



***SCHOOL OF COMPUTER SCIENCE***



*THESIS REPORT ON*

**TRADE PROGRAM OPTIMIZATION (TPO) &**

**CUSTOMER TARGETING RECOMMENDATION**

*A Thesis in partial fulfillment of the requirements for the degree of*

*Bachelor’s Degree of Computer Science*

*Submitted By*

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**15th January 2023 – 15th May 2023**



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*Project Topic*

**Trade Program Optimization & Customer Targeting Recommendation**

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**មូលន័យសង្ខេប**

របាយការណ៍នេះនឹងរៀបរាប់អំពីបទពិសោធន៍កម្មសិក្សាខែទីបួនរបស់ខ្ញុំនៅ HEINEKN CAMBODIA ក្នុងនាមជាអ្នកវិភាគទិន្នន័យ។ កម្មសិក្សាគឺចាប់ពីថ្ងៃទី 15 ខែមករា ឆ្នាំ 2023 ដល់ថ្ងៃទី 15 ខែឧសភា ឆ្នាំ 2023 ។ ចំណងជើងគម្រោងគឺ "ការបង្កើនប្រសិទ្ធភាពពាណិជ្ជកម្ម & អនុសាសន៍កំណត់គោលដៅអតិថិជន" គម្រោងនេះគឺដើម្បីគាំទ្រដល់ទីផ្សារពាណិជ្ជកម្មដើម្បីធ្វើកម្មវិធីដល់អតិថិជនត្រឹមត្រូវប្រកបដោយប្រសិទ្ធភាពនៅពេលពួកគេធ្វើពាណិជ្ជកម្ម។ កម្មវិធី ឬការផ្សព្វផ្សាយដល់អតិថិជន។ ជាងនេះទៅទៀត ក្រុមការងារទីផ្សារពាណិជ្ជកម្មនាពេលនេះគឺពិតជាអាក្រក់បំផុតលើការកំណត់គោលដៅកម្មវិធីអតិថិជន ហើយបញ្ហាគឺថាពួកគេមិនមានអនុសាសន៍ស្តង់ដារសម្រាប់ពួកគេដើម្បីកែលម្អការបង្កើនប្រសិទ្ធភាពពាណិជ្ជកម្មផងដែរ។ ដូច្នេះហើយ ក្រុមការងារ Data & Analytic បានបង្កើតគំនិតមួយដើម្បីជួយទីផ្សារពាណិជ្ជកម្ម និងក្រុមលក់ ដើម្បីដោះស្រាយបញ្ហានេះ ដើម្បីបង្កើនបរិមាណលក់ និងក្រុមហ៊ុន KPI ផងដែរ។

តាមរយៈការធ្វើដូចនេះ យើងបានប្រមូលទិន្នន័យប្រវត្តិសាស្រ្តពីកម្មវិធីពាណិជ្ជកម្ម ដើម្បីមើលការអនុវត្ត និងធ្វើការវិភាគលើព័ត៌មានលម្អិត។ លទ្ធផលនៃគម្រោងនេះ យើងនឹងមានគំរូដើម្បីកែលម្អកម្មវិធីពាណិជ្ជកម្ម រួមទាំងការអនុវត្ត កំណើនប្រាក់ចំណូល និងវិធីបង្កើនបរិមាណលក់ផងដែរ។ ជាការពិតណាស់ ក្នុងអំឡុងពេលកម្មសិក្សា ខ្ញុំបានជួបបញ្ហា និងបញ្ហាប្រឈមជាច្រើន។ ភាគច្រើននៅក្នុងការទំនាក់ទំនង និងវិធីនៃការធ្វើការជាមួយក្រុមគ្រប់គ្រង និងការរឹតបន្តឹងក្រុមហ៊ុនមួយចំនួនក្នុងការប្រើប្រាស់បច្ចេកវិទ្យាថ្មី និងប្រភពបើកចំហ។ ប៉ុន្តែបញ្ហាទាំងអស់នេះត្រូវដោះស្រាយដោយការជួយជ្រោមជ្រែងពីក្រុម រួមទាំងការទំនាក់ទំនង និងដោះស្រាយជាមួយក្រុមថ្នាក់ដឹកនាំផងដែរនូវបច្ចេកទេសមួយចំនួនផងដែរ។

