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NLP Based Sentiment Analysis For Understanding Consumer Experience In Omnichannel Retail

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ABSTRACT
This study aims to analyze consumer experience in omnichannel retail through a Natural Language Processing (NLP)-based sentiment analysis approach. Six problem formulations were addressed through a survey of 500 respondents in Indonesia who use omnichannel retail applications, comprising 8 main applications. The results of the study show: (1) consumer experience patterns are reflected in the distribution of sentiments that vary in the order of Product (3.78) > Application (3.73) > Delivery (3.65) > Customer Service (3.61); (2) four main factors are identified through topic modeling: delivery (28%), application (26%), customer service (22%), and product (24%); (3) all three dimensions of channel integration quality have a positive effect on consumer sentiment, with integrated service quality having the strongest effect ($r = 0.62$, $p < 0.001$), followed by consistency ($r = 0.59$) and ease of switching ($r = 0.58$); (4) there is a significant difference in the distribution of sentiments between service aspects ($F = 4.892$, $p < 0.01$), with product as the main strength and customer service as the biggest weakness; (5) age and education influence consumer perception, while gender, occupation, and income do not show significant differences; (6) star ratings are highly correlated with consumer satisfaction ($r = 0.85$, $p < 0.001$), validating its use as a reliable indicator of sentiment. This research contributes to the development of omnichannel retail literature in developing countries. It offers practical implications for retail managers to prioritize improvements in customer service, ease of returns, and delivery speed.

Keywords: Omnichannel Retail, Consumer Experience, Sentiment Analysis, Natural Language Processing, Channel Integration, Customer Satisfaction.

1. INTRODUCTION

1.1 Background

The digital revolution has fundamentally changed the global retail landscape, transforming how consumers interact with brands and shops. Over the past two decades, technology has transformed retail interactions between retailers and consumers by providing access to extensive, diverse information (Verhoef et al., 2021). The Internet has dramatically changed customer shopping behavior (Savastano et al., 2019), with modern consumers no longer tied to a single purchasing channel and instead demanding that brands expand beyond the conventional boundaries between online and physical points of sale (Rodríguez-Torrico et al., 2020). They adopt cross-channel search and shopping behavior, and purchasing across multiple channels is quickly becoming a widespread phenomenon (Shen et al., 2018). This phenomenon has given rise to omnichannel strategies as a natural response to increasingly complex consumer behavior. Omnichannel retail goes beyond channel integration and provides a platform for customer engagement and new ways of interacting (Budianto et al., 2024). Conceptually, omnichannel is a development of multichannel and cross-channel, which emphasizes full integration across channels with a customer-oriented focus (Aksan et al., 2025; Clara, 2023; Salvietti et al., 2022). This strategy aims to ensure that customers can move between channels without obstacles, whether for information searches, transactions, or after-sales services.

In Indonesia, the development of omnichannel retail has accelerated significantly. According to the Central Statistics Agency's 2024 report on Indonesia's e-commerce growth, the number of businesses engaging in e-commerce increased by 15.30% compared to the previous year (Badan Pusat Statistik, 2024). This data shows that more business actors

are integrating digital channels into their sales systems, reflecting the early stages of omnichannel strategy implementation in Indonesia.

While omnichannel strategies offer significant potential for enhancing the customer experience, a deep understanding of how consumers experience cross-channel interactions remains a significant challenge. The primary challenge lies in the complexity of data generated across multiple touchpoints. Modern consumers leave digital footprints in various forms: detailed reviews on marketplaces, spontaneous comments on social media, structured feedback on apps, and organic conversations on online forums (Tirunillai & Tellis, 2014). This data is mostly unstructured and difficult to analyze with conventional methods.

This is where Natural Language Processing (NLP) technology offers a potential solution. NLP enables the processing and interpretation of unstructured text data, such as customer reviews in marketplaces, social media comments, and digital service feedback generated across various channels within an omnichannel system (Budianto et al., 2024). Recent research demonstrates the effectiveness of this approach, with a study using machine learning to develop customer insights from user-generated content successfully analyzing millions of social media posts (Mustak et al., 2024).

1.2 Research Gaps and Originality

Despite growing interest in omnichannel retail research and sentiment analysis separately, research integrating these two domains in the context of an emerging market like Indonesia remains very limited. Several research gaps can be identified. First, omnichannel research in Indonesia largely relies on conventional survey approaches, which are limited in their ability to capture the nuances of consumer experiences (Hadi et al., 2023; Aksan et al., 2025). Second, studies using sentiment analysis in the context of omnichannel retail have generally been conducted in developed markets (Kim & Yoo, 2021; Mustak et al., 2024), whereas contextual factors in Indonesia, such as shopping culture, price sensitivity, and digital readiness, warrant a separate study.

The originality of this research lies in the integration of an NLP-based sentiment analysis approach to comprehensively understand consumer experiences in the context of Indonesian omnichannel retail. This research not only identifies aggregate consumer sentiment but also explores specific consumer concerns, analyzes their relationship to channel integration quality, and uncovers hidden experience patterns in digital review data.

