; Valaskova et al., 2025) and the COVID-19 pandemic (Chaabouni & Mbarek, 2024) to the 2022 Russia-Ukraine conflict (Höhler et al., 2024) and the subsequent global energy crisis (Gajdzik et al., 2024)—have fundamentally recalibrated consumer behavior. Beyond their macro-economic and societal footprints (Galushko & Riabchyk, 2024), these shocks have forced a significant shift in shopping modalities and product preferences. Extant research (Hartono et al., 2024; Poon & Tung, 2024; Yang et al., 2024; Popa et al., 2025) suggests that during periods of extreme turbulence, consumers undergo a hierarchy-of-needs transition, prioritizing health, personal safety, and logistical availability while exhibiting heightened price sensitivity and cost-conscious decision-making.

The COVID-19 pandemic acted as a catalyst for the institutionalization of e-commerce, transitioning digital solutions from convenience to a structural necessity (Jiang et al., 2023). This technological acceleration hastened the migration from traditional brick-and-mortar retail to online platforms, as consumers normalized behaviors such as digital ordering and home delivery (Brüggemann & Olbrich, 2023). The proliferation of e-commerce platforms has not only expanded product assortments (Nakano, 2022) but also optimized the consumer experience through enhanced accessibility and convenience (Şenyapar, 2024; Yang et al., 2024). As proficiency within digital ecosystems deepened, consumer trust increased, bolstered by mobile integration and logistics efficiencies (Galushko & Riabchyk, 2024). Ultimately, this shift toward flexible acquisition channels, including curbside pickup and omnichannel delivery, has cultivated a more resilient consumer base capable of navigating future systemic disruptions (Yang et al., 2022).

Convenience serves as a primary driver for delivery service adoption, as consumers increasingly prioritize home-based fulfillment to bypass high-density retail environments (Poon & Tung, 2024). The efficacy of online retail is increasingly contingent upon the diversity and quality of these fulfillment modalities (Wang et al., 2023), with delivery fees, scheduling flexibility, and lead times emerging as critical determinants of consumer choice (Kotzab et al., 2024). Hybrid models, such as click-and-collect, offer further utility by bridging digital

procurement with physical collection points (Poon & Tung, 2024). Research by Bonfanti et al. (2023) underscores this shift, noting that contemporary consumers exhibit heightened expectations regarding accuracy, punctuality, and provider professionalism. This "indispensability" of digital services is further reinforced by the low-friction nature of mobile application interfaces (Madinga et al., 2023). Consequently, as the digital marketplace expands, consumers increasingly leverage peer reviews to mitigate perceived risks and validate value propositions (Jiang et al., 2023). This reliance on social proof reflects a broader trend toward information-seeking behavior as a mechanism to navigate purchase uncertainty (Yang et al., 2024).

The convergence of the COVID-19 pandemic and global energy volatility has fundamentally recalibrated consumer risk perceptions, positioning online retail as a primary strategic alternative to mitigate health and safety concerns (Yang et al., 2024). Within this landscape, empirical evidence indicates a definitive pivot in dietary preferences toward functional and preventive nutrition (Galushko & Riabchyk, 2024). This trend, characterized by a prioritization of fresh, organic, and immunity-boosting products, reflects a heightened awareness of the nexus between nutrition and systemic well-being, intensified by the pandemic's disruptions. Consequently, the consumer's pursuit of long-term health resilience has moved organic and health-oriented products from niche markets into a central pillar of post-crisis consumption (Galushko & Riabchyk, 2024).

3. Research methodology

This research investigates the extent to which consumers have recalibrated their consumption habits following the COVID-19 pandemic, the global energy crisis, and the ongoing Russia-Ukraine conflict. Specifically, the study aims to decode the emotional and perceptual drivers of these shifts while identifying distinct consumer segments based on crisis-induced behaviors. To achieve this, the following three research objectives (RO) were established:

- **RO1:** To identify the latent dimensions explaining variations in post-crisis consumer behavior through **Principal Component Analysis (PCA)**, thereby reducing data dimensionality and isolating the core determinants of behavioral change.
- **RO2:** To evaluate the polarity and intensity of consumers' emotional responses toward behavioral shifts using **Sentiment Analysis**, providing a granular perspective on overarching consumer attitudes in the post-crisis landscape.
- **RO3:** To develop a taxonomic classification of consumer groups with homogeneous emotional and behavioral profiles using **Cluster Analysis**, highlighting divergent patterns of adaptation in purchasing habits.

To address the research objectives, we employed a qualitative-driven mixed-methods design, utilizing data from two focus groups conducted in the Romanian market. While the sample size is focused, it strictly adheres to established qualitative methodology guidelines for thematic saturation and depth (Krueger & Casey, 2014). This approach bridges traditional qualitative inquiry with advanced computational techniques—specifically Principal Component Analysis (PCA) and Sentiment Analysis—to facilitate robust pattern extraction from complex dialogue data. Romania serves as a critical focal point due to its status as a "Secondary Emerging Market" (FTSE Russell, 2025; International Monetary Fund, 2025) and its acute exposure to the Russia-Ukraine conflict. This proximity has induced significant supply chain disruptions, refugee migration, and heightened systemic security concerns (Mocernac & Joldescu Stan, 2023), making it an ideal laboratory for examining consumer behavioral shifts within the food retail sector under conditions of regional instability.

