



 Research Article

Detecting Internal Consumer Relationships Through Enhanced Data Aggregation Methodologies

Submission Date: February 08, 2026, **Accepted Date:** March 03, 2026,

Published Date: March 31, 2026

Journal Website:
<http://sciencebring.com/index.php/ijasr>

Copyright: Original content from this work may be used under the terms of the creative commons attributes 4.0 licence.

Sofia Almeida

Department of Computer Science and Machine Learning, University of Cabo Verde, Cabo Verde

ABSTRACT

Understanding consumer relationships has become increasingly complex due to the growing diversity of consumer interactions, behavioral patterns, and transactional data generated across multiple channels. Traditional relationship analysis approaches often focus on observable consumer attributes such as purchase frequency, demographic characteristics, or direct feedback, while overlooking hidden relational structures that influence loyalty, engagement, and long-term behavioral intentions. This research paper proposes an enhanced data aggregation methodology for detecting internal consumer relationships by integrating multi-dimensional consumer information and advanced analytical frameworks. The study conceptualizes consumer relationships as dynamic internal structures formed through behavioral similarities, relational tendencies, brand interactions, and contextual factors.

The proposed framework combines consumer relationship theory with enhanced aggregation mechanisms to identify latent relationship patterns among consumers. The methodology emphasizes the transformation of fragmented consumer data into meaningful relational clusters through systematic data integration, feature representation, behavioral mapping, and relationship inference. Advanced clustering-based approaches support the identification of hidden consumer groups by analyzing similarities in behavioral characteristics and interaction patterns. Previous research on latent behavioral pattern discovery demonstrates the importance of analytical segmentation methods in revealing underlying consumer structures that remain invisible through conventional approaches (Jatav et al., 2025).

The research synthesizes existing consumer relationship theories and extends them through a data-driven perspective. The framework incorporates concepts related to relationship benefits, consumer relationship proneness, brand relationship formation, and multi-level consumer-retailer interactions. The findings indicate that enhanced aggregation methodologies can improve the understanding of consumer relationship networks by identifying internal similarities, predicting behavioral tendencies, and supporting personalized relationship management strategies.

The study contributes theoretically by connecting relationship marketing concepts with computational consumer analytics. Practically, it provides organizations with a structured approach for developing more accurate segmentation models, improving customer engagement strategies, and optimizing relationship-oriented decision-making. However, limitations remain regarding data quality, privacy concerns, contextual changes in consumer behavior, and the interpretability of algorithmic relationship detection. Future research can expand this framework through real-time data processing, adaptive learning systems, and cross-industry validation.

KEYWORDS

Consumer Relationship Detection; Data Aggregation; Customer Segmentation; Behavioral Analytics; Relationship Marketing; Consumer Intelligence; Clustering Methodologies; Predictive Analytics.

1. INTRODUCTION

1.1 Background

The contemporary consumer environment is characterized by continuous interactions between customers, brands, retailers, and digital platforms. These interactions generate large volumes of heterogeneous information, including purchasing activities, communication patterns, engagement behaviors, and relationship indicators. Organizations increasingly require analytical approaches capable of transforming this fragmented information into strategic insights. Traditional consumer analysis methods generally examine individual characteristics or direct behavioral outcomes; however, they often

fail to capture deeper internal relationships existing among consumers.

Consumer relationships represent complex psychological and behavioral structures influenced by trust, affiliation, perceived benefits, emotional connections, and repeated interactions. Research on consumer-brand relationships indicates that consumers may develop different levels and forms of attachment toward brands, creating diverse relationship patterns that influence future behavioral intentions (Breivik and Thorbjørnsen, 2008). Similarly, consumer-retailer relationships involve multiple levels of interaction where economic, social, and relational factors

collectively shape consumer perceptions and behaviors (Gutiérrez, 2005).

The emergence of data-driven methodologies has created opportunities to identify hidden relational structures within consumer populations. Enhanced data aggregation enables researchers and organizations to combine multiple sources of consumer information and discover patterns that cannot be identified through isolated datasets. Such methodologies move beyond conventional segmentation by focusing on internal similarities, relational characteristics, and behavioral connections among consumers.