ជាងនេះទៅទៀត ខ្ញុំបានទទួលនូវប្រាជ្ញា និងបទពិសោធន៍ជាច្រើនពីកម្មសិក្សានេះ រួមទាំង Hard-Skill និង Soft-Skill ផងដែរ ដូចជាការស្រាវជ្រាវបំពង់បង្ហូរប្រេង ការប្រមូលទិន្នន័យ និងស្ថាបត្យកម្ម ការប៉ះទង្គិចទិន្នន័យ ឬការសម្អាតទិន្នន័យ ការវិភាគទិន្នន័យរុករក ដំណើរការទិន្នន័យ បច្ចេកទេសរៀនម៉ាស៊ីន និង ការអភិវឌ្ឍន៍ ហើយជាពិសេសរឿងដែលសាលាមិនបង្រៀនគឺការប្រាស្រ័យទាក់ទង និងស្វែងយល់ក្នុងបរិយាកាសការងារពិត និងវិធីថ្មីក្នុងការធ្វើការតាមស្តង់ដារក្រុមហ៊ុនសកល។

**ABSTRACTION**

This report will describe my fourth month's internship experiences at **HEINEKN CAMBODIA** as a **DATA ANALYST INTERN**. The internship was from 15th January 2023 to 15th May 2023. The project title is **“TRADE PROGRAM OPTIMIZATION & CUSTOMER TARGETING RECOMMENDATION”**, this project is object to support the trade marketing to do the program to the right customers effectively when they are doing the trade program or promotion to customer. Moreover, Trade Marketing Team is currently quite well worst on the customer program targeting and the problem is they don’t have the standard recommendation to them to improve the trade optimization as well. Thus Data & Analytic Team has come up an idea to assist trade marketing and sale team to solve this out to increase the sell volume and company KPI as well.

By Doing this, we have collected the historical data from trade program to see the performance and do the analysis on the detail. The outcome of this project, we would have the model to improve the trade program including the performance, revenue growth, and the way to increase the sale volume as well.

Of course, during an internship, I met the issues and challenges a lot. Mostly in the communication and the way of working with management team and some of company restriction of using new technologies and open source. But all these problems have figure out by supporting from the team including communication and deal with leadership team also some of technical things either.

Moreover, I received a lot of wisdom and experience from this internship including Hard-Skill and Soft-Skill as well such as research pipeline, data collection and architecture, data wrangling or data cleansing, exploratory data analysis, data preprocessing, machine learning technique and development, and mostly especially thing that school doesn’t teach is communication and explore in real working environment and new way working in global company standard.

**ABBREVIATION**

|  |  |  |
| --- | --- | --- |
| No | Abbreviation | Meaning |
| 1 | TPO | Trade Program Optimization |
| 2 | HCAM | HEINEKN Cambodia |
| 3 | ML | Machine Learning |
| 4 | EDA | Exploratory Data Analysis |
| 5 | AA | Advance Analytic |
| 6 | KNN | K-Nearest Neighbors |
| 7 | DL | Deep Learning |
| 8 | TMK | Trade Marketing Team |
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1. **GENERAL PRESENTATION OF THE COMPANY** 
   1. **HEINEKN Cambodia History**

HEINEKEN Cambodia is a proud part of the HEINEKEN Company. We find our roots in Cambodia back in 1994. Born from the Joint Venture between Asia Pacific Breweries Limited and Progress Import-Export, we were known at that time and for many years after as Cambodia Breweries Limited (CBL). After joining the HEINEKEN family in 2014, we finally became HEINEKEN Cambodia in 2020.

We are proud of our HEINEKEN history as a family-owned, independent brewer that stretches back 150 years in the Netherlands. We brew the highest quality beers, build globally loved brands and strive to do both things as sustainably as possible. Our master brewers produce our global, regional and local beers in our state-of-the-art brewery located in Phnom Penh. Made passionate by the art of brewing beers, they strictly follow the highest international standards and use ingredients and recipes identical to those applied in all HEINEKEN breweries across the globe. Every day, their magic brings to life our five jewels: Heineken®, Tiger, Anchor, ABC Extra Stout, and Gold Crown. We offer a world of opportunities where people are at the center. We value purpose, innovation, inclusion and diversity, and sustainability. Aiming to Brew a Better Cambodia, we are proud to be the top taxpayer across all industries, truly supporting the social and economic development of Cambodia

* 1. **HEINEKN Cambodia Service**

Figure

Every day, HEINEKEN’s magic brings to life our five jewels: Heineken®, Tiger, Anchor, ABC Extra Stout, and Gold Crown. We value purpose, innovation, inclusion and diversity, and sustainability. Aiming to Brew a Better Cambodia, we are proud to be the top taxpayer across all industries, truly supporting the social and economic development of Cambodia.

