**Mini-Case Study: SLEEPY INDUSTRIES**

**- Part III -**

*Subrata Garai*

**Data Analysis Plan (Task 6)**

**Task 6:** Prepare a *point form* Data Analysis Plan for Mr. Sleepy identifying in general, the steps needed to gain useful insights.

***Background Information on Sleepy Industries***

THE PROBLEM

Sleepy Industries is experiencing poor sales and Mr. Sleepy does not understand why the company is approaching bankruptcy.

ATTEMPTS TO ADDRESS THE PROBLEM

Mr. Sleepy has taken the initiative to adopt a few new strategies to increase sales:

1. The Barebones style line was introduced as a low cost, low price point line aimed at increasing Sleepy Industries’ target markets to those looking for more economical furniture.
2. The website was upgraded to support direct-to-consumer online shopping with the objective of increasing Sleepy Industries’ net profit.
   * Traditionally, Sleepy Industries was a furniture manufacturer supplying large format and boutique retail stores with their furniture products.
   * By launching direct-to-consumer e-commerce, Sleepy Industries is hoping to improve its overall net profit margin that would traditionally be shared with the retail stores.
3. Mr. Sleepy has also started to collate warranty card responses into an Excel spreadsheet with the belief that analysis of this data will provide answers to Sleepy Industries’ financial problems.
4. Radio commercials based on regional sales trends were developed to encourage more sales from proven target markets.

***Data Analysis Objectives***

THE QUESTIONS TO RESOLVE WITH THE HELP OF DATA ANALYSIS

Mr. Sleepy needs to answer the following questions to help inform the decisions he will need to make to improve sales and make Sleepy Industries profitable again:

1. Which products (SKU) yields him the most profit? Conversely, where is he losing money?
2. How can net profit margins be maximized?
3. How can sales be increased?

***Recommended Key Steps for Useful Insights***

Below are the keys steps in the Data Analysis Plan for Sleepy Industries.

DATA ANALYSIS PREPARATION

**Step 1**: Define the Data Analysis Plan objectives and research questions

* Questions can be grouped into pre-identified areas of inquiry (e.g. industry benchmarking, manufacturing process and operations automation and optimization, workforce optimization and customer analysis).
* *See* [*Data Analysis Objectives*](#Objectives) *sub-section above.*

**Step 2**: Identify the key stakeholders, resources and timelines for data analysis

* Key stakeholders include Sleepy Industries’ senior managers, industry experts for benchmarking, etc.
* Resources include all sources of data and Sleepy Industry personnel who can help collect or provide data.

**Step 3**: Identify assumptions, risks and mitigation plan

* Assumptions, risks, and possible mitigation plans should be discussed with Mr. Sleepy, documented and confidentially shared with Mr. Sleepy and appropriate Sleepy Industries senior management as part of managing expectations.

DATA SOURCES & CLEANING

**Step 4**: Identify the data sources that will be used for the data analysis

* See [Appendix A](#AppA) for list of datasets to be collected from Sleepy Industries and externally.

**Step 5**: Validate the data for use in data analysis

* Data will need to be extracted, transformed (clean, format, quality, relevancy etc.), and loaded for analysis.
* Depending on volume, may need to discuss with Mr. Sleepy data warehousing options.

DATA ANALYSIS METHODOLOGY

**Step 6**: Conduct exploratory data analysis

* Animate the data by producing initial bar graphs, cross tabulation matrices, histograms, scatterplots, heat maps, etc., depending on whether the data are qualitative or quantitative, to get an initial sense of trends.
* Identify possible outliers for further analysis.

**Step 7**: Determine the analytical methodologies to be used and execute inferential data analysis using relevant tools and techniques

* Develop null hypotheses for statistical analysis based on the [Data Analysis Objectives](#Objectives) sub-section above.
* Use statistical analysis software (e.g. R) to test the null hypotheses.
* Use machine learning tools, (e.g. Weka) to identify clusters and classifications (e.g. target markets, popular style lines, highly profitable SKUs, etc.).

REPORT FINDINGS

**Step 8**: Report the findings

* Initial report should centre on answering the research questions and addressing the objectives outlined at the outset (see [Data Analysis Objectives](#Objectives)).
* When presenting the initial findings, stress to Mr. Sleepy that data analytics is an iterative process, requiring more input and refinement to produce more useful insights.

**Step 9**: Re-run data analysis based on feedback from stakeholders

* As more input, feedback, and information is gathered from Mr. Sleepy and his senior managers, data analyses and inferences should be tested and refined.

**Proposed Areas of Inquiry (Task 7)**

**Task 7:** Identify at least 10 SPECIFIC areas of inquiry using analytics which you might propose to undertake, given that you receive the information you requested above. What value do you perceive in each inquiry?

1. *MANUFACTURING COST ANALYSIS AND OPTIMIZATION*

For each SKU, start with an itemized cost breakdown that would include the following costs as variables:

* Direct Costs – e.g., raw materials, equipment and tools, labour and manufacturing, packaging, etc.
* Indirect Costs – e.g., operating expenses, real estate fees (rent, maintenance costs, etc.), insurance and taxes, utilities, etc.

**Value**: Statistical analysis via linear regression modelling and correlation tests would focus on identifying sources of major costs for optimization. Inferences from these models would help to provide insight on the following:

* Understand the cost breakdown for each SKU.
* Identify the major costs for each SKU and determine whether the cost burden of a variable varies heavily by SKU and/or style line.
* Examine the statistical findings with Mr. Sleepy to understand the cost distribution and any variation and to make empirical recommendations on how costs could be better controlled.

