

# **Personalized Promotions: Targeting Pernalonga Customers to Boost Colgate-Palmolive Toothpaste Sales**

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## Executive Summary

- **What kind of customers should Colgate-Palmolive target with its toothpaste?**

Based on our analysis, we believe that Colgate-Palmolive should promote their toothpaste to the customers who are currently Colgate toothpaste loyalists, as well as a combination of customers who frequently purchase other Colgate products and customers who primarily purchase other brands of toothpaste

- **We know we are going to be promoting toothpaste. How likely are our targeted customers to make a purchase, given a promotion?**

Since we know that Colgate is interested in a promotional campaign to boost the sales of Colgate toothpaste, we will be offering a promotion of Colgate toothpaste to our target customers. We believe that by targeting these groups of customers, on average, the probability of purchasing Colgate toothpaste is 81%. Promotions would vary by customer, as outlined in our report. Results based on promotional type are shown in the table below. Our analysis shows that Pernalonga can expect this 14-day promotional program to generate an incremental revenue close to \$1,900 by providing \$250 in additional discounts through personalized promotions for Colgate Toothpaste. Please note that all outcome values are approximate and are based on certain assumptions and past transactional data.

Customer Segment	Total Customers Targeted	Incremental Volume (CT)	Incremental Revenue (\$)	Total Discount Redeemed (\$)
Loyal customers	601	696	1314	165
Target customers	268	309	574	82
<i>Total</i>	<i>869</i>	<i>1,005</i>	<i>1,888</i>	<i>247</i>

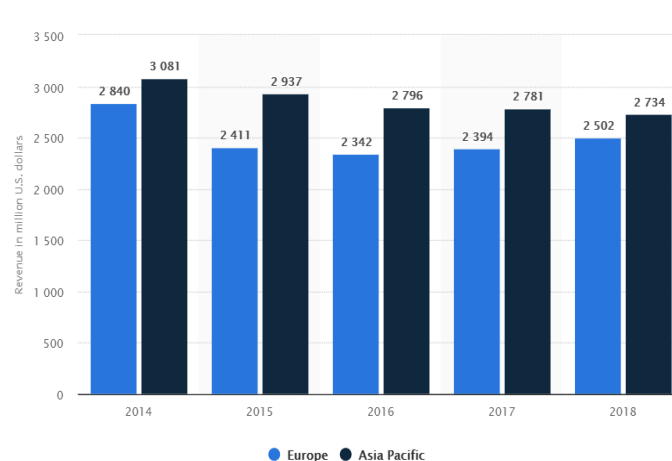
Figure 1: Expected Promotion Outcomes by Segment

## 1. Introduction

Pernalonga is a leading supermarket chain based in Lunitunia that offers a vast variety of over 10 thousand products among more than 400 categories. Its business is currently heavily reliant on promotions, both in-store and through third-party suppliers, with nearly 30% of sales being driven by promotions. While promotions are key in driving customer loyalty and maintaining satisfaction, in-store mass promotions, in particular, can be problematic to the business in that they offer a temporary price reduction to everyone regardless of whether or not the customer needs it. Pernalonga is looking to partner with Colgate-Palmolive to provide personalized promotions to specific target customers in order to boost sales of Colgate toothpaste. Pernalonga is interested in which customers should be targeted based on how likely they are to actually cash-in on the promotion. By exploring Pernalonga's transaction-level data, we were able to solve this problem and come up with a personalized promotion marketing campaign for Colgate toothpaste using Pearson Correlation Similarity and Naive Bayes Classification that will boost Colgate sales and revenue in Pernalonga stores across Lunitunia.