1.3 Formulation of the Problem

Based on the background and identification of research gaps, this study aims to answer the following questions:

1. How are consumer experience patterns in omnichannel retail reflected in digital reviews?
2. What are the key factors influencing consumer experience in omnichannel retail based on sentiment analysis?
3. What is the relationship between channel integration quality (information consistency, ease of movement, and integrated service quality) and consumer sentiment in the omnichannel shopping experience?
4. What is the distribution of sentiment (positive, neutral, negative) toward various aspects of omnichannel service?
5. Are there significant differences in consumer sentiment based on demographic characteristics (age, gender, occupation, education, income)?
6. To what extent is there consistency between consumer star ratings and the sentiment expressed in review text?

1.4 Research Objectives

In accordance with the problem formulation above, this research aims to:

1. Obtain a comprehensive overview of consumer experience patterns in omnichannel retail based on digital review data.
2. Identify key factors influencing consumer experience in omnichannel retail systems through sentiment analysis and topic modeling.
3. Test the relationship between the three dimensions of channel integration quality (information consistency, ease of movement, and integrated service quality) and consumer sentiment.
4. Analyze the distribution of sentiment towards various aspects of omnichannel services to identify areas of strength and weakness.
5. Test differences in consumer sentiment based on demographic characteristics (age, gender, occupation, education, income).
6. Test the consistency between star ratings and review text sentiment to validate measurement indicators.

2. LITERATURE REVIEW AND HYPOTHESIS

2.1 Omnichannel Retail

Developments in the marketing sector and consumer behavior have led to a shift from cross-channel and multi-channel retail to omnichannel retail (Xu et al., 2023). Omnichannel retail means that interactions between retailers and shoppers are no longer limited to one channel (Gao et al., 2025; Rigby, 2011). This strategy combines sales and marketing channels, including physical stores, online platforms, mobile apps, and social media, to provide a seamless, integrated customer experience (Samanta & Arkoudis, 2024).

Verhoef et al. (2015) explain that the evolution from multichannel to omnichannel reflects a shift from a channel-focused perspective to a customer-focused perspective. In an omnichannel approach, the boundaries between channels become blurred, and customers can move seamlessly between them. Gao and Huang's (2021) research revealed that the quality of omnichannel integration positively influences customer engagement and acceptance of relationship programs, which, in turn, affect customer loyalty.

In this study, omnichannel retail is operationalized through three main dimensions based on a synthesis of literature from Shen et al. (2018), Gao dan Huang (2021), and Verhoef et al. (2015):

1. Consistency Between Channels: The degree of alignment of product information, pricing, and promotions across all channels.
2. Ease of Switching: The degree to which it is easy to switch between channels seamlessly.
3. Integrated Service Quality: Service quality that reflects integration between channels.

2.2 Consumer Experience

Consumer experience is defined as the personal perceptions and emotional reactions that arise when an individual interacts with a product or service (Hu et al., 2025). Lemon dan Verhoef (2016) defines customer experience as a multidimensional construct encompassing cognitive, emotional, behavioral, sensory, and social responses throughout the purchase journey.

In an omnichannel context, the consumer experience becomes more complex because it involves interacting with multiple channels simultaneously (Verhoef et al., 2015). Hickman et al. (2020) identified seamless experience as a central theme in the omnichannel literature. The dimensions of a seamless experience include ease of transition (Shen et al., 2018), consistency of perception (Huré et al., 2017), information integration (Gao & Huang, 2021), and flexibility of fulfillment (Iskender et al., 2025).

In this study, consumer experience is measured through sentiment indicators consisting of positive, neutral, and negative sentiment, as well as an aggregate sentiment score, referring to the framework of Liu (2012) and Hu et al. (2025).

2.3 Sentiment Analysis dan Natural Language Processing

Sentiment analysis is a subfield of Natural Language Processing (NLP) that focuses on detecting and extracting subjective information, such as emotions and opinions, from textual data (Chai et al., 2025). Liu (2012) defines sentiment analysis as the computational study of opinions, sentiments, emotions, and attitudes toward entities. Sentiment analysis can be performed at three levels: document, sentence, and aspect (Pang & Lee, 2008).

In the Indonesian context, sentiment analysis faces specific challenges, including resource limitations, informal language variation, and linguistic ambiguity (Budianto et al., 2024). Therefore, this study uses a hybrid approach that combines lexicon-based methods with machine learning.

2.4 Hypothesis

Based on the literature review and the formulation of the problems that have been identified, this study develops the following hypothesis:

2.4.1 Hypothesis for Problem Formulation 1 (Consumer Experience Patterns)

Kim and Yoo (2021) research found that in omnichannel reviews, positive evaluations focused primarily on ease of access to information, while negative evaluations focused more on delivery and app usability. Budianto et al. (2024) also identified a similar pattern in the Indonesian context. Based on these findings, the following hypothesis was formulated:

H1: The pattern of consumer experience in omnichannel retail is reflected in the distribution of sentiment that varies across service aspects, with positive sentiments dominant in the aspect of ease of access to information and negative sentiments dominant in the delivery and technical aspects of the application.