1. *SHIPPING, HANDLING, AND TRANSPORTATION COSTS*

Variables for analysis broken down to the SKU or sales order as appropriate:

* Shipping mode (e.g., provincial distribution chain, local delivery company, etc.)
* Purchase mode (e.g., shipment to retail store as a manufacturer or online purchase)
* Locations of all distribution centers, warehouses, and retail stores
* Locations of all deliveries, to distribution centres and both to retail stores and direct-to-customer.
* Transportation costs (e.g., from which distribution center/warehouse to which retail store or direct-to-consumer location)
* Packaging and handling costs by SKU (e.g., labour costs, transportation packaging costs, etc.)

**Value**: In the initial average results, costs, and profits by style line of the preceding six months Mr. Sleepy provided, the data suggested wide transportation cost variation by style line (see [Appendix B](#AppB)). Further statistical analysis, including linear regressions, scatterplots, and classifications would help inform how shipping costs could be best controlled:

* It could help evaluate whether all the existing store locations are required and whether new retail store partnerships are required, based on customer location, to optimize distribution chains.
* Transportation costs could be better controlled based on the analysis of packaging, handling, and shipping costs by SKU.
* Analyse the delivery drop off points (warehouses, retail stores, direct-to-customers) to assist with delivery contract negotiations, and also to help evaluate other shipment options, e.g. offer free pick-up from retail stores for online customers
* For direct-to-consumer home delivery, analysis could help evaluate the shipment from store location /warehouse location to best minimize cost and optimize logistical efficiency.

1. *WAREHOUSING COSTS*

Variables for analysing the cost of storing the products may include:

* Locations of all retail stores
* Locations of all customers
* Locations of all deliveries
* Indirect costs – real estate (rental fees, maintenance), security, insurance, etc.

**Value**: In the initial map based on the returned warranty cards, there appears to be three main regions in which Sleepy Industries does most of its sales volume (see [Appendix C](#AppC)).

* Statistical analysis could confirm the geographical scatter of customers so it could better inform where warehouses should be located.
* A heat map could also help determine how to best optimize the locations for warehouses to minimize shipping costs.
* Shipping patterns to and from each warehouse could also determine whether Sleepy Industries has an optimized number of warehouses.

1. *INVENTORY MANAGEMENT ANALYSIS*

Variables for analysing the management of inventory include:

* Stock levels by SKU and by warehouse location
* Sales by SKU
* Net profit margin by SKU

**Value**: Analysing stock levels by linear regression modelling, classifications, and scatter tests to identify popular style lines and popular SKUs will help Mr. Sleepy make informed decisions.

* It could help identify which style lines and SKUs have the lowest sales and the highest costs, therefore making them a candidate for production cancellation.
* A more complex analysis could help reveal which style line/SKU are optimized for net profit but are underperforming in the market. Mr. Sleepy may want to consider creating promotional material to push these products.
* Inventory management could help control operating costs and optimize cash flow by avoiding overproduction of unpopular style lines/SKUs.

1. *SEASONALITY PATTERNS*

Variables to help identify any seasonality include:

* All individual sales orders (minimum 2 years, preferably past 10 years, or as far back as Sleepy Industries could provide)
* Sales by SKU (correlated to time - month)

**Value**: Statisticalanalysiscould help to identify and measure seasonal variations within the furniture industry to help Mr. Sleepy plan future inventory levels, staffing, production, etc. (based on past patterns).

* Data could be used to forecast future peak seasons so marketing and promotions could be developed to optimize sales for different seasons.
* Alternatively, data could also help forecast lean periods. This could better help Mr. Sleepy manage costs and cash flows and analysis could help determine sales patterns during quiet seasons so marketing and promotions could cater to the leaner period.

1. *PRICING ANALYSIS*

Variables for pricing analysis may include:

* All direct and indirect costs by product SKU
* All individual sales records
* Net profit margin for each SKU sold
* Mode of sale (retail store or online)

**Value:** Statistical analysiscould be performed to infer correlation and, possibly, cause and effect to deliver accurate insights, prescriptive pricing models and forecasts.

* Pricing strategy combined with product and service quality analysis and management could help determine how Sleepy Industries could turn new customers into loyal repeat purchasers.
* Pricing analysis will also help identify the variables that are correlated with high sales (see Appendix D). This could then be used to help optimize profit and revenue.
* Predictive analytical insight could also be attempted by comparing historical sales records with historical promotions and marketing schemes to see if any trends or patterns emerge when calculation regression models (If data is rich enough, machine learning software could also be used for modelling). From these regression models, the Data Scientist might be able to identify some cause and effect variables for validation and further testing and eventual application for predictive and prescriptive modelling and insight.

1. *WORKFORCE OPTIMIZATION*

Variables to study hiring, labour demand and current labour practices may include:

* Employee roster
* Employee profiles (position, years at Sleepy Industries by position occupied, average work week in hours, salary/wage rate, etc.)
* Employee hiring and leaving (e.g., firings, layoffs, resignations, etc.) information
* Inventory levels and sales records
* Shifts/scheduling details by season, location, capability, etc.

**Value:** Statistical analysis on employee hiring and leaving frequencies and length of employment at Sleepy Industries (and whether employment is disrupted) as well as shift and scheduling management could provide insight to help optimize human resource management.