## 2. Business Context

Colgate-Palmolive is an American oral health and dental care brand that specializes in the production, distribution and provision of household, health care, personal care and veterinary products. Currently, Colgate sells a broadly diversified mix of products in both the United States and countries around the world. In Europe, the toothpaste market registered a negative compound annual growth rate (CAGR) of -1.86% from 2012 to 2017. Though negative growth rates were observed across all the segments of the market, the slowest declining segment of the toothpaste market in Europe between that time period was Specialist Toothpaste, which registered a CAGR of -1.59%. In 2017, the Standard Toothpaste segment in Europe accounted for a majority share of 52.51%, while Cosmetic Toothpaste stood fell in second place, representing 23.20% of the market's 2017 share. Colgate is currently one of the biggest players in the toothpaste market and has maintained stable sales throughout the years.<sup>3</sup>



**Figure 2: Net Sales of Colgate-Palmolive in Europe and Asia-Pacific, 2014 to 2018<sup>2</sup>**  
(in million U.S. dollars)

Toothpaste Brand	Market Share
Colgate-Palmolive	29%
Colgate	22%
GSK	20%
Aquafresh	12%
UNILEVER	11%

**Figure 3: Top 5 Toothpaste Market Share by Brand in Europe, 2018<sup>1</sup>**

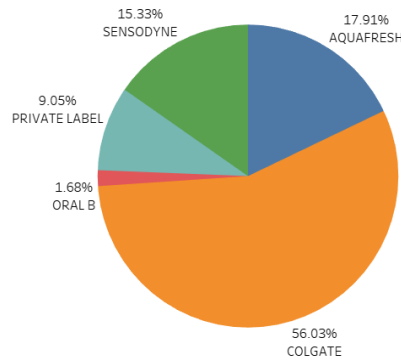
### 3. Data Exploration & Preparation

After developing an understanding of Colgate's current position in the market and gaining insight into the business context, we wanted to look into the data to see if Colgate's share of sales at Pernalonga was similar to its share in the overall market. It was also important to understand the performance of other toothpaste brands and products sold at Pernalonga stores. This helped us to build purchase profiles later in our analysis to make recommendations for which customers to target.

In Pernalonga's supermarket chain, the toothpaste market is dominated by Colgate, which had a market share of 58.09% in 2017. The remaining players in the market are Aquafresh, Sensodyne, Oral B, and Pernalonga's Private Label. In 2017, Colgate's market share increased by 3.14% from 2016, but its gross sales decreased by 3.76%. We observed a similar trend within the other brands, and we discovered that all brands in Pernalonga's toothpaste portfolio decreased their product sale prices in 2017, in addition to decreasing discount rates, which led to an increased overall unit price. When we took a deeper look at net sales for each brand, which is the sum of a brand's gross sales minus its returns, allowances, and discounts, it showed that the change in pricing and marketing strategy helped Colgate achieve a 23.91% growth in net sales in 2017.<sup>1</sup>

Toothpaste Brand	2016 Net Sales	2017 Net Sales
Colgate	\$71,328.87	\$88,385.78
Aquafresh	\$28,068.36	\$28,259.99
Sensodyne	\$21,418.62	\$24,179.70
Private Label	\$13,543.79	\$14,276.14
Oral B	\$1,815.94	\$2,657.38

**Figure 4: Pernalonga Toothpaste Net Sales by Brand, 2016 and 2017**



**Figure 5: Pernalonga Toothpaste Market Share, 2017**

Within Pernalonga's Toothpaste portfolio, there are six sub-categories: Pasta Dentifr Branq, Pasta Sensib Dentari, Pasta Dentifr Tradic, Pasta Dentifr, Medici, Pasta Dentifr Infant, Pasta Dentifr 2 in 1. The most common sub-category product sold by all of the brands is Pasta Dentifr Tradic, which represents 65.84% of all toothpaste sales. As of 2017, Colgate continues to sell 34 products across four of the six sub-categories and holds the majority of the market share for both Pasta Dentifr Branq and Pasta Dentifr Tradic. However, for the children and medical toothpaste market, Aquafresh holds the majority.