1.2 Problem Statement

Although organizations collect extensive consumer data, the ability to detect meaningful internal relationships among consumers remains limited. Many existing segmentation approaches emphasize demographic classification or simple behavioral grouping, which may not adequately represent complex consumer relationships. Consumers with different demographic profiles may demonstrate similar relational behaviors, while consumers with similar purchasing characteristics may possess different psychological relationships with brands.

The primary research problem addressed in this study is the identification of hidden consumer relationship structures through enhanced data aggregation methodologies. The challenge involves developing a framework that integrates behavioral, relational, and interaction-based

information to detect meaningful consumer connections.

Advanced analytical approaches are increasingly important because consumer behavior is influenced by multiple interconnected variables. Clustering-based analytical techniques have demonstrated effectiveness in uncovering latent behavioral patterns by identifying similarities that remain hidden in conventional analysis methods (Jatav et al., 2025). Therefore, integrating such approaches with consumer relationship theories can provide a more comprehensive understanding of consumer networks.

1.3 Research Objectives

This research aims to:

1. Develop a conceptual framework for detecting internal consumer relationships through enhanced data aggregation methodologies.
2. Examine how aggregated consumer information can reveal hidden behavioral and relational patterns.
3. Integrate relationship marketing theories with computational analytical approaches.
4. Analyze the implications of relationship detection methodologies for consumer segmentation and strategic decision-making.
5. Identify limitations and future opportunities associated with data-driven consumer relationship analysis.

1.4 Scope and Significance

The scope of this research focuses on consumer relationship detection through analytical aggregation techniques rather than conventional customer classification methods. The study considers consumer interactions, behavioral similarities, relational tendencies, and brand-related connections as interconnected components of relationship identification.

The significance of this research lies in bridging the gap between traditional consumer relationship theories and modern analytical methodologies. While relationship marketing research provides theoretical explanations of consumer attachment and interaction, computational approaches provide mechanisms for identifying patterns at scale. Combining both perspectives creates opportunities for more precise consumer understanding and improved relationship management.

Organizations can utilize enhanced aggregation methodologies to develop personalized marketing strategies, improve customer experience management, and identify valuable consumer communities. However, effective implementation requires careful consideration of data reliability, ethical usage, and algorithmic transparency.

2. LITERATURE REVIEW

2.1 Consumer Relationship Theory and Behavioral Structures

Consumer relationship research has evolved from transactional perspectives toward broader relational frameworks that consider emotional, social, and behavioral dimensions. Breivik and Thorbjørnsen (2008) examined consumer-brand relationships by comparing alternative relationship models and highlighted that consumer relationships involve multiple dimensions rather than a single attachment mechanism. Their work suggests that relationship strength depends on how consumers interpret brand interactions and integrate brands into their personal experiences.

Similarly, Lu and Zhou (2003) emphasized the importance of brand relationship theory by explaining that brands can develop relationship characteristics similar to interpersonal connections. This perspective indicates that consumers do not merely evaluate products based on functional value but may establish relational meanings associated with brands.

These theoretical contributions provide the foundation for detecting internal consumer relationships because relational patterns often exist beyond observable purchasing behavior. A consumer's relationship with a brand may influence engagement frequency, loyalty intention, and responses to marketing activities.

2.2 Relationship Benefits and Consumer Engagement

Berenguer-Contrí, Ruiz-Molina, and Gil-Saura (2009) investigated relationship benefits and costs within retail environments, demonstrating that consumer relationships are shaped by

perceived advantages obtained through continuous interaction. Their research highlights that consumers evaluate relationships based on economic, social, and psychological outcomes.

This perspective is important for data aggregation methodologies because relationship detection requires considering multiple dimensions simultaneously. A consumer group may demonstrate strong internal similarity because members receive comparable relationship benefits, even when their purchasing patterns differ.

Consumer relationship proneness also influences how individuals engage with organizations. Bloemer, Odekerken-Schröder, and Kestens (2003) explored the impact of social affiliation needs and relationship proneness on behavioral intentions. Their findings indicate that individual differences affect willingness to establish and maintain relationships with service providers.

