Master of Science in Computing and Data Analytics

Business Intelligence and Data Visualization

MCDA 5560

Group Project Report

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1. Executive Summary

The main objective of the project was to utilize the Business Intelligence tools available in order to study and visualize important deductions regarding and business and its workflow. Not only analysis and visualization of any dataset provides us with abundant knowledge of what is going on but also it gives insights on the working of the parameters and what can we do to improve the condition of the business in the near future.

We took a Canadian sales dataset for an online business company which sold and shipped products all over Canadian provinces. Firstly, we took the returned goods and considered them as outliers and deleted their transaction information from sales. This gave us a sales dataset of 7,221 rows which consists of information varying on region, provinces, customer type, product category, shipping method and many more. After a thorough analysis in tableau we visualized that there are three product categories that are sold by the business and furniture is the one that is giving them lease profit. Nunavut and New-Found land are the two provinces which have minimum sales and profit whereas Ontario has the most sales and profit. However, number of consumers are decreasing in Ontario despite the highest sales and profit and are increasing in Alberta. So, all these findings helped us deduce many conclusions and recommendation like which province to focus on, which category of product should be marketed and goods like furniture should be sold more to the corporate consumers rather than the other types of consumers.

2. Introduction

The Canadian Sales dataset consist of **21 columns and 7,221 rows** after preliminary cleaning of order return records . All the columns entitled different attribute of the business and reflects how it helps in the fluctuation of the business values. The Sales dataset was categorized by product categories which had **three major categories, namely Furniture, Office Supplies and Technology**. Similarly, consumers were categorized **into four types, consumers, home office, small business and corporate consumers**. The data was distributed as the company shipped to all **13 provinces** which were further combined into **8 regions**.

2.1. Objectives

The main objectives for analyzing this business transaction dataset were as follows:

- Analyze the Canadian sales dataset and observes fluctuations on basis of various parameters

- Selection of **parameters and KPI's** to observe the business fluctuations

- Perform **cost-benefit and swot analysis** in order to analyze the business context

- Build **dashboards and pivot table** to visualize the inferencing provided by the dataset

- Provide **recommendation and decision-making interface** on the basis of analysis

2.2. Business Performance Metrices

There are various key parameters we kept in mind as we analyzed the dataset and went through it. Such parameters contribute in learning the factors that are driving the business in one direction. They are also known as the Key performance Indicators (KPIs) which should be taken in mind and the dataset is to be looked over on accordance to these KPIs. For our project the indicators and parameters taken can be described as

- **Total Sales and difference of sales** on basis of provinces

- **Current profitable categories of sales** in various Provinces

- **Sales vs Profit** among various categories of products

- Total Customers and **change of customers flow per year**

- **Consumer Segment** inferencing the type of consumers that contribute to the **sales and profit**.

3. Analysis

We used tableau to visualize and indicate the parameters that are causing the noticeable changes in the business values of the sales dataset and the observation and findings are as described below.

3.1. Data and Analytics Result

We took sales and profit as our primary KPI's and went through the data that was dispersed throughout all the provinces. We took an over all summary of sales vs profit and the following pictorial representation is what we got.
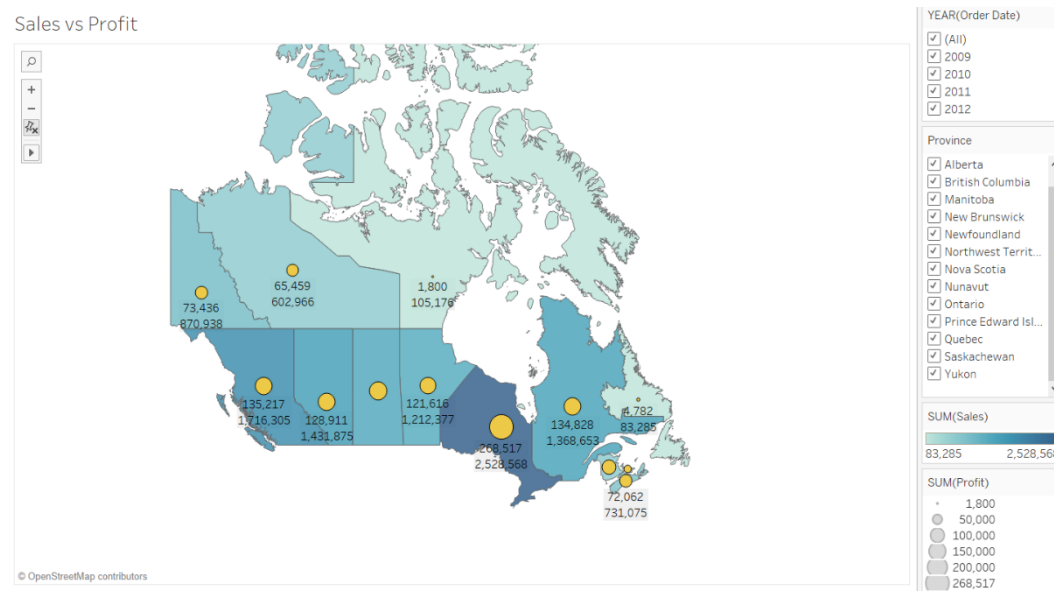