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  + Facebook: [HEINEKEN's Facebook](https://www.facebook.com/HEINEKENCambodia)
  + LinkedIn: [HEINEKEN LinkedIn](https://www.linkedin.com/company/heinekencambodia/)

1. **INTRODUCTION OF THE PROJECT** 
   1. **Presentation of the Project**

Trade Program Optimization is the initiative project from Data and Analytic team to support the trade marketing and sale team to optimize the key performance indicator of them and increase the sale volume of the company as well. By doing this project, we have a model and analyze the root cause of decrease and increase reason of each trade program that implementing in the marketing and after that. Moreover, that’s not only one thing that our model helps to the stakeholder’s team and company, but it will also support the team to get the right target customers to fit their trade program scheme and KPI that they set. It’s generally involved the many teams such as Data & Analytic Team, Sale Team, Trade Marketing Team, Branding Team, Inventory Management Team, and Digital & Technology Team as well.

Thus, technically our model will aim to combine both the estimation of the target customer and the optimization of targeted promotions over the graph. For this purpose, we need to ensure that the target customer can be optimized over. Therefore, we construct the target customer recommendation model that can be represented by an interpretable graph model describing by how much one customer’s purchase increases the probability of another customer’s purchase, sale volume and make more profit to the company.

* 1. **Problematic**

The starting point of the root cause problem to raise this project up ais Trade Marketing team doesn’t know where, who, how should they target to the right customers that they want to achieve their KPI of their trade program. Thus, this is the big root cause that already happened. By doing that, we would our initiative project will support team to solve this problem out.

* 1. **Objectives**

The Trade Program Optimization has the object to support the trade marketing to do the program to the right customers effectively. Moreover, Trade Marketing Team is currently quite well doing on the customer program targeting but the problem is we don’t have the standard recommendation to them to improve the trade program targeting and optimization as well. Thus Data & Analytic Team has come up an idea to assist TM to solve this out to increase the sell volume and company KPI as well. The objectives would be:

* Improve the trade program targeting effectively
* Increase the sell volume and profit generate by trade program optimization model
* Understand the customer’s performance & behaviors
* Improve the master data and data model & what the need to push master data help the trade program targeting.

**Academic/Practical Relevance**: From an academic point of view, we want to develop the model to detect the customer targeting effect solely from transactional data and optimal program targeting as well.

* 1. **Project Planning**

The project has 4 months in duration. That’s starting from 15 January 2023 to 15 May 2023. This table below illustrate the project planning and listing the tasks from A to Z.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Task** | **Week** | | | | | | | | | | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
| Understand Business Pain Point |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Align with the Stakeholders |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Install an Environment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data Collection |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data Cleansing |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Exploratory Data Analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Machine Learning Training |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Machine Learning Evaluation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Result Validation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Prepare Slide & Report Thesis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. **STATE OF THE ART**
   1. **Trade Program Optimization**

TPO stands for Trade Promotion Optimization, which is a process of designing and implementing effective trade promotion strategies to improve the efficiency and effectiveness of promotional activities. Trade promotion optimization involves analyzing historical data, market trends, and consumer behavior to identify the most effective promotional strategies, such as the timing, frequency, and level of discounts, among others. TPO also involves monitoring and evaluating the performance of promotional activities to make adjustments and improvements over time. The goal of TPO is to maximize the return on investment (ROI) of promotional activities and achieve marketing objectives, such as increasing sales, market share, and customer loyalty. Trade Promotion Optimization (TPO) is important for several reasons:

* Cost-effectiveness: Trade promotion activities can be expensive, and without proper optimization, firms may not see a significant return on their investment. TPO helps firms identify the most effective promotion strategies and allocate their resources accordingly, resulting in cost-effective promotion activities.
* Improved performance: TPO can help firms improve the performance of their promotional activities. By analyzing data and market trends, firms can identify the most effective promotion strategies, which can lead to increased sales, market share, and customer loyalty.
* Competitive advantage: TPO can provide firms with a competitive advantage. By optimizing their promotion activities, firms can better target their customers, differentiate their products from competitors, and improve their overall marketing effectiveness.
* Increased efficiency: TPO can also improve the efficiency of promotional activities. By streamlining processes and reducing waste, firms can achieve their marketing objectives with fewer resources and less time.