Therefore, enhanced aggregation methodologies should incorporate both behavioral data and relational indicators to identify meaningful consumer structures.

2.3 Multi-Level Consumer-Retailer Relationships

Gutiérrez (2005) presented a multi-level perspective of consumer-retailer relationships, emphasizing that relationships operate across different levels, including individual interactions, organizational practices, and broader marketplace contexts. This approach challenges simplified consumer analysis models by

recognizing that relationships are dynamic and influenced by multiple factors.

From an analytical perspective, multi-level relationships require aggregation methods capable of combining diverse information sources. Consumer interactions occurring across different platforms can provide complementary insights into relationship development.

The integration of multi-level relationship theory with analytical methodologies creates possibilities for identifying consumer networks rather than isolated consumer profiles. Such approaches can reveal communities of consumers connected through similar relational characteristics.

2.4 Advanced Segmentation and Hidden Behavioral Patterns

Traditional segmentation approaches often categorize consumers based on predefined characteristics. However, advanced analytical methods focus on discovering naturally occurring patterns within data. Jatav et al. (2025) demonstrated the value of advanced clustering techniques in uncovering latent behavioral patterns within customer segmentation. Their research highlights that hidden structures can be identified through systematic analysis of behavioral attributes.

The relevance of this approach to consumer relationship detection is significant because internal consumer relationships are often latent rather than directly observable. Data aggregation combined with clustering methodologies enables

organizations to identify groups based on shared behavioral tendencies, interaction styles, and relational characteristics.

2.5 Research Gap

Although previous studies provide valuable insights into consumer relationships, existing literature largely separates theoretical relationship analysis from computational identification methods. Relationship marketing studies explain why relationships develop, while analytical studies explain how behavioral patterns can be discovered.

A research gap exists in developing integrated frameworks that combine consumer relationship theories with enhanced data aggregation methodologies. Existing approaches require stronger connections between psychological relationship factors and computational detection mechanisms.

This research addresses this gap by proposing a framework that views consumers as interconnected relational entities rather than independent data points. Through enhanced aggregation, organizations can identify internal consumer relationships and develop more adaptive relationship management strategies.

3. METHODOLOGY

3.1 Research Approach and Framework Development

This research adopts a conceptual analytical methodology to develop a framework for

detecting internal consumer relationships through enhanced data aggregation methodologies. The approach integrates theories from consumer relationship management with data-driven analytical processes to establish a structured mechanism for identifying hidden relational patterns.

The methodology is based on the assumption that consumer relationships are not isolated characteristics but interconnected structures created through repeated interactions, shared behavioral tendencies, and similar relationship experiences. Therefore, detecting internal consumer relationships requires aggregation of multiple consumer dimensions rather than relying on single-variable analysis.

The proposed framework consists of five major stages:

1. Consumer data collection and integration
2. Data transformation and feature development
3. Relationship-oriented aggregation modeling
4. Pattern identification through analytical techniques
5. Relationship interpretation and strategic application

Each stage contributes to converting raw consumer information into meaningful relational insights.

3.2 Consumer Data Aggregation Framework

Data aggregation represents the foundation of the proposed methodology. Consumer information is typically distributed across multiple organizational systems, including transaction records, digital interactions, service encounters, feedback mechanisms, and engagement platforms.

The purpose of aggregation is not merely to combine datasets but to create a unified representation of consumer relationships. Conventional aggregation methods often summarize numerical indicators such as purchase frequency or spending value. However, relationship detection requires broader information dimensions.

The enhanced aggregation framework incorporates four primary categories:

Behavioral Aggregation

Behavioral aggregation focuses on measurable consumer actions. These include purchasing frequency, product preferences, interaction timing, service usage patterns, and engagement intensity.

Behavioral similarities provide initial indicators for identifying consumer groups. For example, two consumers purchasing different products may demonstrate similar engagement cycles, response patterns, and loyalty behaviors. Such similarities may indicate an underlying relationship structure.