Systematic disruptions in agricultural and energy supply chains (Lin et al., 2023; European Commission, 2023), combined with the unprecedented migration of Ukrainian refugees (UNHCR, 2023) and regional economic volatility (Lucșan, 2024), have fundamentally altered consumer behavior in the region. To capture these shifts, the focus group discussions were structured around five core thematic pillars: (1) the dichotomy between physical and online retail engagement; (2) the crystallization of new consumption habits; (3) evolving purchasing heuristics; (4) heightened expectations of retail performance; and (5) longitudinal perceptions of future shopping evolutions. This thematic framework allows for a comprehensive investigation into how systemic shocks translate into micro-level consumer decision-making.

The focus group participants were purposively selected to reflect a high-influence demographic: professionals aged 40–52 with higher education. This segment (comprising economists, engineers, and lawyers) was chosen for its significant purchasing power and established decision-making roles in food retail (Mancuso et al., 2023; Duong, 2024). Their stable financial profiles provide a robust basis for identifying consistent behavioral shifts. The inclusion of three distinct occupational fields served to balance analytical, technical, and legal cognitive profiles within the consumer behavior analysis.

Two 90-minute sessions were conducted in a physical format with 14 participants to facilitate direct interaction. The discussions followed a structured guide covering shopping preferences, pricing attitudes, health-safety concerns, and retail expectations. Analytically, the integration of Principal Component Analysis (PCA) and sentiment analysis were employed to address the research objectives. PCA was utilized to reduce data dimensionality and isolate dominant behavioral patterns, while sentiment analysis provided the essential emotional classification required to interpret the qualitative nuances of the data. This dual-method approach ensures that the identified consumption factors are grounded in both structural patterns and participant-driven emotional perspectives.

As illustrated in Figure 1, this study adopts a robust mixed-methods framework (Riandhi et al., 2025) that synthesizes qualitative focus group data with advanced computational techniques: Principal Component Analysis (PCA) and Sentiment Analysis. This integrated approach, supported by contemporary literature (Verma et al., 2023), facilitates a dual-lens understanding of post-crisis consumer behavior. While PCA is utilized to isolate the latent dimensions explaining behavioral variance (Peter & Gupta, 2024), sentiment analysis provides a granular affective mapping of consumer perceptions (Miah et al., 2024). The research architecture follows a four-step systematic procedure (Cui et al., 2023; Miah et al., 2024), commencing with:

- **Step 1: Data Collection.** In 2024, two focus groups were conducted with participants purposively selected for their diverse experiences with crisis-driven behavioral shifts.

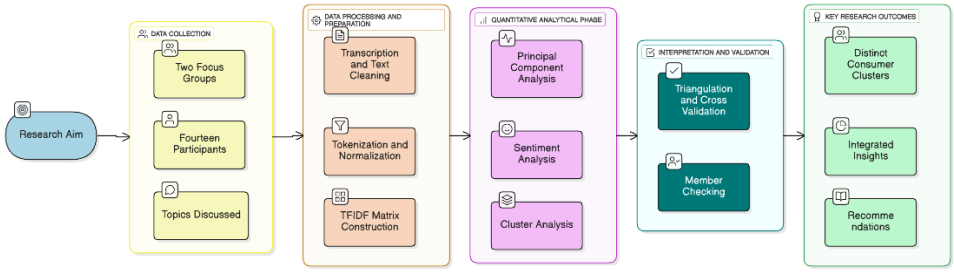

Figure 1. Workflow of the analysis (source: authors' own development using DiagramGPT by Eraser AI)

Discussions were facilitated via a semi-structured guide targeting key thematic domains: digital channel migration, economic caution, sustainable consumption, habit formation, shifting priorities, and technology-mediated retail interactions. All sessions were audio-recorded and transcribed verbatim to ensure analytical integrity.

- **Step 2: Data Preprocessing and Vectorization.** Focus group transcripts were subjected to standardized Natural Language Processing (NLP) protocols, including noise reduction, tokenization, and normalization (Manning et al., 2014). To facilitate subsequent computational analysis, we constructed a document-term matrix utilizing Term Frequency-Inverse Document Frequency (TF-IDF) weighting (Zhang et al., 2010). This vectorization method ensures that the most semantically significant terms are prioritized for dimensionality reduction and sentiment extraction.
- **Step 3: Integrated Computational Analysis.** The analytical phase employed a sequential mixed-methods design:
  - *Dimensionality Reduction* (*PCA*): Principal Component Analysis (PCA) was first applied to isolate latent thematic structures and extract components explaining the maximum variance in consumer responses (Peter & Gupta, 2024). By mitigating multicollinearity, PCA enabled the visualization of primary behavioral patterns while retaining the dataset's core information density.
  - *Affective Mapping* (*Sentiment Analysis*): To complement the structural insights from PCA with emotional context, we employed the TextBlob library (Kathiravan et al., 2023; Maria et al., 2024). Responses were categorized by emotional polarity and intensity on a scale from –1 (extremely negative) to +1 (extremely positive). This quantification allowed for the identification of affective trends linked to specific consumption behaviors.
  - *Pattern Synthesis*: To transcend individual sentiment metrics, the analysis concluded with a *Clustering Approach*. This step served to delineate natural groupings within the sentiment data, revealing broader, homogeneous behavioral profiles across the participant collective.
- **Step 4: Strategic Segmentation via Cluster Analysis.** To delineate latent patterns within consumer sentiment and behavioral shifts, we performed a cluster analysis based on the polarity scores derived in Step 3. Utilizing the k-means algorithm (MacQueen, 1967), we categorized participant responses into distinct clusters to identify homogeneous sentiment profiles. The optimal number of clusters was determined via the Elbow Method (Thorndike, 1953), evaluating the Within-Cluster Sum of Squares (WCSS) to ensure that the final segmentation maximized variance explanation without overfitting. This step is instrumental in identifying latent structures within textual data, facilitating the transition from individual sentiment metrics to interpretable, actionable consumer segments (Manning et al., 2008). By integrating PCA, sentiment analysis, and clustering, this framework captures both the structural and affective dimensions of consumer behavior, providing a nuanced understanding of how divergent groups perceive and adapt to post-crisis consumption paradigms.