* It could help to improve recruiting method, hiring decisions, and employee retention (of the best performers) to maximize Sleepy Industries’ labour force potential and minimize training and recruitment costs.
* It could help to assess whether human resources is a source of profit or loss (depending on retention success, whether employees are employed to their potential, etc.)
* Identify sources of employee job satisfaction, which could therefore become information for predictive analysis

1. *CUSTOMER SEGMENTATION ANALYSIS*

Variables based on customer profiles may include:

* Income range
* Home address
* Whether purchase is for business or personal use
* Number of SKUs purchased by customer
* Amount of money spent by customer
* SKUs and style line purchased by customer

**Value**: Analysis could be used to verify customer segmentation via scatter and classification tests and other models.

* With validated customer segmentation, marketing and production could be targeted based on smaller, specific groups of customers (e.g., region, income, lifestyles, social class, age, ethnicity, mode of buying).
* Sleepy Industries could also better assess the viability of the Barebones style line through a deeper understanding of their customer segmentations' preferences, needs, and what each segment finds most valuable.
* Analysis could also provide predictive insight into identifying potential new products that existing or potential customers could be interested in or improving existing products to meet customer expectations.

1. *CUSTOMER SURVEY ANALYSIS*

Variables to analyse customer satisfaction and feedback may include:

* Number of purchases by customer (e.g. to determine buying patterns – regular, habit buyer; one-time buyer; binge buyer etc.)
* Whether customer would buy again
* Reasons customers buy product

**Value**: Asking the right questions to the customers will help gather useful data for analysis.

* Identifying market trends, positive and negative associations of a product/style along with the reason could help Sleepy Industries capitalize on for inventory control and new product development.
* Help to verify whether market segmentation is based on demographics (e.g., age, ethnicity, region, gender, income, education levels).
* Analysis could also provide insight to optimize customer lifecycle, customer service, quality control and the shopping experience for the various market segments.

1. *ONLINE AND WEBSITE ANALYTICS*

Variables to include in studying website use and potential may include:

* Number of visits per visitor
* Location of visitor
* Time spent on website by page
* Number of translation of browsing to order/sale
* Orders placed
* Type of SKUs purchased together
* Abandoned shopping carts
* Visitor origin (i.e., how did the visitor land on the site – e.g., hyperlinks from ads in social media)

**Value:** Since Mr. Sleepy feels direct-to-consumer sales will significantly increase his revenue, statistical analysis of visitor activity and behaviour on the website could help to optimize Sleepy Industries’ e-commerce.

* Provides insight into what the customers are looking for and how successful the website is in meeting customer needs. This would be measured by correlations in time spent on website against orders placed, order volume, etc.
* Analysis could also confirm web-browsing habits by identifying sources of traffic to the website, and understand which social channels are the top performers with target market segments. This could then be used to better optimize marketing money and time.
* Insight into the platform on which customers are accessing the site (i.e.,mobile vs. laptop vs. desktop vs. tablet, etc.) could help inform decisions on how to optimize the website. Website access and usage patterns might also provide predictive insight to what increases online sales.
* Website visitor location classification and scatter tests and mapping could identify high sales geographical regions for Sleepy Industries to better inform advertising campaigns and optimize distribution and delivery operations (see [Appendix C](#AppC) for a preliminary distribution map).
* Bounce rates analysed by what webpage the visitor leaves the website correlated to product features could help identify where Sleepy Industries is losing customers and how the webpage could be better optimized.

1. *MARKETING CAMPAIGNS ANALYSIS*

Variables to study the effectiveness of marketing campaigns may include:

* Frequency by campaign
* Marketing medium by campaign
* Type of promotion (e.g. percent discount, free delivery, free gift item, etc.)
* Sales record

**Value**: Statistical analysis on the correlation of each marketing campaign against sales would provide insight for future campaigns and promotions.

* Correctly identifying correlations between campaigns and increases in sales could help provide predictive insight into what type of promotion increases sales. Also, analysis could help provide insight into forecasting product demand so labour and inventory can be optimized.
* Linear regression modelling and Pearson correlation matrices could also help evaluate the effectiveness of the radio commercials that were recently developed (see [Appendix E](#AppE)).
* With identification of campaign features that are associated with increased sales, new campaigns could be created based on the successful campaign features. This might provide prescriptive insight into how to increase sales for the Barebones style line and how **new products** can be launched.

1. *COMPETITOR ANALYSIS AND INDUSTRY BENCHMARKING*

Variables for comparing Sleepy Industries against competitors may include:

* Number and size of firms
* Industry trends
* Pricing structure
* Net profit margins
* Product Ranges
* Degree of customer satisfaction

**Value**: Analysis against the industry could be used to determine the gaps and weaknesses between Sleepy Industries and help inform a plan for improvement.

* Principal component analysis (PCA) could compare Sleepy Industries’ products against industry leaders’ products. Comparison of product features, price points, etc., could help Mr. Sleepy optimize Sleepy Industries’ competitiveness (see [Appendix F](#AppF) for sample PCA).
* Analysis could also help inform ways in which Sleepy Industry products could serve as brand substitutions and meet the needs of a gap in the industry.

**Top Three Analytic Inquiries based on ROI (Task 8)**

**Task 8:** Identify the top 3 analytic inquiries above, based on your determination of ROI (return on investment) and the needs of the company. Explain your reasoning.

The top three analytic inquiries selected are analyses the Data Scientist feels would yield a high return on investment in answering the three main questions identified (see the [Objectives](#Objectives) section).

