SAS-based Retail Analysis

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Executive Summary

As the retail industry is characterised by diverse products, a wide range of customers and diverse customer needs, how to identify the target marketing group among a large number of people, find potential customers and develop targeted marketing strategies to maximise the profits of both customers and sellers, thus achieving a "win-win" objective for many multinational retail companies in the process of product sales. This report is based on data from a peer review. This report uses peer-reviewed data as the basis for analysis, decision trees and clustering analysis algorithms in SAS to analyse information about global suppliers, orders and products, and to provide interesting insights, trends and patterns in terms of suppliers, orders and products respectively, in order to provide a theoretical basis for the development of marketing strategies.

Our analysis of the data shows that suppliers are concentrated on three continents, with one third of suppliers located in the US, and the country with the highest number of orders is still the US. Order volumes have been steadily increasing since 2012 until 2016, with the exception of one small drop in 2014, and the lowest number of orders in February and September of the year. In terms of products, we found that sports products were the most popular, with outdoor shoes and clothing in particular selling in higher volumes and at higher margins than other products, and that pricing of products was primarily based on order quantity and cost.

Our advice to multinational retailers is :

 • Choose the right supplier. Reduce sourcing costs at source on the one hand and guarantee the quality of the products on the other.

 • Develop a proper sourcing plan. This includes the selection of the product range and the control of the quantity of products.

 • Develop a reasonable marketing strategy. This includes the combination of traditional retailing and e-commerce, the compatibility of localisation and internationalisation, and the balance between popular products and cold products.

Key Words: SAS, multinational retailing, data visualisation, cluster analysis, decision trees

SAS-based Retail Analysis
BACKGROUND

With the advent of the Big Data era, visualisation techniques are increasingly being used to understand and analyse data in order to learn the mysteries behind it. Data visualisation is a theoretical method and technique that uses computer graphics and image processing techniques to convert data into graphics or images that are displayed on the screen for interactive processing. According to research, 80% of the information humans obtain from the outside world comes from visuals, and visualisation is a basic way for people to make effective use of data. (Nair, Shetty & Shetty, 2021)Data visualisation is based on the characteristics of data, such as temporal and spatial information, to find suitable visualisation methods, such as tables, diagrams and maps, which are easy to understand, inevitable, multi-dimensional, one-sided, professional and other characteristics to visualise the data, in order to help people find the laws or information contained in the massive amount of data.
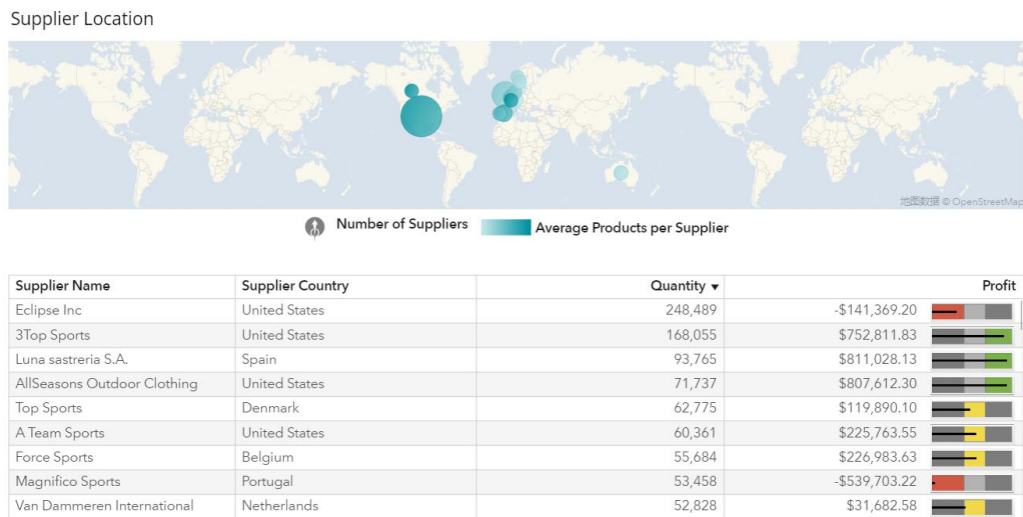
For the retail industry, the mountains of customer information and transaction data collected across different retail channels are often in separate and fragmented databases and systems, making it difficult to gain effective insights from intelligence due to the lack of a realistic approach to information analysis. To survive and thrive in a competitive market, multinational retail companies need industry-specific, analytically powerful solutions. SAS is a powerful data analytics tool with superior strengths in data integration, business intelligence and analytics that retailers can use to develop coherent business strategies and performance metrics for their shops. （Rodriguez, R.N.，2011)