Fig 1: Sales Vs Profit over all the provinces in Canada

From the above representation, we can see that Ontario is the province with highest sales and Nunavut and Newfoundland has low profit and sales respectively.

Similarly, we took product categories as our second business metric and took it with respect to all the provinces.
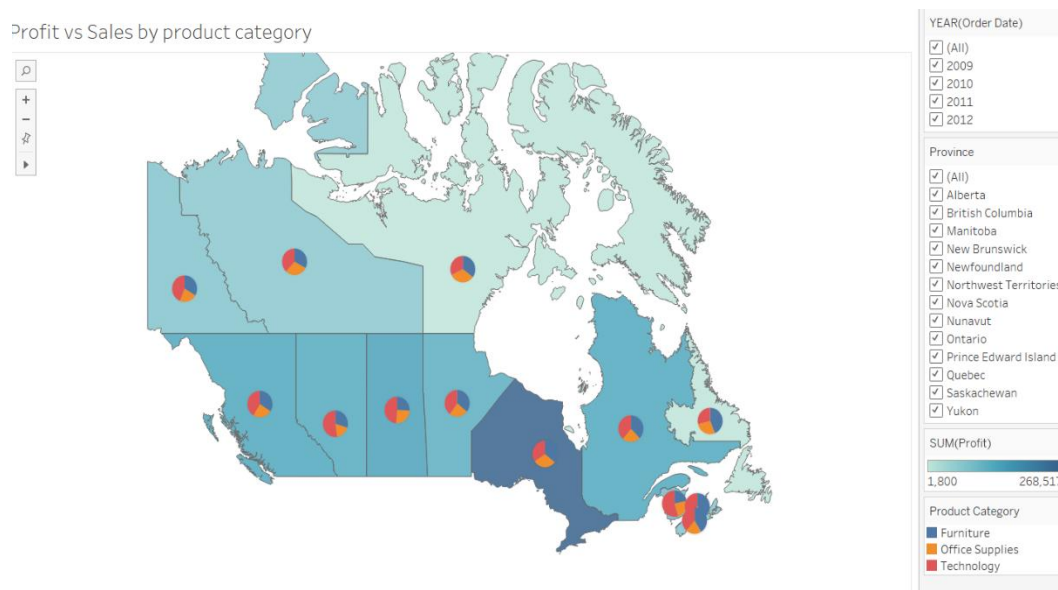

Fig 2: Sales Vs Profit by product categories over all the provinces in Canada
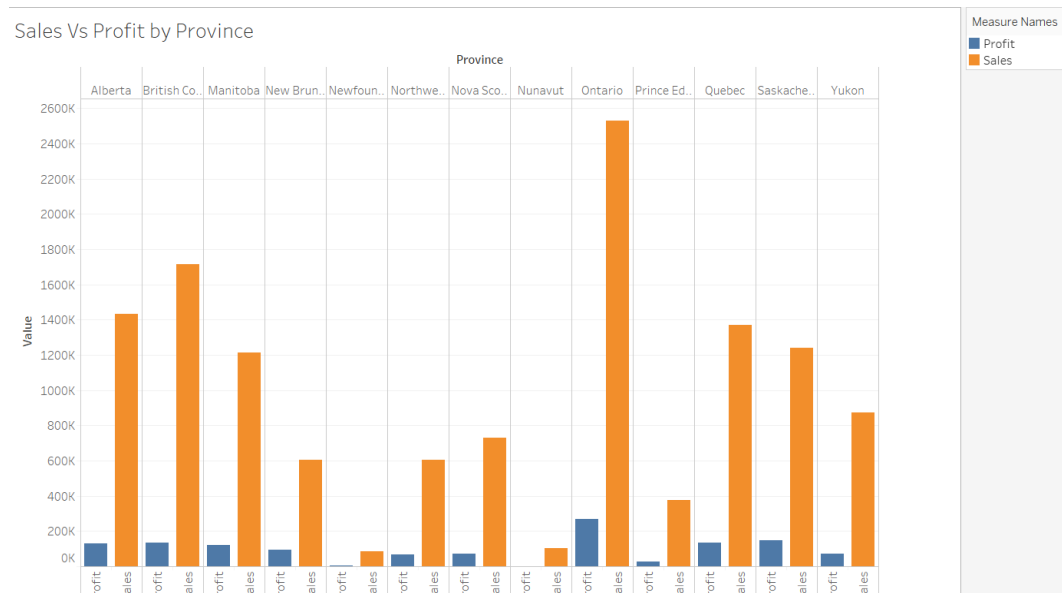
Fig 3: Sales Vs Profit by province

From categorization of the various product, we can see that **Technology** is the product category which is giving more sales and **Office supplies** is sold the least all over the provinces.