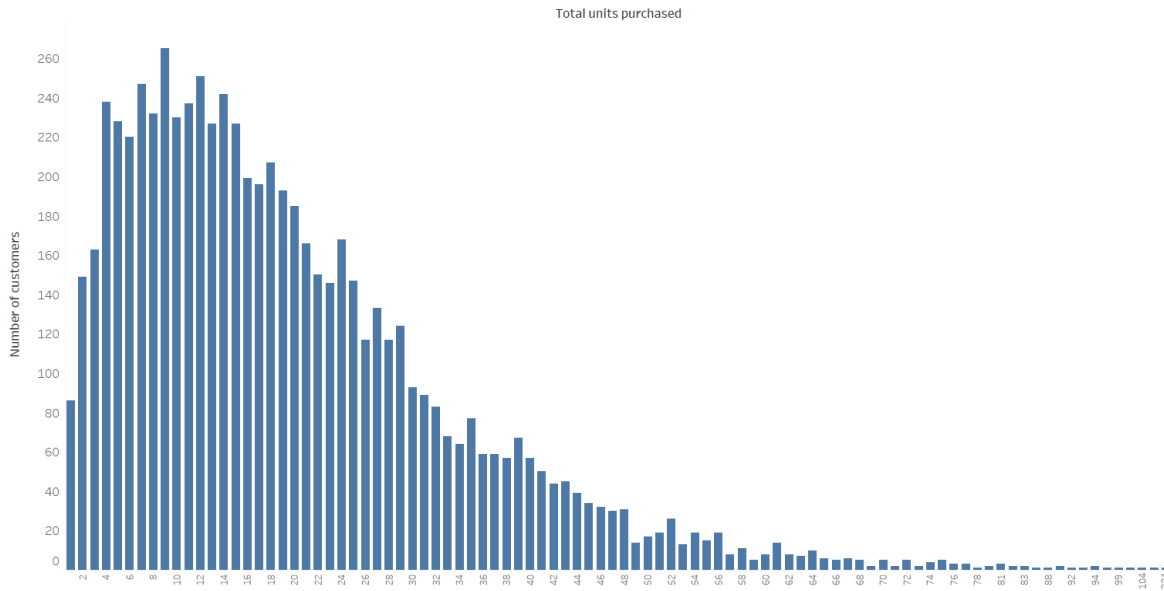
Toothpaste Brand	Pasta Dentifr Tradic	Pasta Dentifr Branq	Pasta Dentifr Infant	Pasta Dentifr Medici
Colgate	\$73,672.23	\$11,590.74	\$1,614.62	\$1,508.19
Aquafresh	\$12,128.41	\$9,062.27	\$3,940.87	\$3,578.44
Sensodyne	\$4,328.43	-	-	\$1,737.76
Private Label	\$10,109.76	\$1,877.52	\$1,048.88	-
Oral B	\$2,657.38	-	-	-

**Figure 6: Pernalonga Sales by Brand, 2017**

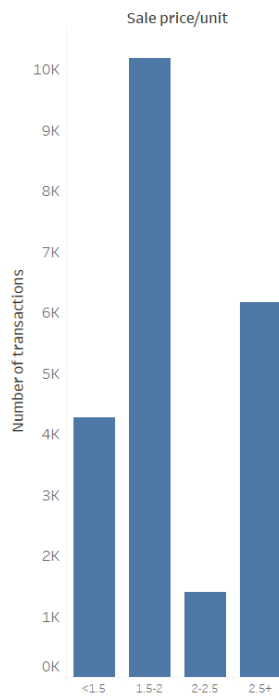
After completing the data exploration, we moved onto cleaning the data in order to segment and identify our target customers. To make sure we were ready for our analysis, we needed to make sure the data was clean and free of any anomalies. One of the biggest anomalies in the data comes from the fact that there are only 753 unique transaction ID's assigned. Given that there are a lot more customers who made multiple transactions, and we even have rows that have the same customer ID, transaction ID, product ID, and store ID (39 records), it was obvious that transaction ID's were not captured correctly and had to be discarded. Thus, we used a combination

of customer ID, store ID, and transaction date to define the transaction ID's and ended up with 2.83 million unique transactions with a varying number of products purchased across customers.