For data analysis and processing, modern tools were used, such as Python libraries 'pandas', 'scikit-learn', 'TextBlob' and 'matplotlib', which allowed for text cleaning and transformation, its vectorization via a term-document matrix, as well as the application of advanced techniques such as Principal Component Analysis (PCA), sentiment analysis and cluster analysis. 'Pandas' was used for data manipulation and preprocessing, 'scikit-learn' for the implementation of PCA and the 'k-means' clustering algorithm, and 'TextBlob' for sentiment

analysis, providing classification of responses according to polarity (positive, negative, neutral) and intensity. Results visualizations were performed using the 'matplotlib' library, which facilitated the graphical representation of principal components and clusters.

The choice of these libraries was based on their proven performance in textual data analysis, the ability to extract relevant information from complex data and highlight essential trends. PCA was used to reduce dimensionality and identify the principal components that explain the variation in consumer behavior, while sentiment analysis provided an emotional perspective on the participants' responses, classifying them according to polarity (positive, negative, neutral) and intensity. The choice of these methods was based on their ability to extract relevant information from complex data, reducing noise and highlighting essential trends. Clustering analysis, using the 'k-means' algorithm was then employed to group responses with similar sentiment profiles, enabling the identification of distinct patterns in consumer perceptions. The choice of these methods was based on their ability to extract relevant information from complex data, reducing noise and highlighting essential trends.

To ensure study validity, multiple validation measures were implemented: method triangulation (McGee, 2024), inter-coder reliability checks for sentiment coding, cross-validation of PCA results, and member checking to confirm interpretations. This comprehensive methodology enables a holistic understanding of shifts in consumer behavior, merging quantitative rigor with qualitative depth (Foroudi & Foroudi, 2024; Riandhi et al., 2025). By integrating multiple analytical and validation techniques, the study offers a nuanced perspective on behavioral changes in the post-crisis context.

The research was conducted on a sample of professionals from diverse fields, ensuring a balanced gender distribution across occupational roles. Analysis of the collected data revealed a variety of professions (engineers, architects, economists, educators), with a predominance of male representatives in technical roles (engineer, manager) and a higher presence of women in fields such as Economics and Law (Table 1).

Table 1. Distribution of respondents across Focus Groups (source: own development)

Focus group 1			Focus group 2		
Gender	Age	Occupation	Gender	Age	Occupation
M	45	Manager	F	46	Chemical Biologist
M	47	Architect	M	46	Mechanical Engineer
M	49	Historian	M	42	Economist
F	41	Economist	M	41	PE Teacher
F	46	Jurist	F	42	Economist
F	45	Lawyer	F	52	Dentist
F	44	Cosmetician	F	44	Lawyer

Although there is varied gender distribution across professions, certain fields remain predominantly associated with a specific gender. The research can serve as a foundation for future initiatives promoting diversity and equity across all professional sectors. 60% of research participants were male, and 40% were female. The median age of men was 44.5 years (approximately half were aged ≤44.5 years, while the other half were older than 44.5 years), and that of women was 45.5 years. The research included 3 economists (21.43% of total occupations), 2 lawyers (14.29%), and one each of the following: manager, architect, historian,

jurist, cosmetologist, biologist, engineer, teacher, and physician (7.14% of total occupations). This uniform distribution suggests professional diversity among respondents. The data indicates relative homogeneity in participants' ages, with a concentration between 41 and 52 years. There is a slight predominance of women and a variety of represented professions, with economists being the most numerous. To determine associations between categorical variables (gender and occupation), the Chi-Square test was applied, yielding a result of λ^2: 11.278, P-Value: 0.336. This indicates no significant association between gender and occupation at a 0.05 (or even 0.01) significance level. The age of the current participants (aged 40–50, higher education) may act as a limitation of the study. However, this category was chosen because it represents an economically active segment, responsible for a large part of consumption decisions, while the high level of education allowed for a more detailed exploration of the topics of interest. The relatively narrow age range and professional composition of the focus groups may limit the generalizability of the findings. However, homogeneity allowed for a more controlled comparison of crisis-induced behavioral transformations within a socio-economically stable segment. Future research will include broader demographic and occupational diversity to validate and extend the findings across different consumer segments.

4. Results

Principal Component Analysis (*PCA*)

The application of Principal Component Analysis (PCA) to the existing dataset highlighted various characteristics of purchasing behavior, such as shopping frequency, types of products purchased, and spending amounts. From the total variables analyzed, PCA delineated four factors (PCA1–PCA4), with a total explained variance of 46.41%: PCA1 (13.73%), PCA2 (12.86%), PCA3 (10.17%), and PCA4 (9.66%). Figure 1 displays the heatmap of correlations between principal components, offering a visual perspective on their relationships. Correlations are represented numerically and visually, with values color-coded from dark red (strong positive correlation) to white (weak or no correlation) or light grey (weak negative correlation). Each numerical value in the correlation matrix indicates the degree of linear correlation between two principal components. The diagonal value of 1 reflects that each component is perfectly correlated with itself, as expected. Values close to 0 outside the diagonal suggest very weak (or nonexistent) correlations between components, which is a desirable outcome in PCA, as components are designed to be orthogonal (independent).