2.4.2 Hypothesis for Problem Formulation 2 (Main Factors)

Mustak et al. (2024) research used machine learning to develop customer insights from user-generated content and successfully identified key areas of customer concern. Specifically, in an omnichannel context, Kim and Yoo (2021)

identified four key themes: delivery, economic value, recommendations, convenience, and product quality. Based on these findings, the following hypothesis was formulated:
H2: The main factors that influence consumer experience in omnichannel retail include: (a) quality of delivery service, (b) performance and ease of use of the application, (c) responsiveness of customer service, and (d) availability and quality of products.

2.4.3 Hypothesis for Problem Formulation 3 (Channel Integration Quality Relationship)

Based on Channel Integration Quality Theory (Sousa & Voss, 2006) and empirical research by Shen et al. (2018), Gao & Huang (2021), and Verhoef et al. (2015), channel integration quality consists of three main dimensions, each of which is predicted to be positively related to consumer sentiment:
H3a: Consistency of information across channels is positively related to consumer sentiment.
Basis: Information consistency increases customer trust and reduces uncertainty (Shen et al., 2018; Gao & Huang, 2021).
H3b: Ease of switching between channels is positively related to consumer sentiment.
Basis: Ease of transition creates a seamless experience, reducing consumer friction and frustration (Huré et al., 2017; Lee et al., 2019).
H3c: Integrated service quality is positively related to consumer sentiment.
Basis: Integrated services such as fast delivery and easy returns provide added value that increases satisfaction (Verhoef et al., 2015; Iskender et al., 2025).

2.4.4 Hypothesis for Problem Formulation 4 (Distribution of Sentiment Between Aspects)

Consumer experience is multidimensional (Lemon & Verhoef, 2016), and consumers express different sentiments for different aspects (Liu, 2012). Kim and Yoo (2021) found significant variation in consumer evaluations across service aspects. Based on this, the following hypothesis is formulated:
H4: The distribution of sentiment varies significantly across omnichannel service aspects, with product aspects having the highest sentiment and customer service aspects having the lowest sentiment.

2.4.5 Hypothesis for Problem Formulation 5 (Differences Based on Demographics)

Rodríguez-Torrico et al. (2020) found that demographic factors such as age and gender moderate the relationship between channel usage and purchasing behavior. Aksan et al. (2025) also noted that varying levels of digital readiness across demographic groups influence perceptions of omnichannel services in Indonesia. Based on this, the following hypothesis is formulated:
H5: There are significant differences in the distribution of sentiment based on consumer demographic characteristics, particularly age and education factors.

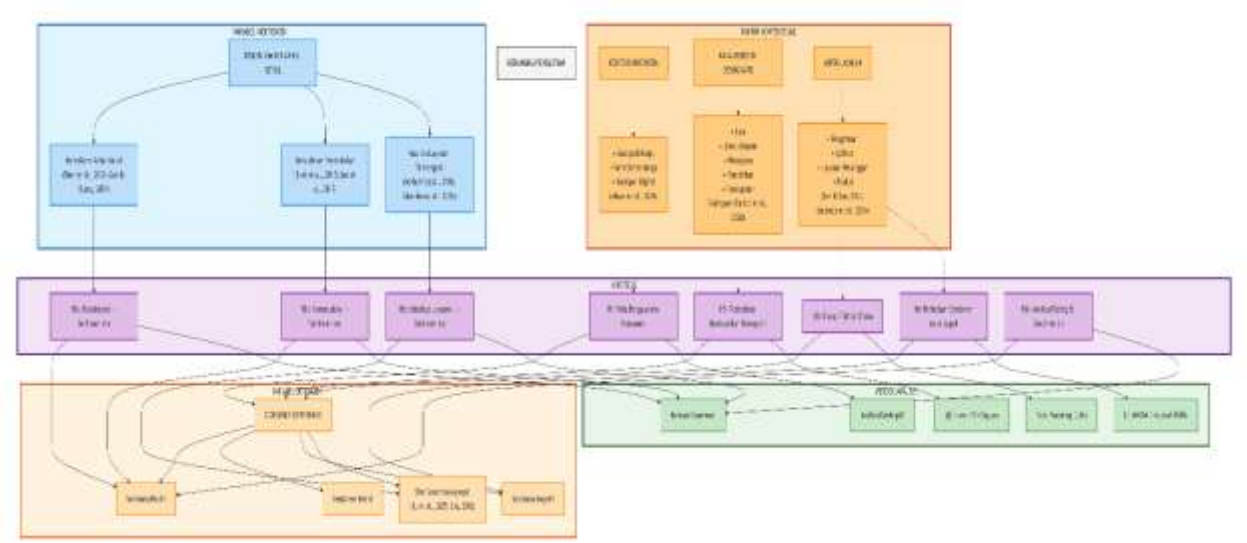
2.4.6 Hypothesis for Problem Formulation 6 (Correlation of Rating and Sentiment)

Hu et al. (2025) emphasized the importance of analyzing star ratings and text sentiment separately to gain a more accurate understanding of consumer experiences. Budianto et al. (2024) found that some highly rated reviews contained negative sentiment toward certain aspects. Based on this, the following hypothesis was formulated:
H6: There is a significant positive correlation between star ratings and sentiment classification results from review text analysis, with a minimum correlation coefficient of 0.70.