Also, to eliminate the effect of customers who purchased Pernalonga's Private Label toothpaste, which is sold by Pernalonga with its own packing, but manufactured by a third party, we needed to exclude transactions from all customers that have purchased the Private Label toothpaste in the past. This allowed us to focus on the pool of customers we can target and their purchase behavior in the past, enabling a more precise analysis and better recommendations. After accounting for this, we had a pool of 3,799 customers we could potentially target.



**Figure 7: Distribution of Number of Colgate Toothpastes Sold Across All Customers**



**Figure 8: Distribution of Paid Amount per Unit of Colgate Toothpaste**

#### **4. Identifying Target Customers and Discount Offers for Personalized Promotions**

##### **a. Defining Loyalty and Target Customer Groups**

As a prerequisite to our analysis, we first had to form a basic understanding of the groups of customers we can consider recommending Colgate toothpaste to. While it is possible to target all 3,799 eligible customers in Pernalonga's customer base, it is very likely that there are sets of customers who are more likely to cash-in on the offer than others. Our first step was to find out who our Colgate toothpaste loyalists are. These customers are in the top 25% of all Pernalonga customers based on Colgate toothpaste revenue, and among all toothpastes that these customers buy, they spend at least 70% of their total sales on Colgate. We will refer to these customers as our "Baseline" customers, as these are the customers who are driving Colgate toothpaste sales and revenue and prefer Colgate over any other toothpaste brand.

Once we found our "Baseline" group of customers, the next step was to find the customers we should target among the rest of the customer base. We can define two different groups of customers. The first group of customers, our "Non-Colgate customers", consists of those who buy toothpaste at Pernalonga often, but they are mostly buying brands other than just Colgate. The second group, our "Other Colgate customers", consists of those customers who do not buy Colgate toothpaste often, but are regular purchasers of other Colgate products, such as oral elixirs, toothbrushes, and waxes. To better identify customers that fit into these groups, we eliminated all customers who are either in the bottom 25% of all spending on Colgate as a brand or in the bottom 25% of those who buy toothpaste at all. By eliminating this cross-section of customers, we obtained a combination of the two target groups we have mentioned previously.

Next, we wanted to identify the customers within these groups who are most likely to purchase Colgate toothpaste if they were provided with an offer. To achieve this, we compared the purchasing habits of customers in the "Baseline" group with those of the other two target groups and derived a purchasing profile for each customer. Specifically, we calculated each baseline customer's spending on all products sold by Pernalonga across all transactions. However, given there are over 10,000 products sold, we narrowed down the profiling based on the top selling products for this segment. Thus, only the top 5,000 products were considered in the profiling as they bring 80% of the overall revenue. For these top products, each target customer's spending was also computed.

After narrowing down our "Baseline" and two target groups of customers, we then calculated the Pearson Correlation Similarity between the "Baseline" customer group and the other two groups based on their purchasing profiles. Next, given a customer's purchasing profile, we were able to calculate the probability that the customer would buy Colgate toothpaste using Naive Bayes Classifier. This will be further illustrated in the following sections.

##### **b. Excluding Inactive Customers**

In order to ensure that we target customers who are *current* customers of Pernalonga, we considered customers as "churned" if they haven't made a purchase from any Pernalonga store in the past 60 days. While it is possible for some of these customers to return and make purchases, it

is unlikely that a short toothpaste promotion alone would suffice in making them revisit Pernalonga stores.

### **c. Promoting the Most Optimal Offer, to the Right Customer**

When looking at target customers, we used the distribution of unit sale prices from 2017 to identify the optimal price. The optimal price was chosen based on the unit price for which the highest quantity was sold in each segment. Further, we noticed that more than 80% of the transactions involved a purchase of only one toothpaste, while most of the remaining involved two. Given this insight, we recommend using a generalized offer in the 14-day pilot that allows customers to buy a single pack of any Colgate toothpaste, as opposed to providing discounts only on specific products or on bundle packs. In order to drive higher sales from those willing to buy in higher quantities, we can offer discounts on multiple purchases.

