ENHANCED RECENCY, FREQUENCY, AND MONETARY METHOD WITH PURCHASE TIMING FOR ANALYSING CUSTOMER PURCHASING BEHAVIOUR

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MASTER OF BUSINESS INFORMATION MANAGEMENT

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A master project submitted
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DECLARATION

I declare that this master project entitled “Enhanced Recency, Frequency, and Monetary Method with Purchase Timing for Analysing Customer Purchasing Behaviour” is the result of my own research except as cited in the references. The master project has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :.....

Name : LIM KEN TAK

Date : 01/10/2024

APPROVAL

I hereby declare that I have read this master project and in my opinion this master project is sufficient in terms of scope and quality as a partial fulfillment of Master of Business Information Management.

Signature :.....

Supervisor Name : TS. DR. SITI AZIRAH BINTI ASMAI

Date : 01/10/2024

DEDICATION

This thesis is dedicated to the people who have been my source of strength and inspiration throughout this challenging yet rewarding journey. To my loving parents, thank you for your unwavering support, endless patience, and unconditional love. Your sacrifices, encouragement, and belief in me have provided the foundation for everything I have achieved. I am deeply grateful for the values you have instilled in me and for always being there to guide me, no matter the obstacles I faced.

To my dear brother and sister, your constant encouragement and understanding have been a true source of motivation. You have always stood by me, offering support in ways both big and small, and for that, I am immensely thankful.

I also wish to extend my heartfelt appreciation to my esteemed supervisor, Ts. Dr. Siti Azirah Binti Asmai. Your expertise, patience, and insightful feedback have been instrumental in shaping this thesis. Thank you for your unwavering guidance, continuous support, and for pushing me to reach new heights. Your mentorship has been invaluable, and I could not have completed this work without your direction and encouragement.

This thesis is a reflection of your love, encouragement, and tireless belief in me, for which I am eternally grateful.

ABSTRACT

The research focuses on advancing the traditional RFM (Recency, Frequency, Monetary) model by introducing a novel metric—Timing—to form the Enhanced RFMT model. This addition aims to provide a deeper understanding of customer purchasing behaviors by accounting for the temporal intervals between transactions. Using this model, the study addresses key questions regarding the effectiveness of integrating Timing into the classic RFM model and its impact on customer segmentation and marketing strategies. The study utilizes primary data collected from online retail transactions to simulate real-world scenarios and test the practical applications of the enhanced model.

The results show that incorporating Timing improves the predictive accuracy of consumer behavior models, enabling retailers to better anticipate customer needs and preferences. It also highlights the benefits of using the RFMT model for more accurate segmentation and improved decision-making in inventory control, marketing communication, and customer retention. Overall, the enhanced model allows businesses to optimize their strategies and adapt more effectively to the dynamic retail landscape.

KAEDAH RECENCY, FREQUENCY, DAN MONETARY (RFM) YANG DIPERTINGKATKAN DENGAN PENGAMBILAN KIRA MASA PEMBELIAN UNTUK MENGANALISIS TINGKAH LAKU PEMBELIAN PELANGGAN

ABSTRAK

Kajian ini menumpukan kepada penambahbaikan model RFM (Recency, Frequency, Monetary) tradisional dengan memperkenalkan metrik baru—Timing—untuk membentuk model RFMT yang Dipertingkatkan. Penambahan ini bertujuan untuk memberikan pemahaman yang lebih mendalam mengenai tingkah laku pembelian pelanggan dengan mengambil kira selang masa antara transaksi. Dengan menggunakan model ini, kajian ini menangani soalan utama mengenai keberkesanan mengintegrasikan elemen Timing ke dalam model RFM klasik dan kesannya terhadap segmentasi pelanggan serta strategi pemasaran. Kajian ini menggunakan data utama yang dikumpulkan daripada transaksi runcit dalam talian untuk mensimulasikan senario dunia sebenar dan menguji aplikasi praktikal model yang dipertingkatkan ini.

Hasil kajian menunjukkan bahawa pengenalan elemen Timing meningkatkan ketepatan ramalan model tingkah laku pengguna, yang membolehkan peruncit meramalkan keperluan dan keutamaan pelanggan dengan lebih baik. Ia juga menekankan faedah menggunakan model RFMT untuk segmentasi yang lebih tepat dan meningkatkan pembuatan keputusan dalam kawalan inventori, komunikasi pemasaran, dan pengekalan pelanggan. Secara keseluruhannya, model yang dipertingkatkan ini membolehkan perniagaan mengoptimumkan strategi mereka dan menyesuaikan diri dengan lebih berkesan dalam landskap runcit yang dinamik.