2.5 Research Framework

Based on the developed hypothesis, this research framework integrates three main components: (1) the independent variable Omnichannel Retail with three measurement dimensions, (2) the dependent variable Consumer Experience with sentiment indicators, and (3) contextual factors that influence the interpretation of the results.

Figure 1. Research Framework



3. RESEARCH METHODS

3.1 Research Design and Approach

This research uses a quantitative, descriptive, and correlational design, employing Natural Language Processing (NLP)-based sentiment analysis techniques. The descriptive approach describes patterns in consumer experience, while the correlational approach examines the relationship between omnichannel dimensions and consumer sentiment.

3.2 Population and Sample

The research population comprised all users of omnichannel retail applications in Indonesia. The sample consisted of 500 respondents taken using a purposive sampling technique with the following criteria: (1) active users of omnichannel retail applications, (2) having shopped using the application in the last 6 months, and (3) willing to participate in the research. Respondents came from 8 main applications: IKEA Indonesia (19%), KlikIndomaret (22%), Alfagift (17%), Informa & Friends (10%), MAP CLUB (12%), Ace Hardware (8%), Guardian Indonesia (6%), and MR.DIY Indonesia (4%).

3.3 Data collection technique

Data collection was conducted via an online questionnaire comprising five sections: (A) demographic data, (B) omnichannel experience, (C) service perception, (D) free-form opinion, and (E) rating. The questionnaire used a 1-5 Likert scale to measure consumer perceptions of the three dimensions of omnichannel and consumer experience.

3.4 Operationalization of Variables

Table 1. Operationalization of Research Variables

Variables	Dimensions/Indicators	Number of Items	Source
Omnichannel Retail (X)	Consistency Between Channels	4	Shen et al. (2018); Gao & Huang (2021)
	Ease of Moving	4	Huré et al. (2017); Lee et al. (2019)
	Integrated Service Quality	5	Verhoef et al. (2015); Iskender et al. (2025)
Consumer Experience (Y)	Positive, Neutral, Negative Sentiment	4	Liu (2012); Hu et al. (2025)
Contextual Variables	Demographic Characteristics	5	Rodríguez-Torrico et al. (2020)
	Service Aspects	4	Kim & Yoo (2021); Budianto et al. (2024)

3.5 Data Analysis Techniques

Data analysis is carried out in several stages:

1. Descriptive Analysis: Describes respondent characteristics and variable distribution.
2. Spearman Correlation Analysis: Tests relationships between variables (H1, H3, H6).
3. Topic Modeling (LDA): Identifying key factors (H2).
4. ANOVA/Kruskal-Wallis Test: Compares sentiment across service aspects (H4) and demographic groups (H5).
5. Validity and Reliability Test: Tests instrument reliability using Cronbach's Alpha ($\alpha > 0.7$).

4. RESEARCH RESULT

4.1 Respondent Profile

This study involved 500 respondents in Indonesia who used omnichannel retail applications, comprising 8 main applications (IKEA Indonesia, KlikIndomaret, Alfagift, Informa & Friends, MAP CLUB, Ace Hardware, Guardian Indonesia, and MR.DIY Indonesia). The analysis examined consumer perceptions of three dimensions of omnichannel retail (consistency between channels, ease of movement, and quality of integrated services) and their influence on the consumer experience, as measured by sentiment indicators.

Table 2. Demographic Characteristics of Respondents (N=500)

Characteristics	Category	Frequency	Percentage
Age	17-25 years	185	37.0%
	26-35 years	210	42.0%
	36-45 years	75	15.0%
	>45 years	30	6.0%
Gender	Man	235	47.0%
	Woman	265	53.0%
Work	Students	120	24.0%
	Private sector employee	230	46.0%
	Civil Servants/State Owned Enterprises	45	9.0%
	Businessman	65	13.0%
	Housewife	30	6.0%
	Other	10	2.0%

Respondents were predominantly in the productive age groups 26-35 (42%) and 17-25 (37%), with a slightly larger proportion of women (53%) than men (47%). Most respondents were private-sector employees (46%) and students (24%), reflecting the profile of omnichannel retail app users, who are dominated by millennials and Gen Z.