The minus sign (–) in certain matrix values indicates a weak negative correlation between components. However, extremely small numerical values (e.g., -8.7×10^{-17}) are more likely numerical noise than meaningful relationships. In practice, these negative values lack significant practical relevance, as PCA inherently minimizes inter-component correlations. The heatmap (Figure 1) confirms that the four principal components are nearly independent, validating PCA as an effective dimensionality reduction method. The absence of strong correlations between components reflects the diversity of factors influencing purchasing behavior. Beyond the four dimensions (D1–D4), additional factors contribute to how focus groups participants acknowledged shifts in consumption habits post-crisis. Since none of the PCA dimensions explain a large proportion of total variance, it is evident that participants considered a combination of factors in relation to post-crisis shopping (rather than being influenced by a single dominant factor). Participants' purchasing behavior may have been shaped by the synergistic effect of multiple vectors (e.g., price, quality, brand, health, or sustainability), rather than just one.

The four main components (PCA1–PCA4) represent distinct dimensions of purchasing behavior, each capturing unique aspects of how consumers have adapted their shopping habits since the crisis. These dimensions highlight both deliberate and reactive changes in behavior, reflecting the interplay between conscious decision-making, habitual tendencies, external pressures, and emerging preferences for convenience and health. Together, these components provide a comprehensive framework for understanding the multifaceted nature of consumer behavior post-crisis, where individual values, priorities, and external influences converge. A detailed exploration of each component is presented below, providing insights into the specific behavioral patterns encapsulated in PCA1–PCA4.

The heat map (Figure 2) illustrates the correlations among the four principal components (PCA1–PCA4), providing a visual and numerical representation of the relationships between them. Because PCA is designed to produce orthogonal (independent) components, the observed correlations are expected to be minimal, and diagonal values of 1 reflect perfect autocorrelation, as anticipated. Correlations close to 0 indicate that the components capture distinct, non-overlapping aspects of the data. The small negative correlations observed in the matrix (e.g., -8.7×10^{-17}) are likely the result of numerical precision issues inherent in the computational processes, rather than significant relationships. These values are negligible and do not affect the validity of the PCA results. The independence of the components, confirmed by the low off-diagonal correlation values, validates PCA as an effective method for dimensionality reduction, ensuring that each principal component provides unique information about the dataset. The nearly orthogonal structure of the components highlights the diversity of factors influencing purchasing behavior, as each component represents a distinct dimension of variation. This independence is crucial for interpreting the results, as it allows for a clearer understanding of how different dimensions, such as deliberate behavioral changes, habitual tendencies, crisis-induced adaptations, and health and comfort preferences, contribute to post-crisis purchasing habits.

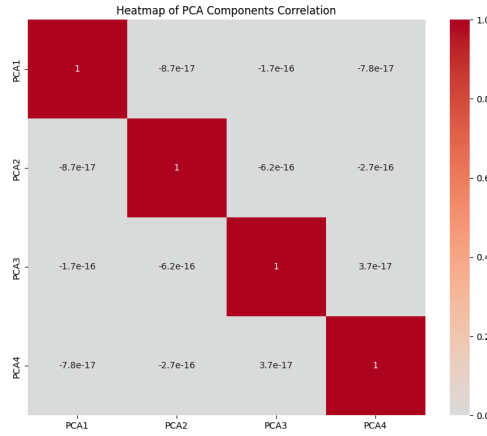

Figure 2. Heatmap of PCA Components Correlation (source: own research)

PCA 1, entitled "*Conscious and deliberated changed behavior*" [Conscious and deliberate behavior change], comprises the terms 'managed', 'thing', 'generally', 'interested', 'long', 'change', 'absolutely', 'intentionally', 'necessarily', and 'keep' (Figure 3, Word-Cloud PCA1). This dimension includes terms suggesting a focus on intentional and necessary shifts in

purchasing behavior, with keywords indicating a potential evaluation of the duration of changes ('long') and attention to retaining pre-established shopping habits ('keep', 'managed') post-crisis. This component reflects a conscious and deliberate alteration in shopping behavior, with terms implying intentional adaptation of habits to preserve or manage aspects of daily life over an extended period. Consumers emphasized making informed, deliberate choices aligned with individual values and ethical considerations. Participants appeared to be focused on sustainable, long-term changes in their post-crisis shopping practices, while also considering the broader societal and environmental implications of their purchases.

PCA 2, entitled "*Reviewed old habits*" (Figure 3, Word-Cloud PCA2), includes keywords such as 'buy', 'change', 'shop', 'focusing', 'really', 'review', 'absolutely', 'behavior', 'definitely', and 'unchanged'. This dimension highlights clarity in purchasing behavior in the post-crisis period, suggesting resistance to change ('unchanged') and confirmation of existing habits ('definitely', 'really'). The component involves a critical re-evaluation of shopping practices ('review'), indicative of highly focused, need-driven purchasing behavior. A tension emerges between maintaining established habits and adapting to the new socio-economic context, with terms implying participants' confidence in their current shopping methods. While most perceived no urgent need for change, a subset remained open to revising and adjusting habits to align post-crisis.

Figure 3. Word-Clouds of the 4 PCAs (source: own research)

PCA 3, entitled "*Crisis induced attitudes*" (Figure 3, Word-Cloud PCA3), includes keywords such as 'product', 'in', 'certain', 'particularly', 'stockpile', 'focusing', 'really', 'don't', 'shop', and 'everything', revealing a selective or specific purchasing attitude with potential tendencies toward stockpiling ('stockpile') and focusing on products ('particularly', 'focusing'). This dimension reflects shifts in consumers' purchasing priorities driven by external crisis-induced changes. Responses suggest participants' selective approach to food purchases, concentrating on specific products due to uncertainty or personal needs. 'Stockpile' signals significant alterations in consumption habits, such as excessive buying or hoarding, driven by fear of scarcity and insecurity. Anxiety about shortages prompted consumers to revise their purchasing

decisions, potentially leading to panic-driven acquisitions. Conversely, 'particularly' and 'focusing' highlight heightened attention to products perceived as maximizing perceived value or aligning closely with participants' expectations, preferences, and needs.