After this, we analyzed the **profit vs sales** over the time period which gave us an insight like the graphical representation below:
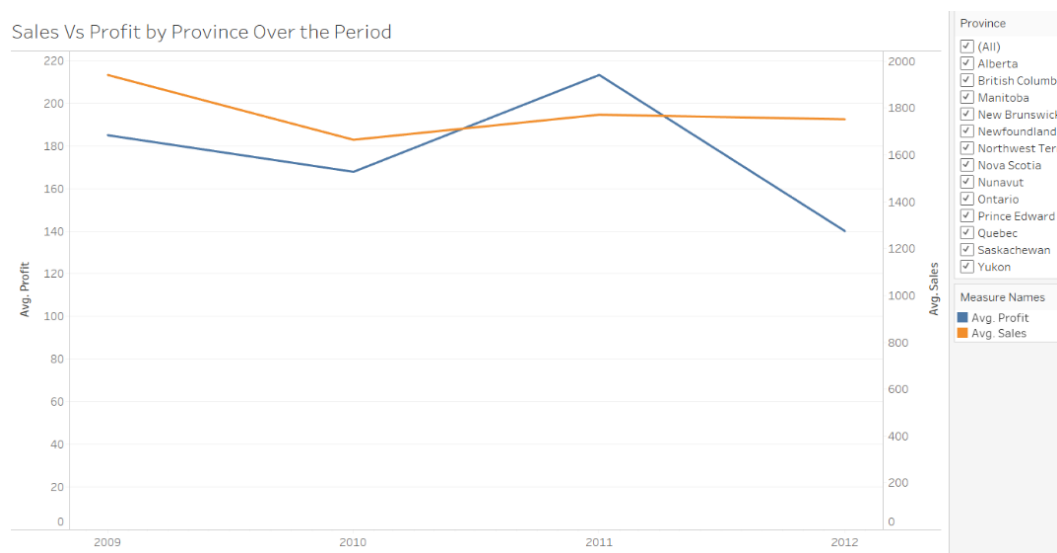

Fig 4: Sales Vs Profit over a time period

We can observe that the sales and profit both have been dropping subsequently over the period of time although the profit spiked up in 2011 but is gradually decreasing in 2012.

On a yearly basis, the detailed rise and fall values of the **sales and profit** can be represented as follows:

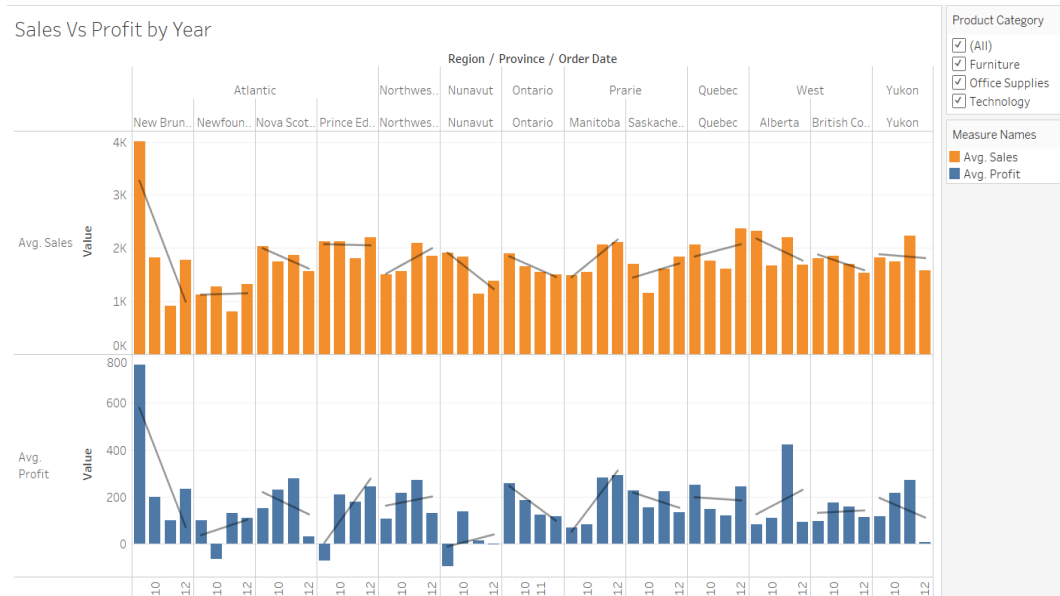**Fig 5:** Detailed Sales and Profit over a time duration

We can observe that the sales and profit both have been going down than when the business originally started but has been rising and falling over the time period.