***Analytic Inquiry Priority 1:   
Manufacturing Cost Analysis and Optimization***

One of the priority analytic inquiries would be a statistical analysis of manufacturing costs and optimization. One of the major problems Sleepy Industry is facing is lack of financial sustainability. Currently, Mr. Sleepy doesn’t clearly understand which SKUs yield him the most profit and whether he has SKUs that is hurting his net profits.

*REASONING*

* **Data collection would be relatively economical**: The variables required for this analysis is available internally from Sleepy Industries, therefore Mr. Sleepy can better control any costs involved in collecting this information, though most of it should be readily available for sharing with the Data Scientist.
* **Net profit margins by SKU are intuitive**: Calculation of net profit margin by SKU is something that Mr. Sleepy and his senior managers can easily understand. This analysis can be used to gain confidence in the Data Scientist’s findings and serve as a launch board for more complex statistical analyses.
* **Possible solutions are immediately ready for implementation**: Statistical inferences from this analysis can be employed immediately to control costs and optimize sales on the SKUs with highest profit margins. Inferences produced from statistical analysis would be incrementally (by variable and level) adjusted to test and measure its effect on Sleepy Industries’ net revenue.
* **Help determine Barebones’ fate**: Analysis can also help determine whether the Barebones style line should be discontinued or better promoted by basing it on its net profit margin. The preliminary dataset on mean costs and profits by style line of the preceding six months indicate that the Barebones style line has low yield in terms of sales and net profit margin. [Appendix B](#AppB) illustrates that preliminary data indicates Barebones has one of the highest mean shipping costs. [Appendix G](#AppG) illustrates the preliminary distribution of the sales by the three dimensions of style line, number of different SKUs per style line, and mean number of units sold per month. More complete and granular data from Sleepy Industries will help produce a fuller picture of sales distribution and which style lines need net profit margin optimization. This will ultimately improve Sleepy Industries’s finances.

***Analytic Inquiry Priority 2:   
Shipping, Handling, Transportation, and Warehousing Costs Analyses***

Sleepy Industries’s financial woes can also be addressed by maximizing net profit margins. Closer analysis of shipping and warehousing costs would be a good place to start. Again, data would come internally from Sleepy Industries.

*REASONING*

* **Shipping costs are a significant portion of gross sale price**: From the preliminary dataset on mean costs and profits by style line of the preceding six months provided by Mr. Sleepy, mean shipping costs by style line indicates shipping costs vary from 8-17% of the gross sale price! This suggests shipping costs containment is an area that could significantly increase net profit margins.
* **Validate direct-to-consumer sales as an effective means to increase net profits**: All of Sleepy Industries’s sales are generated from sharing the profit margin in retail store sales and collecting the entire profit margin in direct-to-consumer e-commerce sales on their website. The website sales is one of the initiatives Mr. Sleepy has launched believing that direct-to-consumer sales will significantly improve Sleepy Industries’s finances. The Data Scientist can confirm whether direct-to-consumer sales through the website are performing at an acceptable net profit margin.
* **Shipping and warehousing costs are subject to management to contain costs**: Additionally, sources of major costs that could be better controlled would be in shipping and distribution warehousing, especially in direct-to-consumer sales. Statistical analytics with better data can help Mr. Sleepy negotiate shipping contracts and optimize the locations and number of warehouses, therefore improving net profit margins.

***Analytic Inquiry Priority 3:   
Customer Segmentation Analysis***

Statistical analysis of Sleepy Industries’s customers to identify target segments should also be a priority analytic inquiry. The data might not be readily available but can be something that can be generated and collected internally, as a start. Understanding the company’s customer segmentation will help inform decisions on how to increase sales volume to secure the company’s future.

*REASONING*

* **To optimize website for e-commerce**: Mr. Sleepy has already spent significant capital into upgrading the website for e-commerce. Using statistical analysis to identify the market segments and to understand better their shopping behaviour, needs, and desires can help inform website improvements. Incremental improvements to the website can possibly yield significant increases in sales volume and this can be measured by continual statistical analysis.
* **To inform marketing campaigns and promotions**: Identifying customer segmentation, in combination with net profit margins by SKU (see [Analytic Inquiry Priority 1](#P1)), can also help Sleepy Industries’s marketing team be more prescriptive in producing profitable marketing campaigns and promotions. It can also help assess whether the radio commercials are targeting the right market segments.
* **To capitalize on customers’ purchasing patterns**: Analytic inquiry into customer segmentation can also help subsidize the missing information on the returned warranty cards. Information from existing customers on reasons for purchasing, whether the customer would buy again, etc., can help provide analytical insight that can then be used to help forecast purchasing patterns to increase sales volume.