Advanced clustering approaches support this process by identifying patterns that are not immediately visible through traditional segmentation. Jatav et al. (2025) emphasized that analytical clustering techniques can uncover latent behavioral structures by examining complex customer characteristics simultaneously.

Relational Aggregation

Relational aggregation focuses on factors that explain the strength and nature of consumer relationships. These include trust, commitment, perceived benefits, social affiliation, and emotional connection.

According to relationship marketing perspectives, consumers establish stronger connections when interactions generate meaningful benefits. Berenguer-Contrí et al. (2009) demonstrated that relationship benefits influence consumer perceptions and long-term engagement behavior.

Therefore, relationship detection models should incorporate not only what consumers do but also why they maintain relationships with organizations.

Interaction Aggregation

Modern consumers interact with organizations through multiple channels. These interactions include online platforms, physical stores, customer support systems, and social communication channels.



Interaction aggregation combines these touchpoints to understand relationship development. A consumer who frequently engages with brand content but purchases occasionally may still demonstrate strong relational involvement.

Multi-level consumer-retailer relationship perspectives suggest that consumer relationships emerge through different interaction layers rather than single transactions (Gutiérrez, 2005).

Contextual Aggregation

Consumer behavior is influenced by situational and environmental factors. Contextual aggregation considers variables such as purchasing situations, service environments, and changing consumer needs.

Including contextual information prevents inaccurate relationship classification. For example, occasional purchases may not indicate weak relationships if consumers demonstrate strong engagement and positive brand association.

3.3 Consumer Relationship Feature Modeling

After data aggregation, the next methodological stage involves converting collected information into analytical features. Feature modeling determines which characteristics represent meaningful consumer relationships.

The proposed model categorizes relationship features into three dimensions:

Functional Relationship Features

Functional features represent practical interactions between consumers and organizations. These include:

- Purchase consistency
- Product adoption patterns
- Service utilization
- Transaction frequency

These indicators explain the functional value consumers receive from relationships.

Emotional Relationship Features

Emotional features represent psychological connections between consumers and brands. They include:

- Brand attachment
- Trust indicators
- Relationship commitment
- Affiliation tendencies

Breivik and Thorbjørnsen (2008) highlighted that consumer-brand relationships involve emotional and symbolic dimensions beyond functional evaluation.

Social Relationship Features

Social features represent consumers' need for interaction and belonging. Consumers may maintain relationships because brands provide social identity, community participation, or interpersonal value.

Bloemer et al. (2003) demonstrated that social affiliation needs and relationship proneness influence behavioral intentions. This suggests that consumer relationship detection should consider individual differences in relationship orientation.

3.4 Enhanced Relationship Aggregation Model

The proposed enhanced aggregation model combines multiple feature categories into a relationship representation matrix.

The model can be expressed conceptually as:

Consumer Relationship Profile = Behavioral Dimension + Relational Dimension + Interaction Dimension + Contextual Dimension

Each consumer is represented not as an independent customer record but as a relational profile containing multiple interconnected characteristics.

The objective is to identify consumers who share similar relationship structures.

For example:

Consumer Group A may include individuals who:

- purchase frequently,
- demonstrate strong emotional attachment,
- actively engage with brand communication.

Consumer Group B may include individuals who:

- purchase occasionally,
- show high trust,
- respond strongly to personalized interactions.

Although both groups may have different transaction values, they represent distinct relationship patterns.

4. RESULTS

The conceptual analysis indicates that enhanced data aggregation methodologies provide a more comprehensive approach for detecting internal consumer relationships compared with traditional segmentation approaches. The primary finding is that consumer relationships are multidimensional structures requiring integration of behavioral, relational, interaction, and contextual information.

The framework demonstrates that consumers with different demographic and transactional characteristics may share similar relationship patterns. This indicates that conventional customer grouping methods may overlook important relational similarities.

The analysis also reveals that clustering-based approaches are effective in identifying latent consumer structures. By examining multiple dimensions simultaneously, analytical models can discover hidden groups based on shared behaviors and relationship characteristics. This finding supports previous research emphasizing the importance of advanced clustering techniques



for uncovering latent behavioral patterns (Jatav et al., 2025).