On the contrary to this, when analyzed based on **customer segment**, we observed slightly different results.
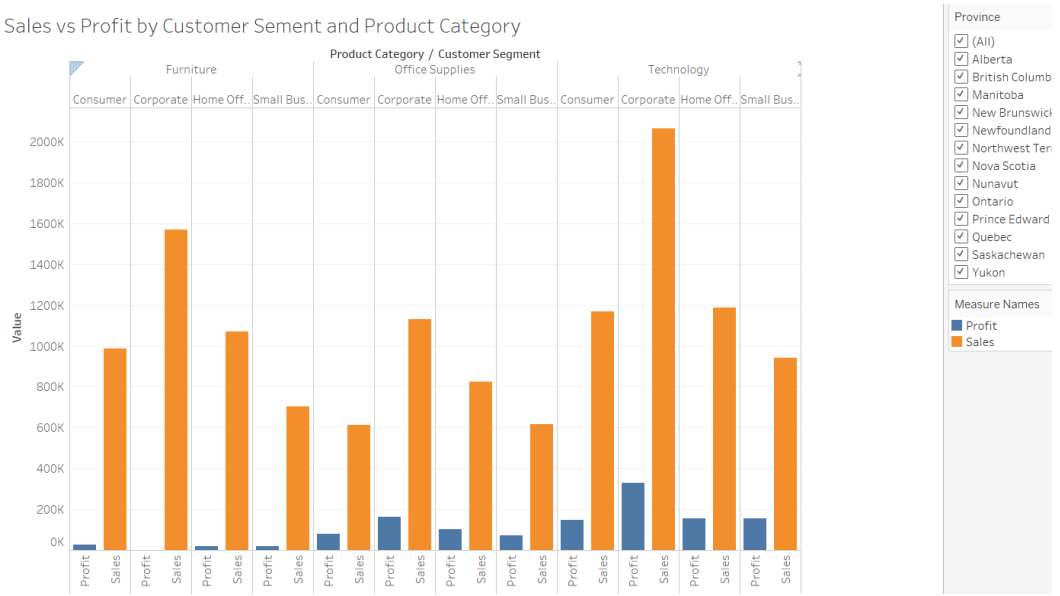

Fig 6: Sales Vs Profit by Customer Segment based on product Category

In the above figure, we can clearly see that the **corporate consumers** are responsible for all the sales and profit of all thee categories and the **normal consumers** are responsible for least profit and small business are responsible for least sales in this category.

Similarly, when we look at the same information with respect to various provinces, we can visualize the following bar graph which indicates that **Ontario** is the province that has all kinds of consumers undoubtedly as it is the province with the highest number of customers over the period.

We can also take this bar chart to analyze how the individual consumers contribute the lowest to the profit for all the product categories.
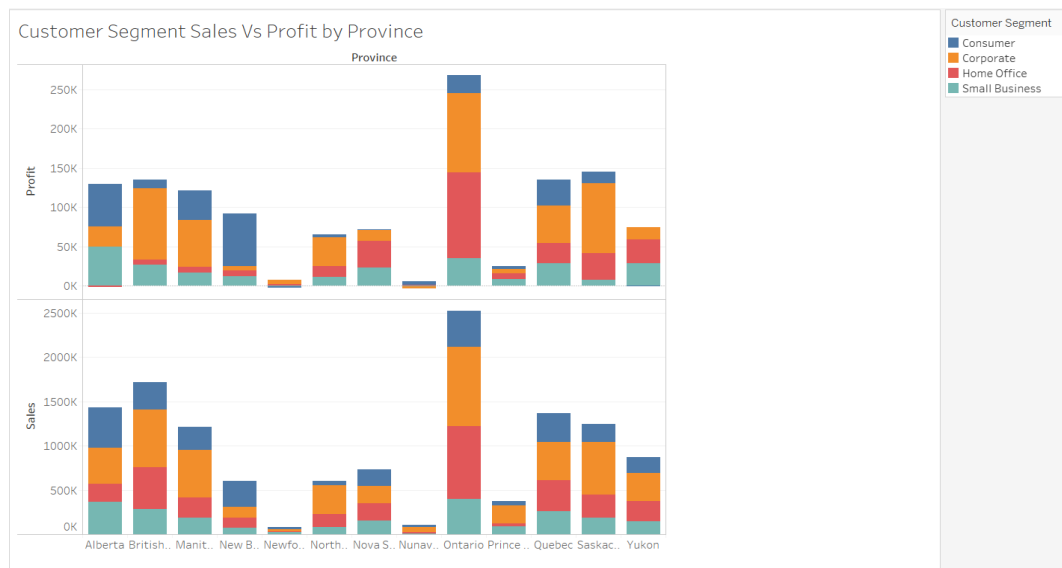