SAS Visual Analytics

Supplier analysis

The supplier analysis section provides a summary of the suppliers. To give a more visual representation of the geographical distribution of suppliers, the report uses a geographical map to show the countries where the suppliers are located, where the size of the coordinates shows the number of suppliers and the shade of the colour represents the average number of products produced by the suppliers in those locations. Secondly, additional tables show detailed information about suppliers, including supplier name, supplier country, number of products ordered produced by the supplier and the total profit generated by each supplier, in descending order of the number of products ordered by the supplier.

Figure 1

Supplier Location

Number of Suppliers   Average Products per Supplier

| Supplier Name	Supplier Country	Quantity ▾	Profit	
Eclipse Inc	United States	248,489	-$141,369.20	
3Top Sports	United States	168,055	$752,811.83	
Luna sastreria S.A.	Spain	93,765	$811,028.13	
AllSeasons Outdoor Clothing	United States	71,737	$807,612.30	
Top Sports	Denmark	62,775	$119,890.10	
A Team Sports	United States	60,361	$225,763.55	
Force Sports	Belgium	55,684	$226,983.63	
Magnifico Sports	Portugal	53,458	-$539,703.22	
Van Dammeren International	Netherlands	52,828	$31,682.58	

Order analysis

The order analysis section provides a summary of orders. In order to visualise whether there is a clear trend in the number of orders placed over time, so that multinational retail companies can keep track of order dynamics and analyse improvements in a timely manner, the report uses two time series charts to show trends in the number of orders placed throughout the year, using the year and month of order as the time axis respectively.

Figure 2

In terms of order quantity, the report uses a decision tree with order month, order country as the forecast value and order quantity as the response value to analyse the impact of the former on the latter, as the decision tree has the advantages of distinct stages and a clear hierarchy, making it easy for multinational retail companies to study collectively and to think through the various factors in a thoughtful manner.
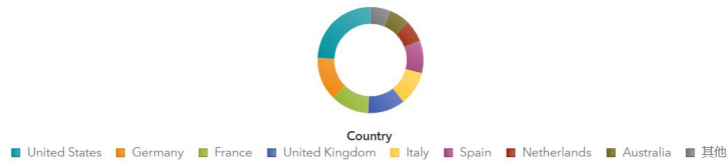
Figure 3
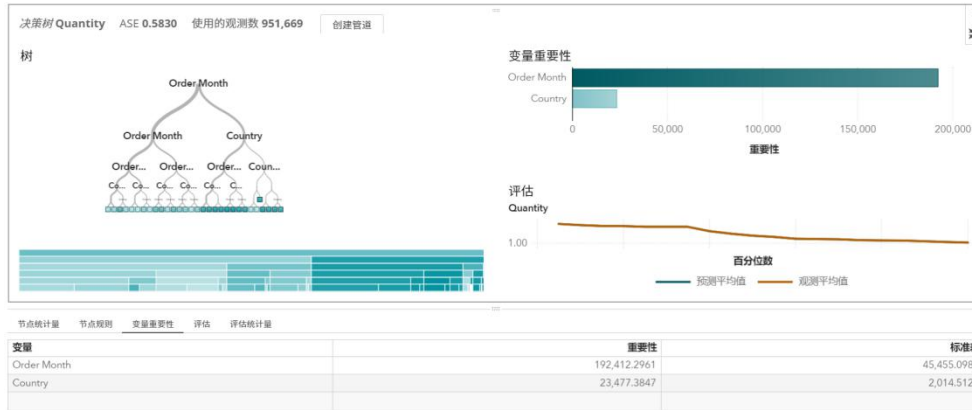
The pie chart visualises the top ten countries in terms of product frequency by region of order generation to help multinational retailers allocate their global market share more appropriately.