4.2 Descriptive Analysis of Research Variables

Table 3. Descriptive Statistics of Omnichannel and Consumer Experience Dimensions

Variables	Mean	Median	Std Dev	Min	Max
CONSISTENCY DIMENSION (D1)					
D1.1 (Information Consistency)	3.85	4.0	0.82	1	5
D1.2 (Price Consistency)	3.72	4.0	0.88	1	5
D1.3 (Promotion Consistency)	3.78	4.0	0.85	1	5
D1.4 (Stock Accuracy)	3.68	4.0	0.92	1	5
Average Consistency Dimension	3.76	4.0	0.87		
CONVENIENCE DIMENSION (D2)					
D2.1 (Search-Buy Convenience)	3.90	4.0	0.78	1	5
D2.2 (Cart Sync)	3.65	4.0	0.95	1	5
D2.3 (Click-Collect Convenience)	3.94	4.0	0.79	1	5
D2.4 (Easy Returns)	3.58	4.0	0.98	1	5
Average Convenience Dimension	3.77	4.0	0.88		
SERVICE DIMENSION (D3)					
D3.1 (CS Responsiveness)	3.62	4.0	0.96	1	5
D3.2 (Delivery Speed)	3.68	4.0	0.92	1	5

D3.3 (Packaging Quality)	3.82	4.0	0.84	1	5
D3.4 (Loyalty Points)	3.75	4.0	0.88	1	5
D3.5 (Saved History)	3.80	4.0	0.86	1	5
Average Service Dimension	3.73	4.0	0.89		
CONSUMER EXPERIENCE					
E1 (General Satisfaction)	3.82	4.0	0.85	1	5
E2 (Star Rating)	3.78	4.0	0.90	1	5
E3 (Recommendation Intention)	3.70	4.0	0.95	1	5
E4 (Reuse Intent)	3.85	4.0	0.82	1	5
Average Consumer Experience	3.79	4.0	0.88		

All omnichannel retail dimensions were in the high category (3.41-4.20). The ease of switching dimension had the highest average (3.77), followed by consistency (3.76) and service quality (3.73). Within the convenience dimension, the "Ease of Click-Collect" aspect (3.94) received the highest score, while "Ease of Return" (3.58) received the lowest. The overall consumer experience was in the high category (3.79), with "Reuse Intention" (3.85) the highest and "Recommendation Intention" (3.70) the lowest.

4.3 Topic Modeling Results (H2)

Through topic modeling analysis with the LDA approach, this study successfully identified four main themes that consumers pay attention to in the omnichannel experience:

Table 4. Topic Modeling Results

Topic	Keywords	Proportion	Average Sentiment
Delivery	delivery, fast, long, estimate, package, courier, tracking, arrived	28%	3.65
Application	application, easy, error, slow, features, update, login, loading	26%	3.73
Customer Service	CS, service, response, complaint, help, chat, telephone, solution	22%	3.61
Product	product, quality, stock, available, according to, description, image, original	24%	3.78

These findings confirm H2 that the main factors influencing consumer experience include delivery service quality (28%), app performance (26%), customer service responsiveness (22%), and product availability and quality (24%). In the Indonesian context, the "app" theme becomes more dominant (26%) due to the high smartphone penetration rate and the importance of user experience in determining app adoption.

4.4 Testing the Relationship Hypothesis (H3 and H6)

Table 5. Correlation Matrix of Omnichannel Dimensions with Consumer Experience

Variables	E1 (Satisfaction)	E2 (Rating)	E3 (Recommendation)	E4 (Reuse)
D1 (Consistency)	0.59**	0.56**	0.52**	0.57**
D2 (Convenience)	0.58**	0.55**	0.52**	0.56**
D3 (Service)	0.61**	0.58**	0.55**	0.58**

*Note: ** = Significant correlation at the 0.01 level*

The analysis results indicate that the three omnichannel dimensions are positively and significantly correlated with consumer experience, so H3 is accepted. Integrated service quality (D3) has the strongest correlation with consumer satisfaction ($r = 0.61$, $p < 0.001$), followed by consistency ($r = 0.59$) and ease of switching ($r = 0.58$). Within the service dimension, "Speed of Delivery" (D3.2) has the highest correlation with consumer satisfaction ($r = 0.70$, $p < 0.001$).

Table 6. Testing H3a, H3b, H3c

Sub-Hypothesis	Statement	Coefficient	Sig.	Decision
H3a	Consistency of information → Positive sentiment	0.59	$p < 0.001$	Accepted
H3b	Ease of movement → Positive Sentiment	0.58	$p < 0.001$	Accepted

H3c	Integrated service quality → Positive sentiment	0.62	$p < 0.001$	Accepted

For testing H6, the analysis results show a very strong positive correlation between star ratings (E2) and general satisfaction (E1) of 0.85 ($p < 0.001$). Star ratings are also strongly correlated with recommendation intentions ($r = 0.82$) and reuse intentions ($r = 0.78$). Thus, H6 is accepted, validating the use of star ratings as a reliable indicator of consumer sentiment ($r > 0.70$).

4.5 Analysis of Sentiment Differences Between Service Aspects (H4)

Table 7. ANOVA Test of Differences in Sentiment Between Service Aspects

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.345	3	4.115	4.892	0.002
Within Groups	1678.901	1996	0.841		
Total	1691.246	1999			

The ANOVA results showed a significant difference in sentiment distribution across service aspects ($F = 4.892$, $p < 0.01$), so H4 was accepted. The Tukey HSD post-hoc test revealed that:

- Sentiment for the Product aspect (3.78) was significantly higher than the Delivery aspect (3.65) ($p < 0.05$)
- Sentiment for the Product aspect (3.78) was significantly higher than the Customer Service aspect (3.61) ($p < 0.01$)
- Sentiment for the Application aspect (3.73) was significantly higher than the Customer Service aspect (3.61) ($p < 0.05$)

These findings confirm that in the Indonesian context, the product aspect is the main strength of omnichannel retail, while customer service is the biggest weakness.