## **5. Similarity Between Colgate Baseline Users and Target Customers**

To narrow down to the ideal customers for targeting, we needed to first examine whether or not it is feasible to target the customers we have outlined previously. We needed to determine just how similar these customers are to our “Baseline” Colgate toothpaste users in order to understand whether or not they would be inclined to cash-in on a promotional offer for Colgate toothpaste. The target customers include those who have bought any Colgate product previously (toothbrush, mouthwash, etc.), as well as those customers who may have bought Colgate toothpaste previously, but tend to buy other brands instead. We needed to compare these target customers’ overall purchasing behaviors to those who are Colgate toothpaste super-users (the “Baseline” users). In this scenario, we calculated Pearson Correlation Similarity scores to measure the similarity between the target customers and the baseline customers given their total paid amounts for each product. If two customers share similar purchasing patterns, then the target customer is likely to use a product that the other one has also bought.

After we created data frames that contain our “Baseline” customers and their spending for each product and the same for target customers, we calculated Pearson Correlation Similarity and found that the mean similarity score between our two target customer segments and our baseline super-users is 0.386, with a minimum and maximum similarity of 0.013 and 0.698, respectively.

<b>Customer ID</b>	<b>Pearson Correlation Similarity</b>
2809801	0.2082
2889977	0.3098
3269530	0.2301
3789517	0.5649
4019802	0.4991

**Figure 9: Example of PSIM Score for Target Customers**



Since the majority of customers have already bought Colgate products (either toothpaste or some other product) at some point in their purchasing history, we considered a Pearson Correlation Similarity of 0.5 or above to be high enough to identify similar tastes between our target customers and “Baseline” customers. With an average similarity of 0.386, we believe that we can recommend Colgate toothpaste to a significant number of customers that are above the 0.5 threshold. We want to target these customers specifically as they are most similar to those who are already Colgate toothpaste super-users, and we can now calculate the probability of purchase for these customers and estimate their intention to purchase Colgate toothpaste.

## **6. Naive Bayes for Personalized Promotions**

Now that we have a subset of the most similar target customers compared to our “Baseline” Colgate toothpaste users, the next step is to calculate the probability that each of these customers will actually purchase Colgate toothpaste. To do so, we used Naive Bayes Classification to calculate a conditional probability of purchase based on the customer’s history of purchased products. In words, this gives us the answer to the question, “Given a customer’s purchasing profile, how likely is this customer to buy Colgate toothpaste?” Given our most similar customers, this will not only help us to determine which customers we should target, but also personalize promotional offers based on how likely a customer is to actually make a purchase.

To calculate the conditional probabilities of purchasing Colgate toothpaste, we implemented the Naive Bayes approach at the customer level by building each customer’s purchase profile based on total amount paid for each of the 5,000 Pernalonga products, as well as whether or not the customer has bought Colgate toothpaste in the past. An important assumption to note about the Naive Bayes method is that the products in the customer profile are independent of each other. This assumption means that just because a customer buys one product, this should not influence whether or not he buys another one in his product profile. To build the most accurate purchase profile possible, we used every single product that Pernalonga sells and computed the total amount paid per product, per customer. We used the ‘naiveBayes’ package to run a Naive Bayes model that outputs the probability of purchase based on our features. These probabilities give us a single value for each customer that represents his or her likelihood to buy Colgate toothpaste. With this, we can see which customers are most likely to purchase, and personalize promotional offerings accordingly. We will describe this approach next.

## **7. Incremental Sales Volume and Revenue Estimation**

In order to maximize the outcome of this campaign, we recommend using coupons that allow customers to purchase any type of Colgate toothpaste. By allowing customers to get discounts on all toothpaste products offered by Colgate, we can enable customers to purchase a product they previously found expensive and allow them to explore additional toothpaste products in Colgate’s oral care portfolio.

Since our primary goal is to drive revenue, we have not focused on a profitability analysis. However, should Colgate decide to extend the promotion in the future, we recommend using a

variable discount rate at an individual level that takes into account each customer's purchase history. This will allow us to estimate the lowest discount rate that would continue to drive that customer to purchase Colgate toothpaste, maximizing revenue.