Fig 7: Customer segment sales and profit by province

3.1.1. Findings

All these deductions and results lead to the same path which induces the following results:

- Furniture category yielded the least profit
- Office supplies had the least sales
- Technology sector contributed to the highest sales and profit
- Ontario has highest sales and profit

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- Nunavut has lowest profit and New-found land has the least sales
- Corporate customers were responsible for sales and profit in all provinces
- Small Business contributed the least to their sales
- Individual consumers gave least profit
- Customers in Ontario are increasing, and Customers in Alberta are increasing subsequently

3.2. Assumptions

For this reporting and analysis, we had various assumptions based on the dataset provided to us. There was various information that were missing, and which could have acted as a loophole to understand the configuration of the whole dataset. For further analysis

- We assumed that the returned products gave no insights on the sales and products as they are refunded and play no role in monetary actions, so we assumed them to be the outliers which need to be cleaned.
- We assumed that the Company provided free shipping, so we derived the cost of the company by deducting the selling price with profit and the shipping price.

Based on these assumptions further analysis was conducted.

3.3. SWOT Analysis

Available data and the assumptions based on analysis led us to understanding the various factors responsible for the company's business scenario. One of such major metrics was to understand the strengths, weaknesses, opportunities and threats that surround the business. Our observations were as follows

Strengths:

- Consumers **are increasing in a daily basis in various provinces which can contribute to increased marketing and sales respectively.**

- In this age, Technology and related product are famous and the company is also gaining profit the most by the same product category.

- The highest sales are in Ontario which is one of the most urban cities of Canada. This can accelerate the business popularity

- As the company provides fast shipping consumers can feel more convenient and attracted towards the same seller.

Weaknesses:

- Furniture has the least sales because of which they have to reconsider the furniture categories in all the aspects.

- Nunavut has the Least profit and New-found land has the least sales, so they have to reach out more to the people in these provinces

- Decreasing customer in urban places like Ontario

Opportunities:

- Alberta has increasing number of customers which means they can shift their focus on marketing and promotion in Alberta in order to amplify their business

- Selling more technology related items as it yields the highest profits

- Discount is leading to effecting promotion and marketing of the business

Threats:

- Negative review of products can cause a certain amount of threat to any online business

- Slow Shipping has the adverse effect on the mentality of the potential customers

- When it comes to business and e-commerce the market has always been competitive.

3.4. Cost-Benefit Analysis

Since we assumed the company provides free shipping to their customers, we can add the shipping cost to the company's cost in order to analyze the cost-benefit factor.

Here we can see that; with available data we conclude that the overall cost of the company and the sales of the company can be grouped side by side as

Province	Product Categ..	Cost	Sales
Alberta	Furniture	418,116	427,144
	Office Supplies	223,682	256,976
	Technology	670,394	747,755
British Columbia	Furniture	583,095	585,863
	Office Supplies	367,791	422,083
	Technology	642,247	708,358
Manitoba	Furniture	434,980	435,749
	Office Supplies	261,348	290,476
	Technology	403,340	486,152
New Brunswick	Furniture	128,109	130,686
	Office Supplies	125,275	143,397
	Technology	261,828	330,161
Newfoundland	Furniture	39,576	36,459
	Office Supplies	18,003	22,777
	Technology	21,710	24,048
Northwest Territories	Furniture	197,534	197,641
	Office Supplies	151,464	176,022
	Technology	193,152	229,303

Nova Scotia	Furniture	308,510	302,558
	Office Supplies	135,787	146,343
	Technology	220,443	282,173
Nunavut	Furniture	35,985	37,149
	Office Supplies	36,916	34,063
	Technology	31,392	33,964
Ontario	Furniture	904,647	903,114
	Office Supplies	643,931	761,890
	Technology	731,267	863,564
Prince Edward Island	Furniture	146,030	147,123
	Office Supplies	77,893	92,028
	Technology	131,411	138,767
Quebec	Furniture	529,047	516,548
	Office Supplies	276,928	318,020
	Technology	437,354	534,085
Saskachewan	Furniture	305,862	317,873
	Office Supplies	294,689	320,446
	Technology	504,635	603,776
Yukon	Furniture	282,148	292,856
	Office Supplies	181,953	197,059
	Technology	339,962	381,023