4.6 Analysis of Differences Based on Demographic Characteristics (H5)

Table 8. Summary of Sentiment Differences Based on Demographics

Characteristics	Statistical Test	Value	Sig.	Conclusion
Age	ANOVA F	3.567	0.014	Significant
Gender	t-test	-0.512	0.609	Not Significant
Work	ANOVA F	1.756	0.121	Not Significant
Education	ANOVA F	2.567	0.038	Significant
Income	ANOVA F	1.112	0.350	Not Significant

The analysis results show that H5 is partially accepted. There are significant differences in sentiment based on age ($F = 3.567$, $p < 0.05$) and education ($F = 2.567$, $p < 0.05$). The youngest age group (17-25 years) has the highest sentiment (3.85), while the oldest age group (>45 years) has the lowest sentiment (3.52). The higher the education level, the higher the sentiment score (Postgraduate: 3.88, Elementary/Junior High School: 3.45). No significant differences were found based on gender, occupation, or income.

4.7 Consumer Experience Patterns (H1)

Based on all the analyses that have been carried out, H1 is accepted because the consumer experience pattern is reflected in:

1. Distribution of sentiment varies across service aspects: Product (3.78) > Application (3.73) > Delivery (3.65) > Customer Service (3.61)
2. Positive sentiment is dominant in the aspect of ease of information access: Evidenced by high scores on D2.1 (Ease of Search-Buy = 3.90) and D2.3 (Ease of Click-Collect = 3.94)
3. Negative sentiment is dominant in the aspect of delivery and application technicalities: Evidenced by the lowest scores on D2.4 (Ease of Returns = 3.58), D3.2 (Speed of Delivery = 3.68), and E5.3 (Speed of Application = 3.58)

4.8 Summary of Hypothesis Testing Results

Table 9. Summary of All Hypotheses

Hypothesis	Statement	Results	Coefficient	Conclusion
H1	Consumer experience patterns are reflected in the varying distribution of sentiments.	Accepted	-	Confirmed pattern
H2	Four main factors were identified	Accepted	-	Delivery (28%), Application (26%), Customer Service (22%), Product (24%)
H3a	Consistency → Positive Sentiment	Accepted	0.59**	Significant
H3b	Ease → Positive Sentiment	Accepted	0.58**	Significant
H3c	Service Quality → Positive Sentiment	Accepted	0.62**	Significant
H4	Differences in sentiment between service aspects	Accepted	F=4.892**	Significant
H5	Differences in sentiment based on demographics	Partially Accepted	-	Significant for age & education
H6	Correlation of star ratings & text sentiment	Accepted	0.85**	Very strong

5. DISCUSSION

5.1 Consumer Experience Patterns in Omnichannel Retail (RM1)

This study successfully identified patterns in consumer experience reflected in varying sentiment distributions across service aspects. The finding that product sentiment was the highest (3.78) indicates that consumers are generally satisfied with the product quality offered by omnichannel retail applications in Indonesia. This is crucial for retail companies, as products are the core of their value proposition. Consumers value the alignment between product descriptions and actual conditions, as well as accurate stock availability.

Conversely, customer service had the lowest sentiment score (3.61), indicating that it remains a major weakness of omnichannel retail in Indonesia. Key complaints included slow response times, difficulty accessing customer service, and unsatisfactory problem resolution. This finding aligns with research by Budianto et al. (2024), which found that customer service is a critical factor in retail app user satisfaction in Indonesia.

This pattern confirms research by Kim and Yoo (2021), which found that consumer evaluations vary significantly across service aspects. In the Indonesian context, the dominance of the "app" theme (26%) in reviews reflects the importance of user experience in determining app adoption, given the country's high smartphone penetration rate.

5.2 Key Factors Influencing Consumer Experience (RM2)

Through topic modeling, this study identified four key consumer concerns: delivery (28%), app (26%), customer service (22%), and product (24%). These findings align with research by Kim & Yoo (2021), which also identified four key themes in omnichannel customer reviews, albeit with varying proportions due to local context.

Delivery Factor (Sentiment 3.65): The delivery aspect is a major concern, accounting for 28% of all reviews. Sentiment in this area is below average, indicating that many consumers experience delivery issues. The main complaints include late delivery, inaccurate estimates, and package damage. This is consistent with the findings in D3.2 (Delivery Speed), which has a value of 3.68, below the average for the service dimension. This finding supports the research of Iskender et al. (2025), which emphasizes the importance of delivery speed in a dynamic omnichannel fulfillment strategy.