Another important finding is that relationship strength cannot be determined solely through purchasing activity. Consumers may demonstrate strong brand relationships through engagement, trust, social affiliation, or emotional connection. This aligns with relationship marketing perspectives emphasizing that consumer relationships involve psychological and social dimensions.

The proposed methodology also highlights the importance of combining theoretical and computational approaches. Relationship theories explain the formation and maintenance of consumer connections, while analytical methodologies provide mechanisms for identifying these connections at larger scales.

The findings suggest that enhanced aggregation can improve organizational understanding of consumers by moving from individual customer analysis toward relationship network analysis. This approach allows organizations to identify consumer communities, predict behavioral tendencies, and develop targeted relationship strategies.

However, the findings also indicate that successful implementation requires careful management of data quality, model interpretation, and ethical considerations. Analytical outputs must be evaluated within the broader context of consumer motivations and organizational objectives.

Overall, the study demonstrates that enhanced data aggregation methodologies represent a valuable approach for detecting internal consumer relationships and improving consumer relationship management practices.

5. DISCUSSION

The findings of this research demonstrate that enhanced data aggregation methodologies provide a significant opportunity to redefine consumer relationship analysis. Traditional approaches generally consider consumers as independent units categorized through demographic, transactional, or behavioral variables. However, the proposed framework suggests that consumers exist within complex relational structures where similarities emerge through multiple dimensions, including behavioral tendencies, emotional associations, interaction patterns, and contextual factors.

A major theoretical implication of this research is the integration of relationship marketing concepts with analytical consumer intelligence. Previous consumer relationship studies have established that relationships develop through perceived benefits, social affiliation, commitment, and brand meaning. Berenguer-Contrí et al. (2009) emphasized that relationship benefits influence consumer evaluations and long-term relationship outcomes, while Bloemer et al. (2003) demonstrated that individual relationship proneness affects behavioral intentions. The present framework extends these perspectives by

suggesting that such relational characteristics can be identified through aggregated consumer data.

The study also highlights the importance of moving beyond transactional measurements. Organizations frequently evaluate customers through indicators such as revenue contribution, purchase frequency, or profitability. Although these indicators remain valuable, they provide an incomplete understanding of consumer relationships. A consumer with moderate purchasing activity may possess strong emotional attachment and long-term loyalty potential. Enhanced aggregation methodologies enable organizations to detect these less visible relationship patterns.

The connection between clustering-based analysis and consumer relationship detection represents another important contribution. Advanced clustering techniques allow organizations to identify naturally occurring consumer groups rather than imposing predefined categories. As demonstrated by Jatav et al. (2025), analytical clustering can reveal latent behavioral structures that remain hidden within traditional segmentation approaches. Applying similar principles to relationship analysis creates opportunities for discovering consumer communities based on deeper relational similarities.

However, several challenges must be considered. One significant challenge involves interpretation accuracy. Analytical models can identify patterns but may not always explain the underlying psychological reasons behind consumer

behavior. For example, two consumers may appear similar based on engagement patterns, but their motivations may differ substantially. Therefore, organizations must combine analytical results with theoretical understanding and managerial interpretation.

Another challenge concerns the dynamic nature of consumer relationships. Relationships evolve due to changing preferences, market conditions, competitive influences, and personal circumstances. A relationship model developed from historical data may become less accurate if consumer behavior changes significantly. Continuous updating and adaptive analytical systems are therefore necessary.

Privacy and ethical issues represent additional limitations. Enhanced aggregation requires access to extensive consumer information, creating potential concerns regarding data protection, transparency, and consumer consent. Organizations implementing such methodologies must establish responsible data governance practices.

From a practical perspective, the framework provides several advantages. Retailers and service organizations can use relationship detection models to design personalized engagement strategies, improve customer retention programs, and allocate resources more effectively. Instead of treating consumers only as revenue-generating entities, organizations can develop strategies based on relationship characteristics.

The research also supports a shift from customer management toward relationship ecosystem management. Consumers influence and interact with brands through connected networks, and understanding these networks can provide strategic advantages. Multi-level relationship perspectives proposed by Gutiérrez (2005) support the idea that consumer relationships operate across multiple interaction levels, requiring analytical approaches capable of capturing such complexity.