PCA 4, entitled "*Healthy food delivery*" (Figure 3, Word-Cloud PCA4), comprises terms like 'necessarily', 'everything', 'keep', 'managed', 'thing', 'fruit', 'lot', 'delivery', 'yes', and 'intentionally'. This component emphasizes logistical aspects of shopping ('delivery') and the acquisition of fresh, safe foods in quantity ('fruit', 'lot'). These terms reflect behavioral shifts toward specific food choices, indicating growing consumer awareness of nutrition and health, alongside a preference for convenience through delivery services. Consumers could swiftly select all dietary options online ('everything') and receive them at home. This time-saving aspect ('managed') allowed them to focus on other life priorities ('thing') while maintaining a health-conscious lifestyle. The intentionality ('intentionally') behind these choices underscored a deliberate alignment with health and convenience post-crisis.

The PCA results revealed four main dimensions influencing post-crisis purchasing behaviors. Each component was correlated with specific terms (Figure 3), indicating distinct trends: deliberate changes, re-evaluation of habits, crisis-induced attitudes, and preferences for health and comfort. So, PCA identified four key components of post-crisis purchasing behavior: PCA1 (conscious and deliberate behavior change), capturing intentional, value-driven, long-term adjustments aimed at managing and preserving routines; PCA2 (reviewed old habits), reflecting a critical re-evaluation of shopping practices and a balance between maintaining habits and selective adaptation; PCA3 (crisis-induced attitudes), indicating selective purchasing and stockpiling behaviors driven by uncertainty and perceived scarcity; and PCA4 (healthy food delivery), highlighting health-oriented choices and convenience through preference for fresh products and delivery services. These brief summaries accompany the first presentation of PCA results (see Figure 3). Sentiment analysis confirmed that most respondents expressed neutral to positive feelings about these changes, suggesting adaptability and resilience. Clustering provided a clear segmentation of participants, identifying groups with similar perceptions, reflecting the diversity of ways in which consumers respond to post-crisis challenges.

Sentiment analysis

Analysis of consumer behavior in the face of dynamic market developments reveals a mix of neutral and positive sentiments (Figure 4), characterized by stability and resilience in adapting to a first switch behavior induced by the pandemic compared to pre-pandemic norms and a second switch behavior post-crisis. The distribution of these sentiments (neutral and positive) was identical across participant responses (Figure 4).

Neutral sentiment was identified in various participant responses:

- 'Definitely', 'buy', 'behavior', 'unchanged' indicate retention of the same purchasing behavior post-crisis, with shopping habits almost identical to those during the pandemic.
- 'Depends', 'type', 'shopping', 'look', 'online', 'site', 'compare' suggest a focus on online purchases that enable price comparisons and perceived added value through the convenience of ordering from anywhere at any time.
- 'Necessarily', 'intentionally' evoke a deliberate, rational behavioral shift that lacks emotional resonance, facilitating uninhibited food purchasing.
- 'Don't', 'even', 'know', 'think', 'changed', 'pandemic', 'also', 'age' reflect ambivalence or a lack of awareness regarding changes in purchasing behavior post-crisis, with transactions following the same principles.

- 'Everything', 'managed', 'keep', 'thing' reveal consistency in purchasing actions and a stable acquisition pattern. This equilibrium implies neither positive nor negative sentiment toward the status quo.

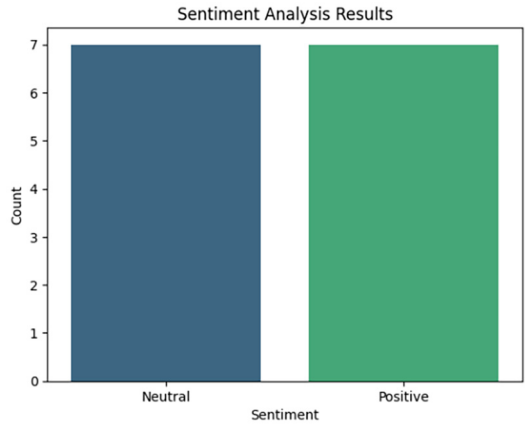

Figure 4. Sentiment distribution in the analyzed text corpus (source: own research)

On the other hand, positive sentiment emerged from other participant statements:

- 'Behavior', 'absolutely', 'change' denote a favorable, undeniable shift in purchasing behavior. Participants emphatically acknowledged this change, framing it positively.
- 'Generally', 'interested', 'delivery', 'time', 'online', 'order' signal approval of online delivery speed and convenience, highlighting the value of time efficiency and location flexibility.
- 'Shop', 'don't', 'stockpile', 'don't', 'buy', 'certain', 'product' reflect consumer avoidance of pandemic-era stockpiling, emphasizing moderation and quality over quantity.
- 'Yes', 'buy', 'lot', 'fruit', 'much' underscore intentional procurement of fresh products (e.g., fruits), driven by heightened health and well-being priorities.
- 'Yes', 'course', 'careful', 'price', 'online', 'also', 'store', 'make' reveal increased price scrutiny across online and physical stores, coupled with financial prudence in identifying cost-effective, high-quality food options.
- 'Don't', 'think', 'anything', 'changed', 'look', 'site', 'compare' highlight attention to cross-platform price comparisons, enabling significant savings and selective purchasing based on value.
- 'Behavior', 'don't', 'really', 'shop', 'price', 'online', 'focusing' suggest unchanged purchasing routines, post-crisis, with consumers valuing price awareness and confidence in selecting priced products, avoiding scams.