**Appendix A:   
Datasets to be Collected Internally, from Sleepy Industries, and Externally**

*This table is revised and updated from the Sleepy Case Part 1 submission.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Dataset** | **Internal/ External**  **Source** | **Structured, Semi-Structured, Unstructured** | **Free/ Not Free** | **Easy/Hard to**  **Create or Compile** |
| Record of all individual sales transactions from the past 10 years.   * Each sales transaction should detail the item(s) sold and at what quantity, sales price for each item, etc. | Internal | Structured | Free | Easy |
| From each retail store, record of all individual sales transactions for the past 10 years. | External | Structured | Should be free | Easy but will need a bit of coordination. |
| From the Sleepy Industries website, record of all individual sales up to the current date. | Internal | Structured | Free | Easy |
| From the Sleepy Industries website, record of all abandoned shopping carts. | Internal | Structured | Free | Easy, once website is set up to track abandoned carts. |
| For each SKU, an itemized breakdown by of costs (raw materials, equipment and tools, labour, packaging, etc.) required to manufacture the product. | Internal | Structured | Free | Easy |
| For each SKU, an itemized breakdown of shipping costs (shipping costs to retail stores, shipping costs for direct-to-consumer sales, delivery distances, delivery labour costs, etc.). | Internal | Structured | Free | Easy |
| Itemized cost breakdown of indirect costs (property rental fees, utilities, marketing costs, insurance, etc.). | Internal | Structured | Free | Easy |
| Inventory record down to the granularity of number of items per SKU, cost to warehouse, etc. | Internal | Structured | Free | Easy but may take time if no running inventory available. |
| Information about competitors’ sales volume, direct and indirect costs, and profit margins, etc., for industry benchmarking and comparison. | External | Semi-Structured | Not Free | Easy if just purchasing this information/Hard if need to compile |
| Warranty cards completed and returned | Internal | Semi-Structured | Free | Easy |
| Customer information to understand who is shopping Sleepy Industry products, which products are they purchasing, in which region do they live, etc. | Internal | Structured | Free | Hard because may have to compile the information from indirect sources |
| Customer satisfaction survey responses | Internal | Semi-Structured | Free | Easy to compile once a survey is developed. |

**Appendix B:   
Mean Unit Sale Price by Style Line vs. Mean Shipping Cost as % of Mean Unit Sale Price**

*This graph is from the Sleepy Case Part 1 submission.*

This initial crude correlational analysis based on Mr. Sleepy’s mean costs and profits by style line of the preceding six months suggests there may be a negative correlation between mean sale price per unit and shipping cost. With a lot more granular data, the Data Scientist would run this model again to validate the relationship between sale price by SKU and shipping costs.

*Based on mean costs and profits provided by Mr. Sleepy, this graph is showing that higher priced models cost less to ship.*

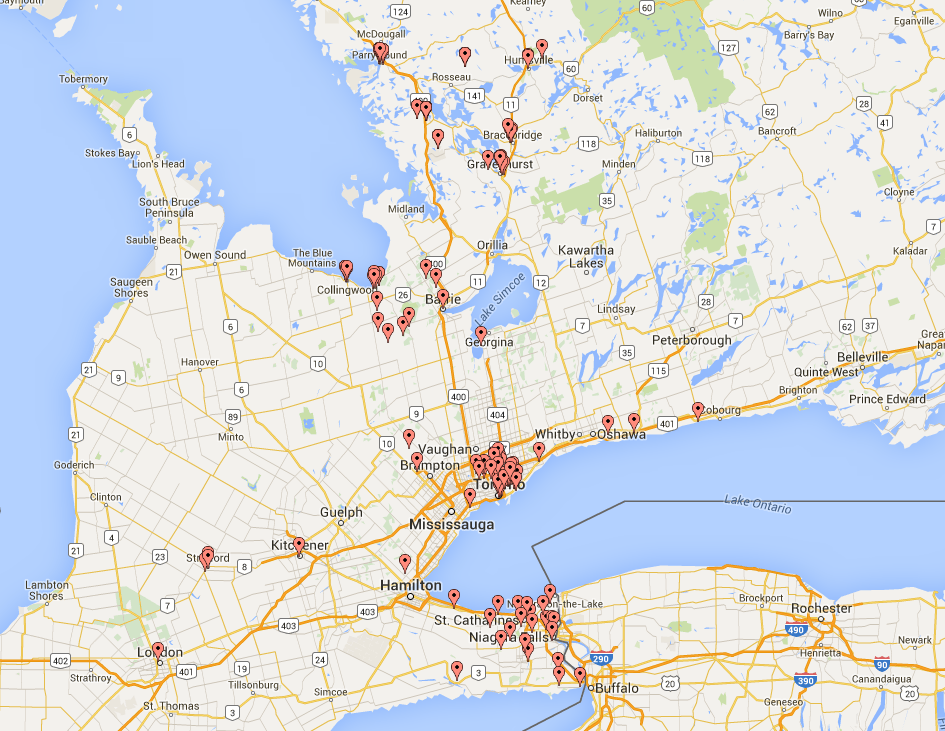
**Appendix C:   
Preliminary Geographical Distribution of Sleepy Industry Product(s) Owners**

*This map is from the Sleepy Case Part 2 submission.*

Owners of Sleepy Industries products who returned a warranty card are plotted geographically (with help of [batchgeo.com](http://batchgeo.com/)). From this preliminary data, there appears to be 4 main regions in which Sleepy Industries products enjoy significant sales:

1. Barrie
2. Muskoka
3. GTA
4. Niagara

It also suggests that there is an Eastern region (a region east of the GTA, along Highway 401, that would include Port Hope, Bowmanville, and Courtice) and a Western region (a region west of the GTA, along Highway 401, include London, Stratford, and Kitchener). More data will either confirm or reject this hypothesis.