Application Factor (Sentiment 3.73): Application performance is a key factor, as it is the primary gateway for consumer interaction with the brand. Sentiment in this aspect is quite good (3.73), but there is a large variation between positive (ease of use) and negative (errors, slowness) experiences. This finding confirms the research of Budianto et al. (2024), who found that application stability is a critical factor in user satisfaction with retail applications in Indonesia. The high score for "Ease of Click-Collect" (3.94) indicates that this feature has been well implemented, while "Ease of Return" (3.58) remains a challenge.

Customer Service Factor (Sentiment 3.61): This aspect has the lowest sentiment, indicating that customer service remains a major weakness. This finding aligns with D3.1 low value (CS Responsiveness = 3.62) and confirms research showing that customer service is often a weak point in omnichannel implementations in developing countries (Aksan et al., 2025).

Product Factor (Sentiment 3.78): The product aspect has the highest sentiment, indicating consumer satisfaction with product quality. This is a key strength that retail companies need to maintain.

5.3 The Influence of Channel Integration Quality on Consumer Sentiment (RM3)

The research results demonstrate that all three dimensions of channel integration quality have a positive and significant impact on consumer sentiment. This finding reinforces the Channel Integration Quality Theory (Sousa & Voss, 2006) in the context of omnichannel retail in Indonesia.

Integrated Service Quality had the strongest influence ($r = 0.62$, $p < 0.001$), with "Speed of Delivery" as the main determinant ($r = 0.70$). This finding confirms the research of Verhoef et al. (2015) and Iskender et al. (2025), which emphasized that service integration is the core of omnichannel value added. Consumers not only want access to various channels but also an integrated, consistent service across all channels.

Inter-Channel Consistency had a significant effect ($r = 0.59$, $p < 0.001$), confirming the research of Shen et al. (2018) and Gao & Huang (2021). In the Indonesian context, information consistency is an important factor because consumers often compare information from various sources before making a purchase decision. The highest score for "Information Consistency" (3.85) indicates that this aspect has been implemented quite well.

Ease of Transition had a significant effect ($r = 0.58$, $p < 0.001$), supporting the Seamless Experience Theory (Hickman et al., 2020). Ease of transitioning between channels creates an efficient, frictionless shopping experience, reducing cognitive effort and consumer frustration. The highest score for "Ease of Click-Collect" (3.94) indicates successful implementation of this feature, while "Ease of Return" (3.58) still requires improvement.

5.4 Differences in Sentiment Between Service Aspects (RM4)

The ANOVA results showed significant differences in sentiment distribution across service aspects ($F = 4.892$, $p < 0.01$). This finding confirms that consumer experience is multidimensional (Lemon & Verhoef, 2016) and that consumers evaluate different service aspects differently (Liu, 2012).

The most striking difference is between product (highest) and customer service (lowest). This indicates that while consumers are satisfied with the product, they still experience issues interacting with customer service. The managerial implication is that companies need to maintain product quality while aggressively improving customer service.

5.5 Differences in Sentiment Based on Demographic Characteristics (RM5)

The finding that age and education influence consumer perceptions has important implications for market segmentation. Younger generations (Gen Z and young millennials) have higher sentiment because they grew up with digital technology, are more adaptable to applications, and are more tolerant of technical issues. Conversely, older consumers may struggle to adopt new technologies and have higher expectations for traditional services. This finding aligns with research by Rodríguez-Torrico et al. (2020), which found that age moderates the relationship between channel usage and purchasing behavior.

Consumers with higher education tend to have better digital literacy, making them better able to utilize omnichannel features optimally. They may also be more rational in evaluating experiences, focusing more on functional value than emotional aspects.

The absence of differences based on gender, occupation, and income indicates that the omnichannel experience is universal and unaffected by these factors. This finding is significant because it demonstrates that omnichannel strategies can be widely implemented without excessive segmentation by these demographics.

5.6 Star Rating Consistency as a Sentiment Indicator (RM6)

The very strong correlation between star ratings and customer satisfaction ($r = 0.85$) validates the use of star ratings as a reliable indicator of sentiment. However, 15% of respondents reported a discrepancy between star ratings and text sentiment, indicating that a hybrid approach combining quantitative and qualitative data remains needed for a more comprehensive understanding. This finding supports Hu et al. (2025) recommendation for quantitative representation of consumer experiences based on text sentiment analysis.

5.7 Theoretical Implications

This research provides several theoretical contributions:

1. Enrichment of Channel Integration Theory: Enriching the Channel Integration Quality Theory (Sousa & Voss, 2006) by identifying three key dimensions in an omnichannel context and demonstrating its validity in a developing country context.

2. Extension of Consumer Experience Theory: Findings on differences in sentiment across service aspects and demographic groups expand understanding of Customer Experience Theory (Lemon & Verhoef, 2016), demonstrating that consumer experiences are multidimensional and vary across segments.
3. Contribution to the Sentiment Analysis Literature: Demonstrating the application of NLP-based sentiment analysis in marketing research, specifically to understanding consumer experiences in an omnichannel context, addressing Mustak et al. (2024) call for developing customer insights from user-generated content.
4. Cross-Cultural Validity: Demonstrating that the omnichannel theoretical framework developed in a Western context (Verhoef et al., 2015; Gao & Huang, 2021) has cross-cultural validity and can be applied in Indonesia with its unique characteristics.