A significant proportion of consumers remained loyal to traditional purchasing habits, yet clear signs of a shift toward heightened price awareness and a preference for digital convenience, particularly online shopping and food delivery services, were evident. Although most respondents reported no major changes in purchasing behavior, enough consumers expressed shifts that suggest significant evolution and a positive valuation of this new reality. These changes include greater attention to pricing, increased adoption of online shopping services, higher expectations for delivery timelines, healthier consumption choices, more prudent spending approaches, and reliance on product reviews. Thus, despite the predominance of

stable habits, a general positive trend of consumer adaptability emerged. This reflects growing sophistication and economic prudence, fueled by technology and influenced by health and value considerations. Such adaptability is crucial for understanding how consumers will interact with markets and economies in the future.

Overall, responses suggest that while many consumers maintain consistent purchasing behavior, a subset adopted adaptive strategies to navigate economic and social changes. Price sensitivity, attention to delivery times, health-focused purchasing, and reliance on reviews are all ways in which consumers enhanced or tailored their shopping experiences to align with current needs and circumstances.

Sentiment analysis on each cluster

Cluster 1 presented a marginally positive average sentiment (0.09), with participant responses ranging from neutral to mildly positive (0.20 polarity) regarding behavioral transitions (Figure 5). This sentiment arises from the synergistic effect of various factors perceived as advantageous in the post-crisis landscape. Specifically, consumers manifested moderate satisfaction (0.10 polarity) with digital retail, prioritizing the temporal efficiency of avoiding physical stores and the logistical reliability of door-to-door courier services for essential goods. Beyond convenience, online platforms facilitated strategic price comparisons and a heightened focus on health-centric products, such as fresh produce, to bolster immunity, a likely legacy of the crisis context. This digital environment encourages deliberative decision-making, mitigating impulsive consumption and fostering resource optimization. Post-crisis, these shopping modalities have achieved seamless normalization within daily routines, significantly enhancing overall customer satisfaction. Ultimately, consumers in this cluster evidenced high resilience, rapidly internalizing pandemic-induced changes and valuing them as permanent, positive enhancements to their lifestyle (Figure 5).

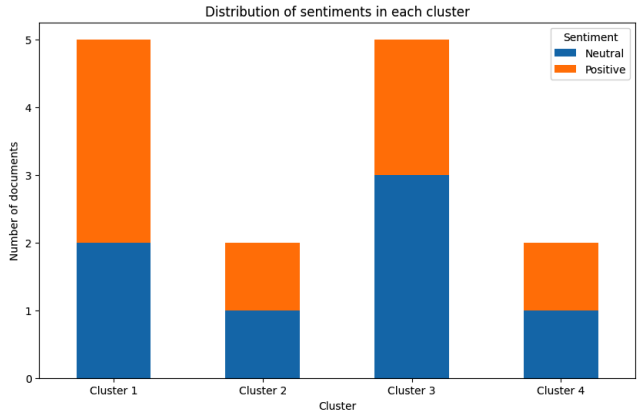

Figure 5. Sentiment distribution across the four clusters (source: own research)

Cluster 2 exhibited a slightly positive sentiment, with polarity scores between 0.10 and 0.20 (Figure 5), signaling a definitive shift in purchasing priorities. This segment reflects a partial modification of behaviors, characterized by a hybrid approach to acquisition methods and a heightened focus on food provenance and quality. Consumers in this cluster demonstrated significant interest in high-quality, eco-friendly products, utilizing price-comparison tools to

optimize expenditure. Notably, this group displayed a dual awareness: evaluating the societal impact of their consumption on local producers while simultaneously managing the constraints of personal budgets. The behavioral transitions induced by recent crises were perceived positively, underscoring a resilient adaptation to the shifting socio-economic landscape. These positive experiences were further augmented by the post-restriction "freedom" to explore new retail environments and products that better align with personal values and immediate satisfaction. Ultimately, Cluster 2 represents a conscientious consumer base that balances traditional habits with modern, value-driven, and socially responsible priorities.

Cluster 3 reflects a marginally positive average sentiment (0.08), indicating a mild yet favorable perception of post-crisis behavioral shifts (Figure 5). In the current socio-economic climate, characterized by restored mobility, consumers have moved away from crisis-induced stockpiling toward a deliberate, health-centric approach. This segment prioritizes food quality and nutritional relevance, particularly fresh produce, over sheer quantity, reflecting a commitment to waste reduction and responsible consumption. A polarity peak of 0.19 underscores a preference for intentional shopping practices that align with specific dietary needs and health preservation. Driven by a confluence of budgetary constraints and lifestyle re-evaluations, these consumers have become highly selective regarding product attributes. Furthermore, this group demonstrates an increasing inclination toward socially and ecologically responsible purchasing, favoring local and eco-friendly options. This behavioral evolution is significantly reinforced by prior personal experience, illustrating a stable transition toward a more informed and conscientious retail engagement model.