*Initial geographical distribution of Sleepy Industries products owners based on returned warranty cards.*

**Appendix D:   
Preliminary Pearson Correlation Matrix based on Mean Costs and Profits by Style Line of the Preceding Six Months**

This Pearson correlation matrix is based on the mean costs and profits by style line of the preceding six months Mr. Sleepy initially provided the Data Scientist. It suggests there is high correlation (0.904) between the most popular style lines and the mean gross profit margin. This statistical analysis should be calculated with a fuller dataset to see what correlations can be identified.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Different SKUs within style | Mean units sold /mo | Mean sale price /unit | Mean gross margin % | Mean shipping cost as % of selling price |
| Different SKUs within style | **1** | **0.771** | -0.450 | 0.591 | 0.704 |
| Mean units sold /mo | **0.771** | **1** | -0.233 | **0.904** | 0.504 |
| Mean sale price /unit | -0.450 | -0.233 | **1** | -0.400 | **-0.804** |
| Mean gross margin % | 0.591 | **0.904** | -0.400 | **1** | 0.612 |
| Mean shipping cost as % of selling price | 0.704 | 0.504 | **-0.804** | 0.612 | **1** |

*Pearson correlation matrix\* based on Mr. Sleepy’s initial set of data (mean costs and profits by style line of the preceding six months).*

*\* Values in bold are different from 0 with a significance level alpha=0.05*

**Appendix E:   
Radio Commercials Campaign based on**

*These radio commercials are from the Sleepy Case Part 2 submission*

The GTA and Muskoka regions significantly have most of the sales and much of the high income residents ($150K+ and $75K-150K income groups) are purchasing Sleepy Industries’ items. Particularly, the GTA customers mostly like the Flash and Hiheels lines and Muskoka customers like Canadiana and Rustic lines. Hence, the radio commercials should target these two market segments to maximize the loyalty strategy and focus on areas where sales are demonstrably successful.

*RADIO COMMERCIAL 1:*

*Region: Muskoka*

*Income Groups: $75-150K and $150K+ income range*

*Lines: Canadiana and Rustic*

Muskoka. Quintessentially Canadian. Beautiful nature. Quality time with your family and friends. Let Sleepy Industries furniture be part of your Muskoka backdrop. The Canadiana line is traditional farm-style chic and the Rustic line offers natural wood finishes that complement the nature around you. And you don’t have to leave Muskoka to experience Sleepy Industries. Just go to [sleepyindustries.com](http://sleepyindustries.com), click what you like, and it will be delivered direct to your door. When you think of Muskoka, think of Sleepy Industries. 100% Canadian. 100% Natural. 100% Quality.

*RADIO COMMERCIAL 2:*

*Region: GTA*

*Income Groups: $150K+ income range*

*Line: Hiheels*

Dorothy only had to click her ruby shoes to go home. At Sleepy Industries, we might not have ruby shoes, but we do have our Hiheels line. It’s hip, it’s chic, it’s modern. And it can help take *YOU* home by turning that Waterfront condo, or that Etobicoke townhouse, or that North York *house* into a *home*! No need to click your heels, but you do need to click *on* that computer, visit [sleepyindustries.com](http://sleepyindustries.com), and use that *mouse* to click on your new pieces for your home and we do the rest. Like Dorothy, with a couple of clicks, Sleepy Industries will deliver your new home right to you.

*RADIO COMMERCIAL 3:*

*Region: GTA*

*Income Groups: $75-150K income range*

*Line: Flash*

A stylish designer line with high-end finishes

In The Six, there’s *one* company that offers a stylish designer furniture line with luxe finishes. *Five* letters spell the style name you need to know: F-L-A-S-H, Flash. *Four* steps, and you’re living in style: [sleepyindustries.com](http://sleepyindustries.com), click to pick, add an address, and pay. *Three* days after delivery and you’ll wonder how you possibly lived without your new furniture. *Two* words are all you need to know when it comes to furnishing your home: Sleepy Industries. *One* place, Sleepy Industries, is your countdown to style. What are you waiting for?

**Appendix F:   
Preliminary Principal Component Analysis Based on Preliminary Data**

The following principal component analysis was performed using XLSTAT as a preliminary demonstration of what type of analysis can be done on the data, once collected. Data input for this analysis is from the initial dataset Mr. Sleepy provided (mean costs and profits by style line of the preceding six months).

**XLSTAT 2016.03.31199 - Principal Component Analysis (PCA) - Start time: 6/28/2016 at 12:11:03 PM**

* Observations/variables table: Workbook = Mini-Case Sleepy Industries Part 1\_data - Copy.xlsx / Sheet = Sheet1 / Range = Sheet1!$B:$F / 8 rows and 5 columns
* PCA type: Pearson (n)
* Type of biplot: Distance biplot / Coefficient = Automatic

*SUMMARY STATISTICS*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Observ-ations | Obs. with missing data | Obs. without missing data | Minimum | Maximum | Mean | Std. deviation |
| Different SKUs within style | 8 | 0 | 8 | 4.000 | 31.000 | 13.625 | 9.501 |
| Mean units sold /mo | 8 | 0 | 8 | 48.000 | 210.000 | 118.000 | 61.579 |
| Mean sale price /unit | 8 | 0 | 8 | 89.000 | 609.000 | 315.125 | 163.123 |
| Mean gross margin % | 8 | 0 | 8 | 0.220 | 0.410 | 0.301 | 0.071 |
| Mean shipping cost as % of selling price | 8 | 0 | 8 | 0.080 | 0.170 | 0.123 | 0.035 |