Figure 4

Product Frequency by Country
Frequency Percent

Country	Frequency Percent ▼
United States	24.41%
Germany	13.20%
France	11.74%
United Kingdom	11.30%
Italy	10.39%
Spain	9.94%
Netherlands	6.57%
Australia	6.34%
Belgium	2.62%

The report also uses yearly time series charts with frequency as the measure and order type as the grouping to provide new ideas for the traditional retail industry.

Figure 5
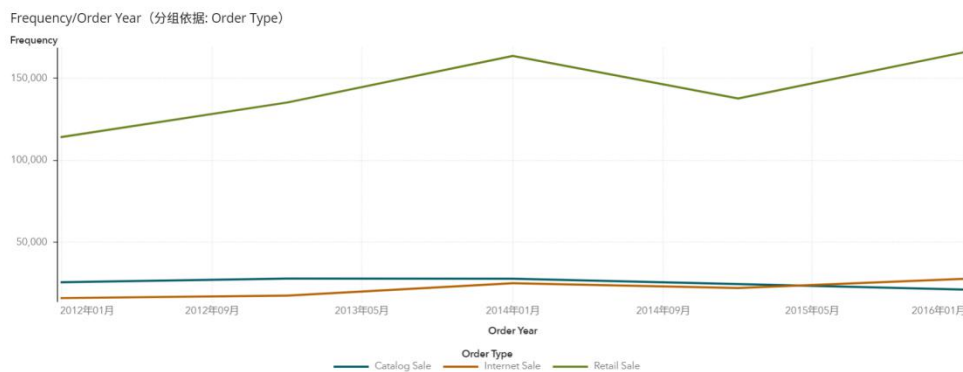
Product analysis

The product analysis section provides a summary of the products. Firstly, as a whole, in order to find the intrinsic structure between product lines, product categories and product groups that facilitate market segmentation by multinational retail companies, the report uses cluster analysis to show the relationship between the three in a more visual way.
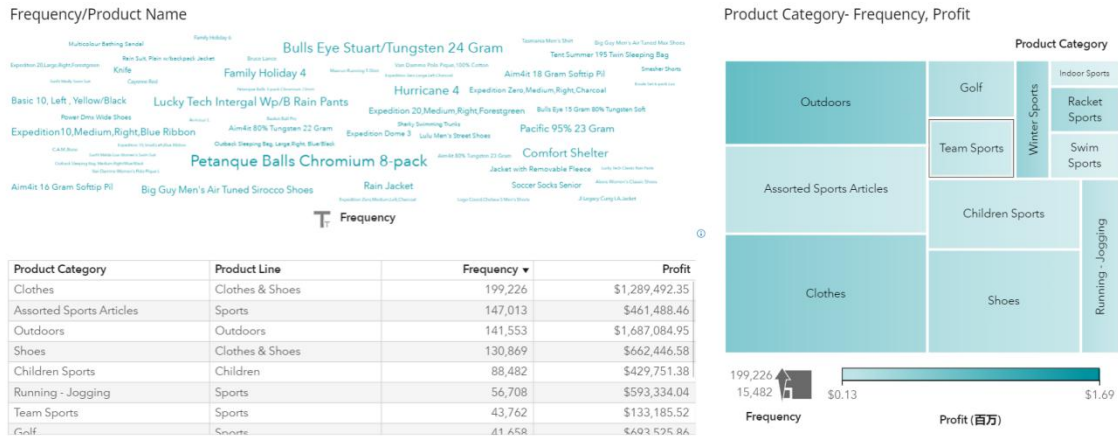
Figure 6
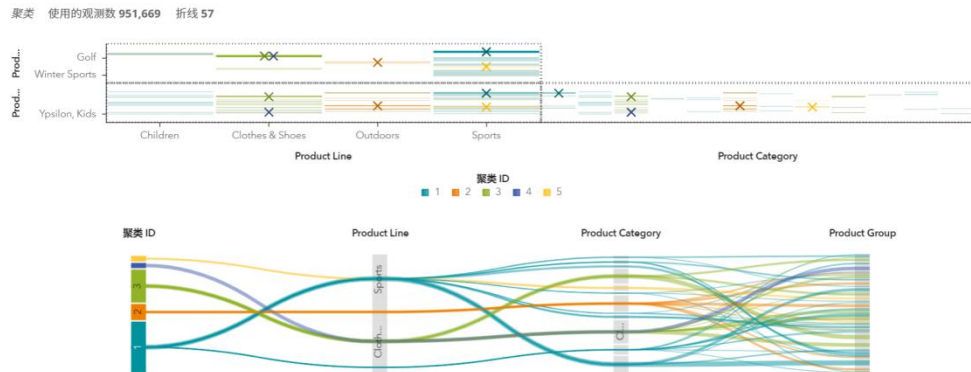
In part, to show the comparison between multiple indicators for both data, the report uses a butterfly chart to show the four product lines sorted by order frequency and quantity, and a biaxial bar chart to show the number of suppliers and orders for each product line in descending order based on order quantity.