Cluster 4 showed the most pronounced positive sentiment, with polarity scores ranging from 0.30 to 0.60, indicating a high valuation of post-crisis behavioral shifts (Figure 5). Members of this segment prioritized cross-platform price comparisons, reflecting an orientation toward exploration, financial prudence, and shopping efficiency. This positive sentiment is rooted in the pursuit of "value-for-money," where the ability to secure optimal returns on expenditure provides a sense of financial agency and self-confidence. The group's reliance on digital comparison tools signals high technological fluency and a sophisticated understanding of retail pricing tactics. This "discovery" process generates significant transactional utility, contributing to the cluster's elevated sentiment. Overall, while the broader text corpora across all clusters remained slightly positive or neutral, suggesting that behavioral changes were evolutionary rather than radical, Cluster 4 stands out for its favorable perception of these shifts. Within this group, the average polarity of 0.30, peaking at 0.60, underscores a strategic focus on maximizing value and achieving financial savings through informed, technology-mediated decision-making.

5. Discussion

The research findings are categorized into four primary dimensions of post-crisis behavior: (1) Purchasing Behaviors (frequency and product type), (2) Emotions and Perceptions (attitudes toward habit shifts), (3) Structural Changes (systemic behavioral evolution), and (4) External Context (socio-economic and geopolitical influences).

PCA results reveal significant behavioral transitions. PCA1 ("Conscious and Deliberate Behavior") underscores the adoption of intentional, sustainable habits focused on resource efficiency. Conversely, PCA2 ("Re-evaluating Old Habits") reflects a critical analysis of traditional practices, balancing legacy behaviors with contextual agility. These shifts are mirrored in the

cluster results: Cluster 3 demonstrates a responsible, sustainability-oriented approach with a slight positive sentiment, indicating a transition from crisis-driven reactivity to a rational, adaptive consumption model.

Generally, sentiment analysis ranges from neutral to positive, signaling consumer stability. Figure 3 illustrates high satisfaction levels regarding online retail, expedited logistics, and healthy food access, elements synthesized in PCA4 ("Healthy Food Delivery"). Notably, Cluster 4 achieves a maximum polarity of 0.60, highlighting strong positive associations with digital integration, price transparency, and realized financial savings. Collectively, these dimensions illustrate a sophisticated recalibration of the consumer psyche in the post-crisis landscape.

Consumers demonstrated a high valuation of the flexibility and choice-optimization afforded by digital platforms, fostering a positive perception of post-crisis transitions. This aligns with Wang et al. (2023), who posit that perceived convenience and optimization capabilities significantly bolster purchase intentions and trust in cross-cultural e-commerce. Similarly, Tiutiu et al. (2025) underscore that platform technology, service quality, and accessibility are primary drivers of consumer retention and favorable responses to digital flexibility.

Applying the k-means algorithm, this study identified four distinct consumer typologies. Cluster 1 (Digital Integration) represents rapid adopters who have fully normalized online shopping and logistics into daily routines. Cluster 2 (Hybrid-Traditionalists) reflects partial adaptation, prioritizing quality and eco-friendly products while retaining legacy habits. Cluster 3 (Conscientious Consumers) emphasizes product attributes, health, and sustainability, signaling a shift toward responsible consumption. Conversely, Cluster 4 (Value-Optimizers) exhibits high trust in technology and financial planning, leveraging price transparency to maximize savings. Collectively, these segments illustrate a multifaceted landscape of adaptation, ranging from functional digital reliance to value-driven and ethical recalibration.

Post-crisis consumer behavior is driven by a synthesis of heightened health awareness, safety considerations (Yang et al., 2024), and the pursuit of experiential value (Imschloss & Schwemmle, 2024). Financial sensitivity remains a primary determinant; as Codjia and Saghaian (2022) observed, even marginal price fluctuations significantly impact spending, underscoring the enduring influence of economic volatility. This fiscal caution is matched by a structural migration toward digital "click-and-order" platforms, reflecting a fundamental prioritization of convenience and security (Poon & Tung, 2024). Consistent with Sharma et al. (2023), this transition transcends temporary pandemic measures, signaling a permanent shift toward digitized, high-efficiency retail ecosystems.

Qualitative data from focus groups corroborate these trends, revealing a heightened awareness of safety protocols and a more cautious, deliberative approach to consumption. This mirrors Veselovská et al.'s (2022) findings that safety concerns have evolved into a core behavioral pillar. Participants characterized the cumulative impact of recent health, energy, and socio-economic crises as a catalyst for "value-maximization." Such behavioral evolution aligns with the typologies proposed by Yang et al. (2024), where consumers blend traditional habits with adaptive digital practices, including e-banking and social commerce, to navigate uncertainty.

In this landscape, product quality emerges as a critical trust-building factor. While the current study's qualitative depth provides nuanced insights into these shifts (Morgan, 2019), future research should employ broader demographic sampling to enhance the generalizability of these findings across diverse socio-economic strata. Ultimately, the data illustrates a sophisticated recalibration of consumer priorities, where digital fluency, safety, and quality-centric value propositions converge to define the new retail reality (Zeng et al., 2025).

Based on PCA variance and keyword association, respondents exhibited more purposeful and selective shopping habits, driven by economic volatility, lifestyle redefinition, and technological integration. Sentiment analysis reveals a predominantly positive orientation toward these behavioral shifts, suggesting high consumer resilience and successful adaptation to the post-crisis reality (Stanca et al., 2025). Consumers now demonstrate increased rationality, with a heightened awareness of price-quality ratios, product characteristics, and logistical efficiency (Kotzab et al., 2024). Furthermore, recent systemic shocks (health, energy, and socio-economic) have catalyzed a "health-conscious" transition, prioritizing nutrition and sustainable choices as core consumption values (Galushko & Riabchyk, 2024; Hartono et al., 2024).