Our current approach uses the probability of purchase for each customer, along with the average toothpaste quantity per transaction for each segment, allowing us to find the expected incremental sales volume at a segment level. The incremental revenue and discounts redeemed have been calculated at a toothpaste sub-category and the customer segment level based on historical transactional data. For instance, the discounted price has been calculated based on the (rounded up) mean paid amount per unit within that segment. Finally, sale volume distribution of sub-categories has been used to estimate the incremental volume of each sub-category.

Customer Segment	Total Customers Targeted	Incremental Volume (CT)	Incremental Revenue (\$)	Total Discount Redeemed (\$)
Loyal customers	601	696	1314	165
Target customers	268	309	574	82
<b>Total</b>	<b>869</b>	<b>1,005</b>	<b>1,888</b>	<b>247</b>

**Figure 10: Expected Promotion Outcomes by Segment**

Colgate Toothpaste Sub-Category	Recommended Price (Mean discounted price for that segment)	Segment	Current Selling Price (without discounts)	Sale Distribution within Segment	Expected Units Sold	Expected Discount Redeemed	Incremental Revenue
PASTA DENTIFR BRANQ	\$2.49	Baseline	\$2.99	11%	75	\$38	\$188
PASTA DENTIFR BRANQ	\$2.29	Target	\$2.99	11%	34	\$24	\$78
PASTA DENTIFR TRADIC	\$1.79	Baseline	\$1.99	88%	610	\$122	\$1,093
PASTA DENTIFR TRADIC	\$1.79	Target	\$1.99	87%	269	\$54	\$482
PASTA DENTIFR INFANT	\$2.09	Baseline	\$2.69	0%	3	\$2	\$7
PASTA DENTIFR INFANT	\$1.99	Target	\$2.69	1%	4	\$3	\$8
PASTA DENTIFR MEDICI	\$3.99	Baseline	\$4.49	1%	7	\$3	\$27
PASTA DENTIFR MEDICI	\$3.49	Target	\$4.49	1%	2	\$2	\$7

**Figure 11: Expected Promotion Outcomes & Recommended Discounted Price by Toothpaste Sub-Category**

## 8. Conclusion and Next Steps

Currently, we have estimated the incremental sales quantity Pernalonga can expect to achieve based on the assumption that each customer who accepts the offer will purchase the average transaction quantity of toothpaste in that segment. To improve our prediction process, we have also looked at price elasticities at the individual customer level, which is calculated based on the percentage change of out-of-pocket unit price and the percentage change of customer purchase quantity over time. Given the price elasticity of each customer in our target customer group, we hope to be able to make more refined and precise predictions on the incremental sales for each individual and generate the overall incremental sales for Colgate and Pernalonga.

Customer ID	Number of Purchase 2016	Number of Purchase 2017	Avg Unit Price 2016	Avg Unit Price 2017	Price Elasticity
40759962	20	24	0.936	0.925	-17.688
78999683	12	6	0.882	0.907	-17.633
51749997	5	4	2.462	2.490	-17.586
85089799	6	4	0.873	0.890	-17.467
51329643	5	8	2.050	1.978	-17.263
16189742	10	16	1.915	1.848	-17.181
11629887	4	9	1.865	1.729	-17.128
32759748	2	5	0.965	0.880	-17.029
16489703	5	1	0.850	0.890	-17.000

**Figure 12: Example of Price Elasticity Analysis by Customer**

Based on our analysis thus far, we believe that targeting our selected customers with the right promotion based on similarity of purchase history will lead Pernalonga and Colgate toothpaste to a boost in sales. By implementing a Naive Bayes approach, we can reasonably determine how likely a customer is to buy Colgate toothpaste, allowing us to more accurately personalize the most optimal discounts that will yield the highest returns on Colgate toothpaste. Moving forward, we hope to help Pernalonga use these insights to properly design a pricing model that we can then apply to all of Colgate's toothpaste offerings to increase not just revenue, but also maximize profit by optimizing the discount amounts at an individual level.

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