Figure 7
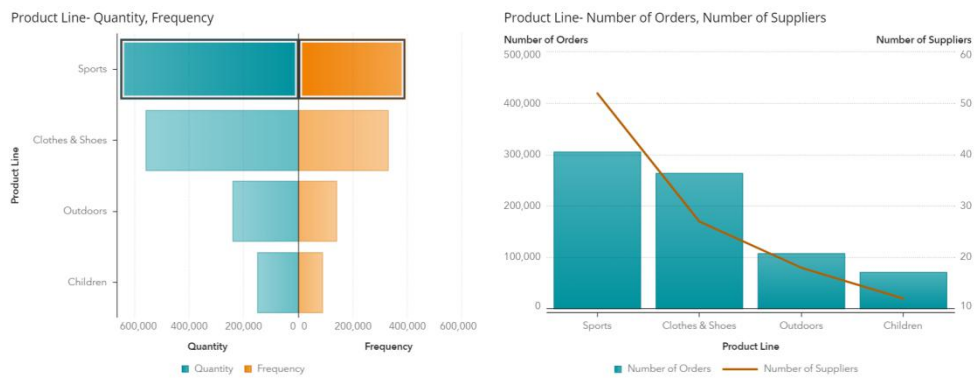
The tree diagram shows the total frequency and total profit for each product category, where the size of the rectangle represents the frequency of the product category and the shade of the colour represents the total profit generated by these product categories. The frequency of each productname is presented by Word - cloud so that the reader can get the main information about the most frequent product name in a short time.

Figure 8

Frequency/Product Name

Product Category- Frequency, Profit

| Product Category	Product Line	Frequency ▾	Profit
Clothes	Clothes & Shoes	199,226	$1,289,492.35
Assorted Sports Articles	Sports	147,013	$461,488.46
Outdoors	Outdoors	141,553	$1,687,084.95
Shoes	Clothes & Shoes	130,869	$662,446.58
Children Sports	Children	88,482	$429,751.38
Running - Jogging	Sports	56,708	$593,334.04
Team Sports	Sports	43,762	$133,185.52
Golf	Sports	41,658	$693,525.86

For product pricing, the correlation matrix visualises the relationship between order quantity, cost, retail price and discount to help multinational retailers price their products and run promotions more appropriately.