*CORRELATION MATRIX (PEARSON (N))*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Different SKUs within style | Mean units sold /mo | Mean sale price /unit | Mean gross margin % | Mean shipping cost as % of selling price |
| Different SKUs within style | **1** | 0.771 | -0.450 | 0.591 | 0.704 |
| Mean units sold /mo | 0.771 | **1** | -0.233 | 0.904 | 0.504 |
| Mean sale price /unit | -0.450 | -0.233 | **1** | -0.400 | -0.804 |
| Mean gross margin % | 0.591 | 0.904 | -0.400 | **1** | 0.612 |
| Mean shipping cost as % of selling price | 0.704 | 0.504 | -0.804 | 0.612 | **1** |

***Principal Component Analysis***

*EIGENVALUES*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | F1 | F2 | F3 | F4 | F5 |
| Eigenvalue | 3.412 | 1.033 | 0.408 | 0.134 | 0.013 |
| Variability (%) | 68.250 | 20.668 | 8.156 | 2.675 | 0.251 |
| Cumulative % | 68.250 | 88.917 | 97.074 | 99.749 | 100.000 |

*EIGENVECTORS*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | F1 | F2 | F3 | F4 | F5 |
| Different SKUs within style | 0.466 | 0.105 | 0.769 | -0.164 | -0.392 |
| Mean units sold /mo | 0.457 | 0.514 | -0.044 | -0.223 | 0.689 |
| Mean sale price /unit | -0.366 | 0.678 | 0.227 | 0.593 | -0.056 |
| Mean gross margin % | 0.466 | 0.327 | -0.594 | 0.088 | -0.562 |
| Mean shipping cost as % of selling price | 0.472 | -0.398 | 0.045 | 0.751 | 0.230 |

*FACTOR LOADINGS*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | F1 | F2 | F3 | F4 | F5 |
| Different SKUs within style | 0.861 | 0.106 | 0.491 | -0.060 | -0.044 |
| Mean units sold /mo | 0.845 | 0.522 | -0.028 | -0.082 | 0.077 |
| Mean sale price /unit | -0.676 | 0.690 | 0.145 | 0.217 | -0.006 |
| Mean gross margin % | 0.861 | 0.332 | -0.379 | 0.032 | -0.063 |
| Mean shipping cost as % of selling price | 0.871 | -0.405 | 0.029 | 0.275 | 0.026 |

*CORRELATIONS BETWEEN VARIABLES AND FACTORS*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | F1 | F2 | F3 | F4 | F5 |
| Different SKUs within style | 0.861 | 0.106 | 0.491 | -0.060 | -0.044 |
| Mean units sold /mo | 0.845 | 0.522 | -0.028 | -0.082 | 0.077 |
| Mean sale price /unit | -0.676 | 0.690 | 0.145 | 0.217 | -0.006 |
| Mean gross margin % | 0.861 | 0.332 | -0.379 | 0.032 | -0.063 |
| Mean shipping cost as % of selling price | 0.871 | -0.405 | 0.029 | 0.275 | 0.026 |

*CONTRIBUTION OF THE VARIABLES (%)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | F1 | F2 | F3 | F4 | F5 |
| Different SKUs within style | 21.743 | 1.093 | 59.144 | 2.686 | 15.333 |
| Mean units sold /mo | 20.922 | 26.379 | 0.192 | 4.993 | 47.515 |
| Mean sale price /unit | 13.373 | 46.021 | 5.161 | 35.129 | 0.316 |
| Mean gross margin % | 21.710 | 10.664 | 35.298 | 0.777 | 31.551 |
| Mean shipping cost as % of selling price | 22.251 | 15.843 | 0.205 | 56.415 | 5.286 |

*SQUARED COSINES OF THE VARIABLES*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | F1 | F2 | F3 | F4 | F5 |
| Different SKUs within style | **0.742** | 0.011 | 0.241 | 0.004 | 0.002 |
| Mean units sold /mo | **0.714** | 0.273 | 0.001 | 0.007 | 0.006 |
| Mean sale price /unit | 0.456 | **0.476** | 0.021 | 0.047 | 0.000 |
| Mean gross margin % | **0.741** | 0.110 | 0.144 | 0.001 | 0.004 |
| Mean shipping cost as % of selling price | **0.759** | 0.164 | 0.001 | 0.075 | 0.001 |

*Values in bold correspond for each variable to the factor for which the squared cosine is the largest*

*FACTOR SCORES*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Observation | F1 | F2 | F3 | F4 | F5 |
| Obs1 | 0.574 | -0.268 | -1.097 | 0.301 | -0.052 |
| Obs2 | 0.528 | 0.994 | 0.690 | -0.360 | -0.006 |
| Obs3 | -2.104 | 0.091 | 0.249 | -0.052 | 0.220 |
| Obs4 | -2.957 | 0.692 | 0.327 | 0.494 | -0.135 |
| Obs5 | -1.150 | -0.365 | -0.578 | -0.745 | -0.100 |
| Obs6 | 1.962 | 1.227 | -0.631 | 0.145 | 0.107 |
| Obs7 | 2.876 | -0.121 | 0.786 | 0.066 | -0.085 |
| Obs8 | 0.272 | -2.251 | 0.254 | 0.151 | 0.050 |

*CONTRIBUTION OF THE OBSERVATIONS (%)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | F1 | F2 | F3 | F4 | F5 |
| Obs1 | 1.205 | 0.870 | 36.870 | 8.460 | 2.711 |
| Obs2 | 1.022 | 11.958 | 14.607 | 12.102 | 0.031 |
| Obs3 | 16.223 | 0.100 | 1.899 | 0.251 | 48.033 |
| Obs4 | 32.036 | 5.795 | 3.283 | 22.837 | 18.180 |
| Obs5 | 4.844 | 1.607 | 10.252 | 51.858 | 9.905 |
| Obs6 | 14.099 | 18.223 | 12.196 | 1.955 | 11.479 |
| Obs7 | 30.299 | 0.178 | 18.919 | 0.403 | 7.140 |
| Obs8 | 0.271 | 61.270 | 1.973 | 2.134 | 2.520 |