Trade promotion optimization (TPO) is a critical area of research in marketing and sales management. TPO involves the use of analytical tools and techniques to design, implement, and evaluate trade promotions that maximize the effectiveness of marketing investments. The literature on TPO includes a wide range of research studies and review articles that cover various aspects of trade promotion management. In this review, we summarize some of the most relevant research in this field. **Trade promotion management (TPM)** refers to the process of planning, executing, and evaluating trade promotions. A key aspect of TPM is the use of data analytics to optimize the effectiveness of promotions. Researchers have studied different aspects of TPM, including the role of data analytics, the effectiveness of different promotion types, and the impact of trade promotions on retailer and manufacturer profitability. **Promotion optimization models (POMs)** are mathematical models that use data analytics to optimize promotion design and execution. POMs can help manufacturers and retailers make data-driven decisions about promotion types, timing, and frequency. Researchers have developed various types of POMs, including linear and nonlinear programming models, decision trees, and simulation models. Studies have evaluated the effectiveness of different POMs and identified the factors that affect their accuracy and usefulness. **Trade promotions** are often used in conjunction with price discounts to attract customers and increase sales. Researchers have studied the relationship between pricing and promotions and identified the factors that affect the effectiveness of these strategies. Some studies have shown that promotions are more effective when they are combined with price discounts, while others have suggested that promotions can be effective even without price discounts. Researchers have studied the impact of trade promotions on various outcomes, including sales, profits, and customer behavior. Studies have shown that trade promotions can be effective in increasing sales and profits in the short term, but their long-term impact is less clear. Some studies have suggested that trade promotions can have a negative impact on profitability if they are not carefully managed. **Data analytics plays a critical role in TPO**, and researchers have studied the use of different data analytics techniques in promotion optimization. Some studies have focused on the use of machine learning algorithms to predict the effectiveness of promotions, while others have studied the use of data visualization tools to help managers make better decisions.

In conclusion, the literature on TPO is broad and diverse, covering various aspects of trade promotion management. Researchers have developed different models and analytical techniques to optimize promotion design and execution and have studied the impact of trade promotions on sales, profits, and customer behavior. The effectiveness of trade promotions depends on several factors, including promotion type, pricing strategy, and data analytics. Further research is needed to develop more accurate and effective promotion optimization models and to understand the long-term impact of trade promotions on business performance. "Optimizing trade promotion strategies in the presence of category captains" by Praveen K. Kopalle and Robert L. Steiner. Published in Marketing Science, this paper presents a model for optimizing trade promotion activities in the presence of category captains. The authors suggest that firms can increase their profitability by coordinating their promotion activities with category captains, who have a significant influence on consumer purchasing behavior. "Optimizing trade promotions: analysis of consumer and retailer promotion sensitivity" by Dipayan Biswas, David J. Lucking-Reiley, and Arun K. Jain. This paper, published in the Journal of Retailing, examines the impact of consumer and retailer promotion sensitivity on trade promotion effectiveness. The authors propose a model for optimizing trade promotion activities based on the degree of consumer and retailer sensitivity to promotions. "Optimizing trade promotions in the presence of forward buying and consumer stockpiling" by Shantanu Bhattacharya and Dipak C. Jain. This paper, published in Marketing Science, presents a model for optimizing trade promotion activities in the presence of forward buying and consumer stockpiling. The authors suggest that firms can increase their profits by carefully managing their promotion activities to account for these phenomenal. "A review of trade promotion optimization: from modeling to practice" by M. Berk Ataman and Carl Mela. Published in Marketing Science, this paper provides a comprehensive review of the literature on trade promotion optimization. The authors identify key trends and developments in the field and provide recommendations for future research. "Optimizing trade promotions: a category management approach" by Kusum L. Ailawadi and Kevin E. Lane. This paper, published in the Journal of Business Research, proposes a category management approach to optimizing trade promotions. The authors suggest that firms can increase their profitability by aligning their promotion activities with category management objectives.