Fig 8: Total costs and sales for the business

From the above sheet we can observe that the sales for the furniture is way less than it's cost in most of the cases and since

For furniture, Sales/costs < 1

So, it is not feasible to go along with the existing situation of the furniture category in long term. It is wise to reconsider all the products in furniture and manage the profit margin and even exclude some products in order to gain profitable business.
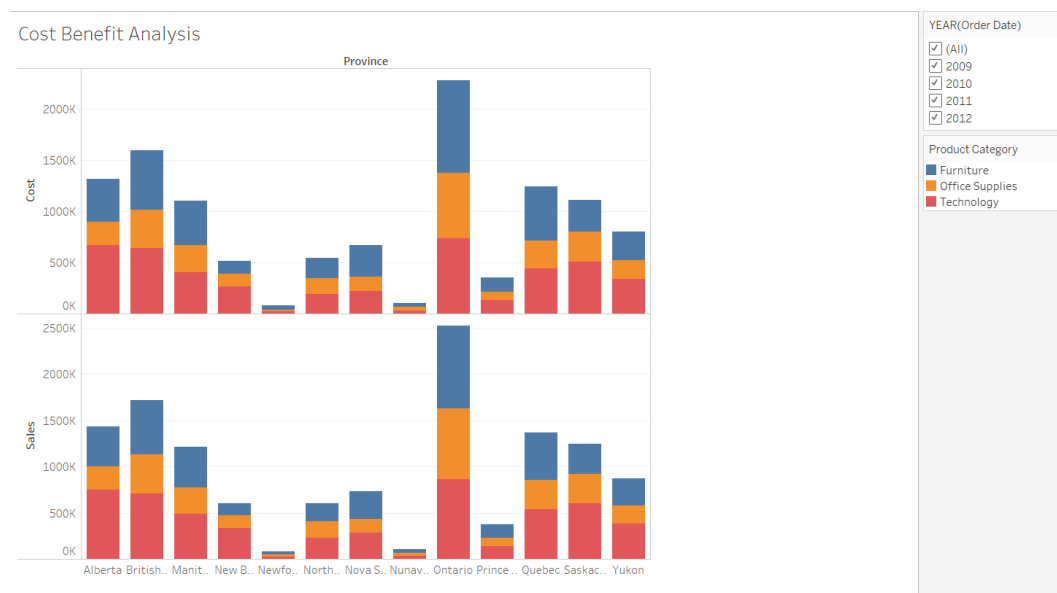

Fig 9: Cost benefit analysis

4. Conclusion

Hence, we can conclude that Furniture section must be reconsidered even regarding the various customer segments. Marketing in provinces like Alberta, Nunavut and others should be focused and appropriate marketing and cost-benefit strategies should be initiated. Analyzing the reasons for decrease in consumer number from Ontario (as it has highest sales and profit over the years) can also lead to betterment of the business. Similarly, they should provide more offers, discounts and efficient service to increase sales and profit in provinces like Newfoundland and Nunavut.

In addition to this there are several observations that can be fruitful for the business growth some of which can be elaborated as

- Collecting feedbacks from customers to provide better service and evolve the business accordingly.

- Provision of fast and efficient Shipping for customer satisfaction

- Use data mining tools for prediction and association mining that can somehow contribute to predict the shortcomings in the future as well.

- Better cancellation and return policies for customer satisfaction

- Additional discounts and Promotion codes in order to increase and diversify their market