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LIST OF ABBREVIATIONS

R	-	Recency
F	-	Frequency
M	-	Monetary
T	-	Timing
GMM	-	Gaussian Mixture Model
CRM	-	Client Relationship Management
AI	-	Artificial Intelligence
BDA	-	Big Data Analytic
RBV	-	Resource-Based View
B2B	-	Business-To-Business
RTM	-	Real-Time Marketing
BLE	-	Bluetooth Low Energy Beacons
CLSC	-	Closed-Loop Supply Chain
OCR	-	Online Customer Survey
KPI	-	Key Performance Indicator
PDCA	-	Plan, Do, Check, Act

CHAPTER 1

INTRODUCTION

1.1 Background

The retail business remains as a foundation of present day economies, filling in as a crucial course among makers and customers since its importance resonates through different areas, including both physical and digital domains and understanding the complex elements inside this industry is critical for boosting productivity, benefit, and consumer loyalty.

Overview of Retail Industry

The retail scene has gone through significant changes throughout the long term, moved by moving buyer inclinations, innovative headways, and worldwide financial patterns where traditionally, retail involved brick-and-mortar establishments where customers actually visited stores to make buys. In any case, with the appearance of online business, the limits of retail have extended dramatically. Today, buyers can peruse, analyze, and buy items from the solace of their homes, facilitated by online platforms and mobile applications which has prompted a union of disconnected and online retail channels, establishing an omnichannel climate where consistent mix and customized encounters are central. The retail business consolidates an alternate display of regions, including yet not confined to shape, equipment, food, and redirection and each area presents uncommon troubles and opportunities, impacted by components like irregularity, customer economics, and competitive scene. In addition, the rising of specialty markets and customization designs

has added unpredictability to the retail biological system, requiring light-footed techniques to conform to developing solicitations.

Importance of Retail Insights

In this dynamic environment, access to precise and actionable insights is fundamental for retailers looking to flourish in the midst of serious competition and retail insights incorporate a range of data driven observations and analysis that enlighten purchaser behaviour, market patterns, and operational performance and by utilizing these insights, retailers can settle on informed choices in regards to product assortment, pricing techniques, promotional campaigns, and inventory management.

The worth of retail insights goes beyond past simple operational effectiveness; it directly influences customer engagement and dependability and by understanding customer preferences and purchase patterns, retailers can tailor their offerings to line up with customer expectations, in this manner cultivating more grounded connections and driving recurrent expenditure. Besides, bits of knowledge into market patterns and competitive elements empower retailers to expect shifts popular and proactively change their techniques to keep a upper hand and generally, retail insights act as a compass directing retailers through the complexities of a steadily developing marketplace and enable decision-makers with the information expected to explore vulnerabilities, alleviate risks, and profit by arising valuable opportunities.

Role of Technology in Retail Management

Vital to the age and use of retail insights is the unavoidable role of technology in retail management where from retail location frameworks and stock following programming to Client Relationship Management (CRM) platforms and advanced analytics tools, technology supports each feature of current retail operations.

Perhaps of the most extraordinary innovation as of late is information examination, which empowers retailers to get noteworthy experiences from tremendous pieces of information created through different touchpoints, including on the online transactions, social media interactions, and in-store ways of behaving. Through methods, for example, predictive analytics and machine learning, retailers can uncover hidden patterns and relationships inside datasets, empowering them to pursue information driven choices with a more serious level of precision and certainty. Besides, advancements in Artificial Intelligence (AI) and automation have reformed retail processes, from supply chain management and logistics to customized advertising and customer service since artificial intelligence powered algorithms can break down huge datasets progressively, empowering retailers to customize product recommendations, improve valuing methodologies, and convey targeted marketing campaigns custom-made to individual inclinations and ways of behaving.