This positive sentiment underscores the capacity of consumers to derive satisfaction through adaptive strategies despite environmental challenges. Consistent with Ingram et al. (2024), such behavioral adjustments enhance consumer fulfillment by discovering new, efficient purchasing modalities. Consequently, consumers have become adept at optimizing delivery timelines and maximizing experiential value while maintaining financial consciousness. This shift toward "value-optimization" likely reflects both a response to persistent economic uncertainty and a broader trend toward deliberate, informed consumption. Ultimately, these results indicate that post-crisis consumers are not merely reactive but are proactively reshaping their purchasing ecosystems to align with personal well-being and fiscal prudence (Hartono et al., 2024).

6. Implications and conclusions

This paper contributes to the literature by integrating PCA, sentiment analysis, and clustering to explore post-crisis consumer behavior. By leveraging PCA, the study identifies core dimensions of behavioral variation, while sentiment analysis provides nuanced emotional insights. Subsequent cluster analysis of polarity scores reveals distinct consumer segments based on emotional and behavioral responses, offering a unique typology of post-crisis adaptation. The research further distinguishes itself through a dual approach: identifying behavioral shifts while examining underlying determinants such as economic adaptability, digitalization, and the rising prioritization of health and sustainability. Consequently, this work supports both theoretical discourse and commercial practice by facilitating trend identification and strategy development aligned with emerging consumer priorities. The study's outcomes directly address the research objectives. Cluster analysis yields a novel segmentation of adaptation patterns, while PCA highlights critical behavioral drivers, including safety concerns, technological agility, and price-quality optimization. Additionally, sentiment analysis indicates a predominantly positive orientation toward evolving purchasing habits, suggesting resilient consumer adaptability and a continued pursuit of value. These findings provide a robust foundation for developing commercial strategies and policies tailored to contemporary socio-economic realities.

Theoretically, this research advances frameworks for understanding post-crisis consumer behavior, extending beyond traditional pre-crisis or intra-crisis contexts. By integrating the influences of economic uncertainty, digital adoption, and sustainability concerns, this study refines consumer behavior models for dynamic market conditions. The novelty of this integrative approach enables researchers and practitioners to move beyond descriptive analysis of purchasing habits to understand the underlying drivers of consumer action under the pressures of crisis and conflict.

Findings suggest that behavioral shifts emerge from a confluence of internal factors, such as personal values and attitudes, and external pressures, including economic volatility and armed conflict. While many consumers maintain baseline habits, a significant subset adopts adaptive strategies, including heightened price sensitivity, increased reliance on delivery services, and a prioritized focus on health-centric products. These insights elucidate how consumers navigate systemic socio-economic shifts, underscoring the critical necessity for agile, consumer-centric retail strategies in an increasingly volatile global landscape.

From a managerial perspective, identifying key behavioral drivers facilitates the design of product development, engagement, and innovation strategies aligned with shifting consumer expectations in volatile environments. Practically, these insights enable firms to refine communication, optimize customer interactions, and engineer products that precisely address evolving sentiments. By prioritizing personalized, authentic engagement across digital platforms, including social media, mobile applications, and live-streaming, businesses can cultivate deeper resonance and long-term brand loyalty.

Furthermore, the emergence of a more deliberate, calculative shopping ethos offers opportunities to enhance consumer satisfaction; as individuals maximize resources, they derive greater perceived value from their purchases. This effect is particularly pronounced in contractionary economic periods where marginal savings are highly valued. Beyond individual transactions, this consumer shift carries systemic implications, such as stimulating retail competition and advancing price transparency. Ultimately, these dynamics may elevate industry standards and ensure closer alignment between pricing and market value. Collectively, these developments foster a more robust consumer perception of market integrity and economic resilience, providing a blueprint for firms to navigate the complexities of the modern socio-economic landscape.

The primary finding of this study is the accelerated digital transformation of consumer behavior. Crisis-induced pressures have catalyzed a structural shift toward e-commerce, as consumers increasingly prioritize the convenience of digital payments and integrated delivery services over traditional brick-and-mortar retail. This transition represents a durable recalibration of purchasing preferences rather than a transient reaction. Parallel to this technological pivot is a profound redefinition of consumer priorities, with heightened emphasis on perceived value, product quality, and sustainability. These evolving expectations necessitate a strategic response from retailers, who must enhance service delivery models to meet sophisticated post-crisis demands. Consequently, the intersection of digital fluency and value-driven decision-making defines the new competitive landscape, requiring firms to balance technological efficiency with ethical and quality-centric value propositions.

The findings provide critical insights into consumer behavior shaped by recent global crises, highlighting the necessity for retailers to adapt to a post-crisis paradigm. By embracing technological advancements, prioritizing sustainability, and enhancing customer experience, retailers can navigate this rapidly evolving market. While these results open promising avenues for future research, the study's reliance on focus groups presents inherent limitations, including small sample sizes and potential participant bias. To enrich these findings, future studies should consider structured surveys to enhance statistical significance or in-depth interviews to explore personal experiences overlooked in group settings. Furthermore, the sample's geographic focus on Romania and the specific 40–52 age demographic limits generalizability. While this segment was intentionally selected to analyze economically active and informed consumers, the sentiment analysis remains subject to linguistic nuances that may affect polarity classification. Future research incorporating diverse age groups, educational

backgrounds, and socio-economic statuses would provide a more comprehensive perspective, complementing the current study's focused depth.

Funding

This paper was co-financed from a project of the Babeș-Bolyai University Cluj-Napoca, Romania GS-UBB-FSEGA-DabijaDanCristian.

Author contributions

The authors had an equal share to all sections of the paper.

Disclosure statement

The authors declare that they do not have any competing financial, professional, or personal interests from other parties.

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