Overall, the discussion indicates that enhanced data aggregation methodologies provide a bridge between theoretical relationship marketing and practical consumer analytics. The approach does not replace traditional relationship theories but strengthens their application by enabling large-scale detection and analysis of hidden consumer structures.

6. CONCLUSION

Consumer relationships have become increasingly complex due to changing market environments, digital interactions, and expanding sources of consumer information. Traditional segmentation methods often provide limited insights because they primarily focus on visible characteristics while ignoring deeper relational structures. This research proposed an enhanced data aggregation methodology for detecting internal consumer relationships by integrating behavioral, relational, interaction, and contextual dimensions.

The study developed a conceptual framework that combines consumer relationship theories with analytical methodologies. The framework demonstrates that consumer relationships can be identified through aggregated information representing multiple aspects of consumer behavior and engagement. By applying analytical techniques such as clustering and similarity-based relationship mapping, organizations can discover hidden consumer groups and understand relationship patterns more effectively.

The research contributes to existing knowledge by connecting two previously separated domains: relationship marketing theory and computational consumer analytics. Existing studies have extensively examined how consumer relationships develop through benefits, affiliation, trust, and brand connections. However, fewer approaches have addressed how these relationships can be systematically detected within large-scale consumer datasets. This research addresses that gap by presenting a relationship-oriented analytical perspective.

The findings indicate that enhanced aggregation methodologies can improve consumer segmentation accuracy, support personalized marketing strategies, and enable organizations to manage relationships more effectively. Instead of focusing only on customer value based on transactions, organizations can evaluate consumers according to relationship characteristics and long-term engagement potential.

Despite these contributions, the methodology has limitations. The effectiveness of relationship detection depends on data quality, feature selection, analytical accuracy, and ethical data management. Consumer relationships are dynamic, meaning models must continuously adapt to changing behaviors and market conditions. Additionally, algorithmic analysis cannot completely replace human interpretation because consumer motivations often involve psychological and social factors that require contextual understanding.

Future research can extend this framework by developing real-time relationship detection systems, integrating artificial intelligence-based adaptive models, and validating the methodology across different industries. Further studies may also investigate how consumer relationship networks evolve over time and how organizations can use these insights to build sustainable customer relationships.

In conclusion, enhanced data aggregation methodologies represent a valuable direction for modern consumer relationship analysis. By combining theoretical understanding with advanced analytical capabilities, organizations can move beyond conventional segmentation and develop deeper insights into the internal structures that influence consumer behavior.

REFERENCES

1. D. S. Jatav, M. H. Mirza, M. Pal, A. Tripathi and R. Nair, "Uncovering Latent Behavioral Patterns Using Advanced Clustering in Customer Segmentation," 2025 IEEE International Conference on Advanced Computing Technologies (ICACT), Tirupati, India, 2025, pp. 590-595, doi: 10.1109/ICACT67549.2025.11351402.
2. G. Berenguer-Contrí, M. E. Ruiz-Molina, and I. Gil-Saura. "Relationship benefits and costs in retailing: A cross-industry comparison." *Journal of Retail & Leisure Property*, vol. 8, pp. 57–66, 2009.
3. J. Bloemer, G. Odekerken-Schröder, and L. Kestens. "The impact of need for social affiliation and consumer relationship proneness on behavioural intentions: An empirical study in a hairdresser's context." *Journal of Retailing and Consumer Services*, vol. 10, pp. 231–240, 2003.
4. E. Breivik and H. Thorbjørnsen. "Consumer brand relationships: an investigation of two alternative models." *Journal of the Academy of Marketing Science*, vol. 36, pp. 443–472, 2008.
5. S.S.M. Gutiérrez. "Consumer-retailer relationships from a multi-level perspective." *Journal of International Consumer Marketing*, vol. 17, pp. 93–115, 2005.
6. T. Lu and Z. Zhou, "Brand theory based on brand relationship." *Business Economics and Administration*, vol. 12, pp. 4–9, 2003.