Technology has worked with the consistent combination of online and offline retail channels, empowering retailers to offer omnichannel experiences that take special care of the inclinations of current purchasers and whether through click-and-collect services, expanded reality-enabled shopping encounters, or social commerce platforms, technology has enabled retailers to engage with customers in innovative ways, obscuring the lines

among physical and advanced domains. Retailers can use technology to acquire deeper insights into consumer behavior and market dynamics by using data and analytics where technology is the driving force behind innovation and efficiency in retail management and retailers can create outstanding experiences that appeal to modern consumers and adjust to the changing demands of the market by embracing technology-driven solutions. The retail sector is a dynamic, multidimensional environment that is marked by intense rivalry and ongoing change and in light of this, it is impossible to overestimate the significance of retail insights, which are essential for making wise decisions and developing strategic plans where retailers possess the necessary skills and capabilities to drive development, unlock new opportunities, and reimagine the future of retail through the use of technology as a catalyst.

1.2 Problem Statement

Current challenges affecting retailers include; The volatile consumer behaviour, emerging technologies and increase competition. These challenges reveal the need to have a customer knowledge and use state of the art analytical tools to arrive at the most suitable solutions. This segment particularly focuses on the issues related to traditional customer analysis based on RFM method and stress on the need of improving other models like RFMT (Recency, Frequency, Monetary + Timing) model to handle such issues (Akram et al., 2021).

Challenges in Traditional Retail Management

The conventional approach of RFM analysis which solely works on the basis of recency, frequency and monetary value come across several challenges that hampers its applicability in the current retail scenario. The uncertainty of the consumers is one of the major problems that businesses face when trying to implement their strategies. It is important

sufficiently in understanding consumers whereby their preferences, tastes and their purchase behavior change due to factors like new products, change in trends and economic status. This makes it a challenge to forecast the demand in a Retail store, to maintain adequate stock and to ensure the right product mix is available in the shelves to meet the ever changing customer demands. The application of traditional RFM analysis may have several shortcomings as it fails to provide a concrete picture about the customers. One of the drawbacks of applying this model is that it fails to take into account the time profile of transactions made with customers, thus affording a less vivid vision of customer value. For instance, the customer who bought considerable quantities of products three months ago may not be more valuable than the client who has purchased moderate amounts in the last couple of weeks. These shortcomings can create problems with fine-grained segmentation of customer bases and hence proper marketing techniques.

Besides, the traditional analysis using RFM method still comes with major issues arising from outdated technology as well as manual implementation of the processes. Due to overreliance on the static models and historical data, the concepts do not suit the current fast-growing digitization of business and the dynamically changing expectations of the clients. The number of digital disruptors and e-Commerce giants is increasing and conventional retailers should invest in sophisticated analytical tools and technologies or they face the danger of declining their market share.

Need for Enhanced RFMT Analysis

Due to some limitations related to the classical RFM method, there is an increasing demand for a new method that would involve new factors to increase the model's accuracy and improve customer classification (Muley et al., 2024). The RFMT method that extends

the RFM method by incorporating an additional variable, Timing, provides additional insights about customer behaviour since it also takes into account the time at which the transactions were completed in addition to considering the extent, frequency and proximity of transactions. This enables the retailers to have adequate data on the level of engagement of the customers so that they can be in a position to plan well for the future with regards to the market trends, the stocks as well as the customers that are likely to be retained.

More broadly, through embedding of the RFMT method, retailers can gain a better understanding of the specificity of customer behavior that should, in turn, enhance the assessment of segmentation methods and marketing communication activities. Integration of the Timing variable also leads to better insights on when customers are most receptive to brand messages thus helping retailers to better time their promotions and subsequently enhance the experiences of their customers. Furthermore, application of the theory involves exploring of real time information and hence its deployment can assist the RFMT method based retailers to embrace change to support their competitive edge in the current complex market environment. The change from the conventional style of analysis referred to as RFM to the new and improved RFMT prevalence is vital to any retailer that aims at developing a strong and profound approach to their predictive analysis. Thus, by taking Timing into account, retailers are able to enhance the understanding of customers' actions, which enable to make accurate decisions and increase the overall performance of the business.

1.3 Proposed Solution

The proposed solution involves refining the already existing approaches to the customer analysis by including the more sophisticated methodologies, which make the conventional RFM method evolve into the RFMT method. The underlying goal of this approach is to offer improved and clearer view on customers' behaviors, markets and operating performance.