*SQUARED COSINES OF THE OBSERVATIONS*

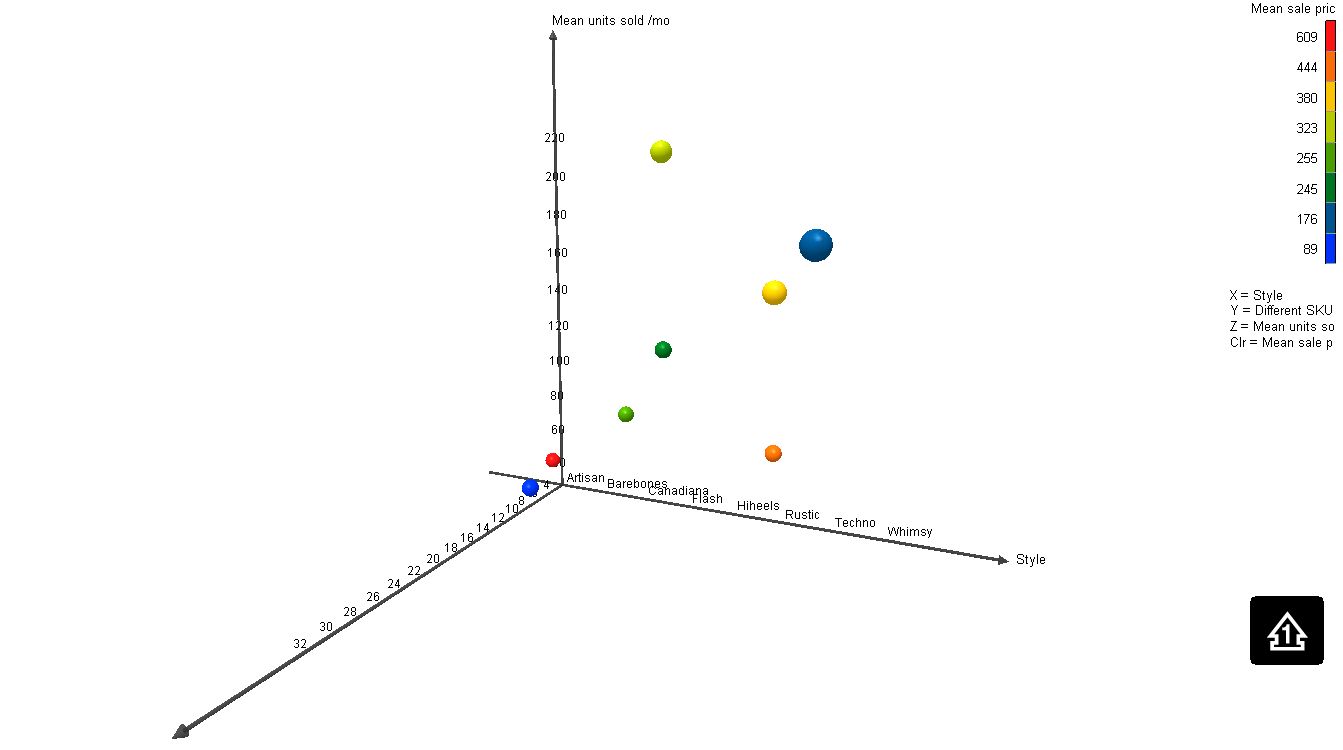
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | F1 | F2 | F3 | F4 | F5 |
| Obs1 | 0.194 | 0.042 | **0.709** | 0.053 | 0.002 |
| Obs2 | 0.149 | **0.528** | 0.254 | 0.069 | 0.000 |
| Obs3 | **0.973** | 0.002 | 0.014 | 0.001 | 0.011 |
| Obs4 | **0.912** | 0.050 | 0.011 | 0.025 | 0.002 |
| Obs5 | **0.562** | 0.056 | 0.142 | 0.236 | 0.004 |
| Obs6 | **0.665** | 0.260 | 0.069 | 0.004 | 0.002 |
| Obs7 | **0.928** | 0.002 | 0.069 | 0.000 | 0.001 |
| Obs8 | 0.014 | **0.969** | 0.012 | 0.004 | 0.000 |

*Values in bold correspond for each observation to the factor for which the squared cosine is the largest.*

**Appendix G:   
Preliminary Three Dimensional Modeling of Sales Distribution by Style Line, Number of Different SKUs, and Monthly Mean Number of Units Sold**

This model illustrates the preliminary distribution of the sales by the three dimensions of style line, number of different SKUs per style line, and mean number of units sold per month. It suggests the Barebones (red ball) and Artisan (smaller blue ball, closest to the red ball) style lines have low yields. Conversely, the Whimsy (large blue ball), Techno (yellow ball), and Hiheels (lime green ball) have high yields.

More complete and granular data from Sleepy Industries will help produce a fuller picture of sales distribution and which style lines need net profit margin optimization.

*This is a 3-dimensional model produced in XLSTAT from Principal Component Analysis. The above illustration is a 2-dimensional snapshot of the preliminary 3-dimensional model.*