5. Appendix A [SQL Script]

Data Cleaning; removing all the records of order return

CREATE TABLE Sales_Canada AS

SELECT * FROM orders

WHERE OrderID NOT IN (SELECT OrderID FROM returns)
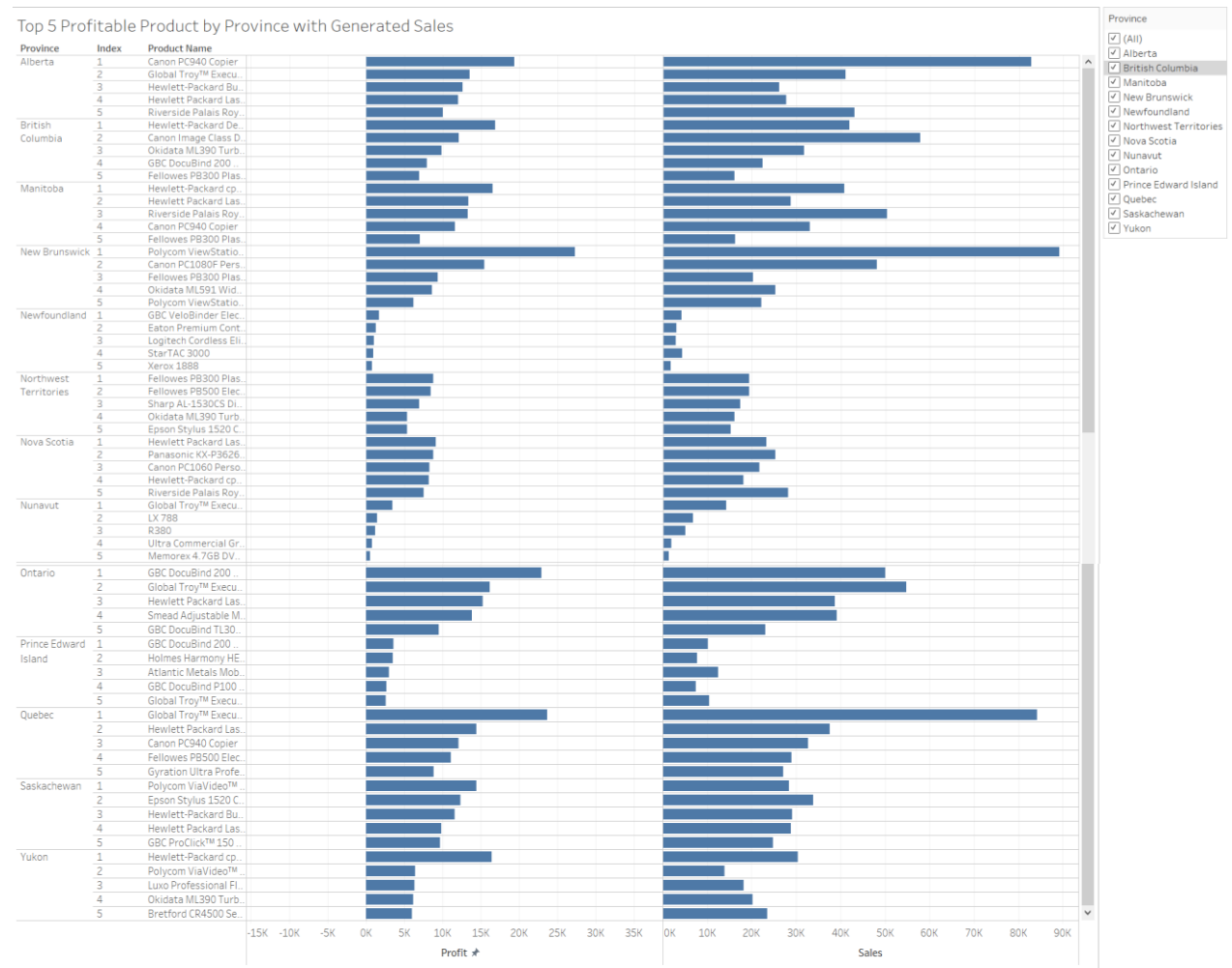
LIMIT 10000;

6. Appendix B [Tableau Dashboards]

Fig 10: Top 5 profitable product by province with generated sales
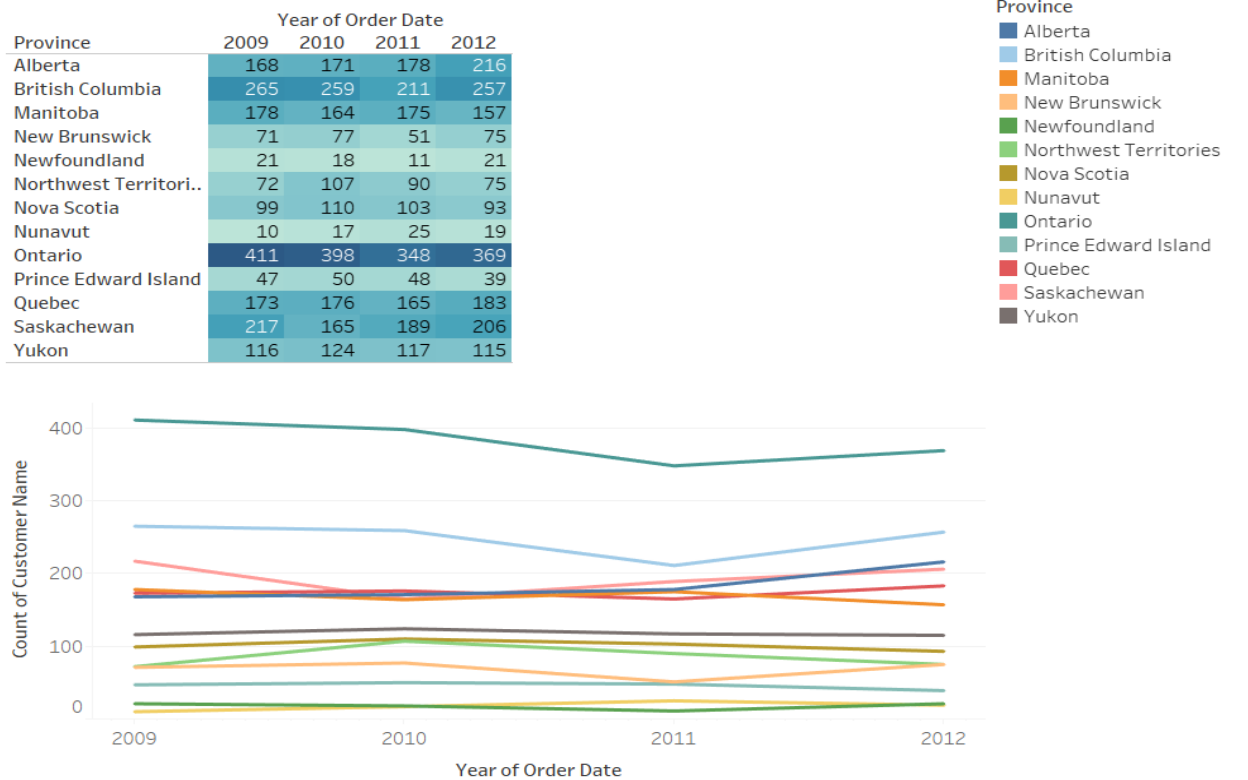
Customer flow by Year relative to Province