Firstly, we shall be able to identify the behavior of our customers by use of the RFM method where customers are rated based on the last time, they purchased the products, the frequency of purchasing and the amount they spend. Although the RFM method is powerful, it is not necessarily privileged with the dynamic view which will allow a firm to successfully gauge customer trends and the likely future behaviour. To overcome with this limitation, the Timing variable will be incorporated as a very important modification in the current model, thereby changing the name of the model to RFMT. Timing is a variable that prepares the data for analysis from the temporal perspective, which reveals the likelihood of consumers' interaction with the brand and helps to improve the model's precision and customer classification.

The main goal of this solution is to evaluate the distinct between the RFM method and the RFMT method. This comparison will therefore assist in establishing the extent of the impact of the Timing variable in providing a more enhanced and practical insight customer profile variations, market conditions and business performance. If used together with the RFMT method, real time data analysis enables the retailers to overcome the limitations of sales forecasts and historical information and make immediate decisions based on the tendencies taking place in the market. Thus, utilizing such developed analytics

solutions as the Timing variable, retailers can predict consumers' behavior more effectively and adjust their approaches.

Such marketing and communication campaigns requiring consistency of information sources complemented by the interactive uses of the internet and social networks or physical shopping experiences are likely to benefit from this broader view of the customer. Furthermore, it will ensure that customers are given a consistent experience across different contacts, thus enhancing the performance of the business and customers' satisfaction level.

1.4 Research Question

In order to improve retail insights, the following study topics will be used as a foundation for examining how purchase timing might be integrated with RFMT:

i) How can the RFMT method be developed and tested to enhance customer segmentation by incorporating the Timing (T) variable alongside Recency, Frequency, and Monetary metrics?

ii) How does the addition of the Timing variable in the RFMT method affect the correlation between Recency, Frequency, and Monetary value compared to the traditional RFM model?

iii) What insights can be gained by evaluating and comparing the correlation coefficients from both the RFM and RFMT methods, and how can these insights be effectively visualized for better understanding?

1.5 Research Objective

The main purpose of this study is to extend the use of the current RFM method to include the Timing variable, and call for the new revised model RFM classification system. The purpose of the study is to prove that the inclusion of the Timing variable contributes to the improvement of the predictive analysis and provide profound understanding of customer's behaviors, making the marketing strategies, demand forecasts, and overall business performance more effective.

Specific Objectives to achieve:

- RO1: To develop and test the RFMT method, which uses the same customer segmentation approach as the traditional RFM model but incorporates the Timing (T) variable to gain deeper insights into customer behavior.
- RO2: To compare the correlation coefficients between the RFM and RFMT methods, demonstrating how the Timing factor interacts with Recency, Frequency, and Monetary value.
- RO3: To evaluate and compare the correlation coefficients from both the RFM and RFMT methods, and visualize the results for clearer insights.

The aforementioned research objectives are intended to contribute to our growing understanding of the relationship among retail performance, Real-time Marketing and Forecasting Techniques (RFMT), and purchase timing and by fulfilling these goals, the study hopes to provide retailers with useful information that will help them adjust to changing consumer behavior, enhance their marketing plans, and spur business expansion in the face of a more competitive and dynamic retail environment.

1.6 Significance of the Study

It is vital to examine the conceivable academic commitments and genuine implications for the retail business to completely see the value in the meaning of consolidating buy timing with Real-time Marketing and Forecasting Techniques for further developed retail insights and this part centers around how the recommended study will upset scholarly information headway and spike advancement in the retail business.

Potential Contributions to Academia

The proposed study is a ground-breaking project that makes numerous important contributions to the scholarly literature:

- The study contributes to the advancement of retail management theory by investigating the integration of purchase time with RFMT which enhances current ideas on retail marketing, forecasting, and consumer psychology by providing fresh perspectives on the temporal dynamics of consumer behavior and the use of real-time data in retail decision-making. By combining ideas from supply chain management, data analytics, and marketing, the study builds a bridge between interdisciplinary viewpoints where through the integration of perspectives from several disciplines, the research promotes a comprehensive comprehension of retail operations and customer behavior, opening doors for interdisciplinary research partnerships and information sharing.
- By creating cutting-edge techniques for merging purchase timing data with RFMT and evaluating it, the study makes a methodological contribution and through the use of cutting-edge analytics methods like predictive modeling and machine learning