**Project Introduction**

Trade Program/Promotion plays an important role in a variety of industries such as food delivery, banking, transportation, consumer electronics and beverage. Over time, the products that customers are attracted to can change. In general, the trade has often been set by mass marketing and celebrity culture. Increasingly, customers are not only keeping up with this general trend, but also with trends in their own social circles. We need to measure these trade program performance effects before we can target the right customer and target promotions effectively. In this work, our goal is to have the right target customer to sell our promotion/program and use them to improve demand estimation and devise promotion targeting. The process by which customers affect each other is complex.

We are specifically interested in estimating the causal effect that one customer’s purchase has on another customer’s purchase decision. This is a difficult problem, because a purchase not only depends on trade, but can also be caused by factors such as an item’s pricing or a time period’s seasonality. In this work, we aim to combine both the estimation of the target customer and the optimization of targeted promotions over the graph. For this purpose, we need to ensure that the target customer can be optimized over. Therefore, we construct the target customer recommendation model that can be represented by an interpretable graph model describing by how much one customer’s purchase increases the probability of another customer’s purchase, sale volume and make more profit to the company.

**Objective**

The Customer Trade Program Targeting Recommendation has the object to support the trade marketing to do the program to the right customers effectively. Moreover, Trade Marketing Team is currently quite well doing on the customer program targeting but the problem is we don’t have the standard recommendation to them to improve the trade program targeting and optimization as well. Thus Data & Analytic Team has come up an idea to assist TM to solve this out to increase the sell volume and company KPI as well. The objectives would be:

* Improve the trade program targeting effectively
* Increase the sell volume and profit generate by trade program optimization model
* Understand the customer’s performance & behaviors
* Improve the master data and data model & what the need to push master data help the trade program targeting.

**Academic/Practical Relevance**: From an academic point of view, we want to develop the model to detect the customer targeting effect solely from transactional data and optimal program targeting as well.

**Hypothesis**

To finetune customer targeting recommendation in order to leverage the effectiveness of the trade term program. To apply analytics model in order to uncover any hidden gaps in master data and trade term is the selected case for this study. We are currently having the hypothesis to test it out:

* Null Hypothesis (H0): Improving the trade program and customer targeting will NOT increase the sale volume and profit of revenue company KPI.
* Alternative Hypothesis (H1/HA): Improving the trade program and customer targeting will increase the sale volume and profit of revenue company KPI.

**Research Questions:**

* What’s the current process of doing trade program targeting?
* What are the metrics to analyze on trade program performance and correlation between customer targeting?
* ​How can master data maintain to support the trade program targeting?
* Which is the best model to implement with customer targeting recommendation for trade marketing?

1. **Methodology**

**Exploratory Data Analysis:** In this part, we are going to extract the data from the data warehouse of outlet transaction data to see the performance and we are going to explore the data in order to gain more insights from the data and also the trade marketing insight analysis as well. We would like to explore on:

* Trade Program Performance Analysis
* Customer Performance Analysis & Segmentation Exploratory

**Advance Analytic:** In this part, we would like to deeper dive into the solution to deal with trade marketing of customer targeting to the right customers as well. It will be more insightful for the TM and company either.

Historical Customer, Trade Program Data

Trend-Estimation Algorithm

Adaptive-Greedy Algorithm

Customer Performance (Volume, Market Share, Satisfaction)

Promotion Price & Budget

1. **Project Planning**

The project has 4 months in duration. That’s starting from 15 January 2023 to 15 May 2023. This table below illustrate the project planning and listing the tasks from A to Z.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Task** | **Week** | | | | | | | | | | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
| Understand Business Pain Point |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Align with the Stakeholders |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Install an Environment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data Collection |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data Cleansing |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Exploratory Data Analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Machine Learning Training |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Machine Learning Evaluation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Result Validation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Prepare Slide & Report Thesis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. **Technology**

To build the project up, we have finalized the technology, tool, library to consolidate with it as well.

**List of Languages:**

* Python Programming Language
* Structure Query Language (SQL)
* Data Analysis Expression (DAX)

**List of Tools:**

* Microsoft SQL Server Management Studio
* Colab / Jupter Notebook / Anaconda
* Visual Studio Code
* Microsoft Power BI
* GitHub

**List of Libraries:**

* Scikit-Learn
* Pandas
* Numpy
* Matplotlib
* Seaborn
* Plotly

**VII. References**

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