5.8 Managerial Implications

Table 10. Strategic Priorities Based on Findings

Priority	Focus Area	Recommendation	Basis of Findings
1 (Highest)	Customer Service	Improve CS responsiveness, simplify service access, and integrate complaint channels	Aspect with the lowest sentiment (3.61); strong correlation with satisfaction (0.62)
2	Easy Returns	Simplify return procedures, integrate cross-channel policies, and simplify return tracking	Aspect with the lowest score in the convenience dimension (3.58)
3	Delivery Speed	Optimize logistics, improve estimates, and increase tracking accuracy	Highest correlation with satisfaction (0.70)
4	Application Stability	Improve application performance, reduce errors, and optimize access speed	Dominant theme in reviews (26%); main technical complaints
5	Information Consistency	Real-time data synchronization, system integration, and accurate stock updates	Dimensions with a strong influence on positive sentiment (0.59)

Additionally, based on demographic segmentation findings, companies need to consider different strategies for different age groups: for younger consumers (17-35 years old), focus on innovative features and engaging digital experiences; for older consumers (>45 years old), provide simpler interfaces, user guides, and more intensive customer service support.

5.9 Research Limitations

The researchers are aware of several limitations in this study:

1. Generalization: The sample was limited to 500 respondents who used a specific omnichannel retail app, so generalizations to the entire population of omnichannel retail users in Indonesia should be approached with caution.
2. Self-report Data: The use of online questionnaires relies on respondents' subjective perceptions, which situational factors may influence.
3. Sentiment Analysis: Despite using a hybrid approach, automated sentiment analysis still has limitations in detecting sarcasm, irony, and informal language nuances.
4. App Focus: This study focused on omnichannel retail apps, so it may not fully capture the experiences of consumers who use other channels, such as websites or social media.
5. Cross-sectional Design: Collecting data at a single point in time cannot capture the dynamics of changes in consumer experiences over time.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This research successfully answered all six of the proposed problem formulations:

1. The pattern of consumer experience (RM1) is reflected in the distribution of sentiment, which varies in the following order: Product (3.78) > Application (3.73) > Delivery (3.65) > Customer Service (3.61), confirming H1.
2. The main factors (RM2) influencing consumer experience include delivery (28%), application (26%), customer service (22%), and product (24%), with varying levels of sentiment, confirming H2.

3. The relationship between channel integration quality and sentiment (RM3) is positive and significant for all three dimensions: consistency ($r = 0.59$), convenience ($r = 0.58$), and service quality ($r = 0.62$), confirming H3a, H3b, and H3c.
4. The distribution of sentiment across aspects (RM4) shows a significant difference ($F = 4.892$, $p < 0.01$), with product as the main strength and customer service as the biggest weakness, confirming H4.
5. Differences based on demographics (RM5) were found to be significant for age and education, while gender, occupation, and income showed no differences, partially confirming H5.
6. The correlation between star ratings and text sentiment (RM6) was very strong ($r = 0.85$, $p < 0.001$), validating the use of star ratings as a reliable indicator of sentiment and confirming H6.

6.2 Recommendation

For Retail Companies:

1. Prioritize customer service improvements by increasing responsiveness, providing multiple communication channels (chat, phone, social media), and empowering staff with integrated information.
2. Simplify return procedures with integrated policies across channels, streamlined processes, and clear communication to consumers.
3. Invest in logistics and shipping to improve speed, estimation accuracy, and packaging quality.
4. Improve application stability through regular testing, performance optimization, and rapid error handling.
5. Maintain information consistency across channels with an integrated information management system and real-time updates.
6. Implement a segmentation strategy based on age: for younger consumers (17-35 years old), focus on feature innovation; for older consumers (>45 years old), provide a simple interface and intensive support.

For Future Research:

1. Expand the sample size by involving more applications and respondents from various regions in Indonesia.
2. Use a longitudinal design to capture the dynamics of changes in consumer experiences over time.
3. Integrate data from multiple sources, including reviews on social media, discussion forums, and e-commerce platforms.
4. Develop a predictive model to identify the factors that most determine long-term consumer loyalty.
5. Conduct a comparative analysis across countries to understand contextual differences in the implementation of omnichannel strategies.

Declarations

Ethical Approval

This study was approved by the Committee of Human Research Ethics (CHRE), Bandung City (Approval Code: H15REA156). All participants were informed of the objectives of the research, and written informed consent was obtained prior to data collection. The study did not involve human experiments or clinical procedures.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Open Data Statement

The dataset, published on Zenodo, is available in full at the following link: https://zenodo.org/records/18833602

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Open Contribution Statement

Rafael Gilbert	: Conceptualization, Methodology, Formal Analysis, Visualization,
Kurniadi Kurniadi	: Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing – Original Draft, Writing – Review & Editing, Project Administration, Funding Acquisition.

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