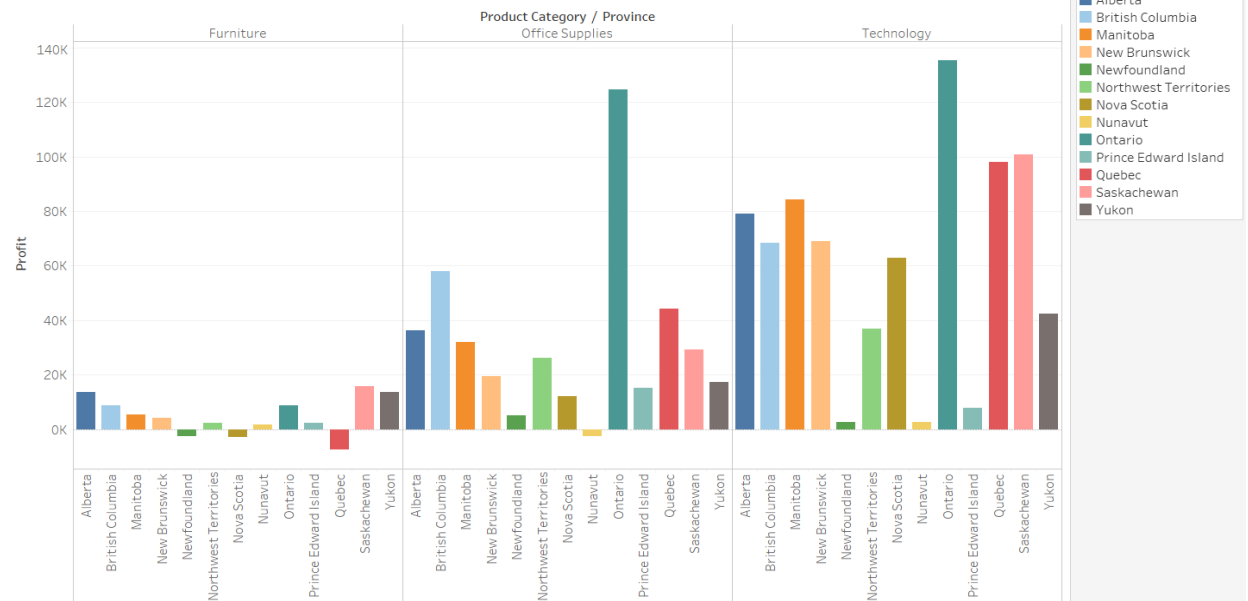| Province	Year of Order Date			
	2009	2010	2011	2012
Alberta	168	171	178	216
British Columbia	265	259	211	257
Manitoba	178	164	175	157
New Brunswick	71	77	51	75
Newfoundland	21	18	11	21
Northwest Territori..	72	107	90	75
Nova Scotia	99	110	103	93
Nunavut	10	17	25	19
Ontario	411	398	348	369
Prince Edward Island	47	50	48	39
Quebec	173	176	165	183
Saskatchewan	217	165	189	206
Yukon	116	124	117	115

Fig 11: Customer flow by year relative to province

Fig 12: Product category profit by province

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