Figure 9

price correction
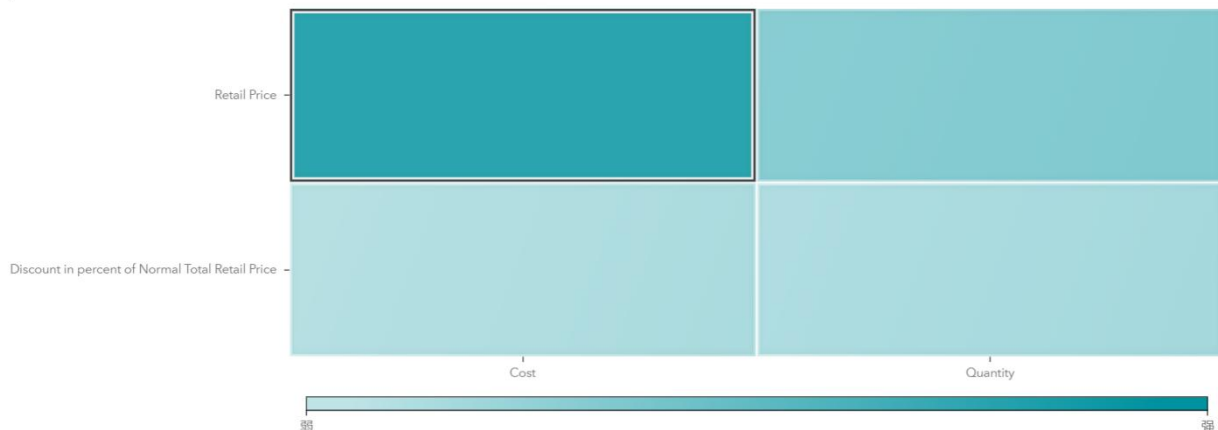
Discussion of findings

Based on the analysis of the above data, the report divides the findings into three categories.

Supplier analysis

Sourcing is the process of obtaining the right quality and quantity of raw materials, supplies, services and equipment from the right suppliers at the right time and in the right quantity at the right price and is critical to the success of every business as it affects the ability to sell quality goods and services at a reasonable price. (Bai & Liu, 2011)From a supplier perspective, we can see that a total of 64 suppliers are located in 13 countries around the world, with a concentration in three continents - Australia, North America and Europe. The country with the most suppliers is the USA, with 24 suppliers and an average of 76.5 products produced per supplier. The top three suppliers in terms of orders were Eclipse Inc, 3Top Sports and Luna sastreria S.A., but Eclipse Inc had negative profits for the year; the next three suppliers were Dutchman Bikes, A. Pereira Sport and SportPharma Inc.

Accordingly, we recommend that retailers primarily choose US suppliers for their sourcing, as the fact that one third of the world's suppliers are concentrated there is evidence of a mature industry chain and quality resources. On the one hand, as the quality of life improves and the pace of life accelerates, people tend to buy in bulk and one-stop shopping, which requires merchants to offer a sufficient number of products under one roof to attract more consumers. On the other hand, for multinational retailers, the collection of suppliers, distributors, retailers and end users as a whole, the flow of commerce, logistics, information flow control, in the supply, replenishment, inventory and other aspects of the response, fast behavior, with high marketing efficiency, high-tech support of the supply chain system so that multinational retailers bypass the intermediate links, directly from the manufacturers, and is the globalization of the marketable categories By purchasing in bulk, they have the upper hand in terms of supply, (Palmer, 2005)which gives them greater scope to lower prices at the end of the sale, so they can effectively save money and time by ordering products in the same place.

In addition, the 3Top Sports supplier in the United States, for example, has shown that the number of products ordered is much higher than other suppliers and the profitability of its products is higher throughout the year, which effectively shows that the quality of its products is excellent and favoured by the majority of buyers; and the pricing is reasonable and generates high revenue, which meets both quality and economic indicators, so we recommend that retailers We recommend that retailer companies choose suppliers that have both high order volumes and profits for this type of product.

Order analysis

Retailers in the market analysis, forecasting to pay full attention to domestic and international political, economic situation and other factors, each economic cycle of the formation of different factors, but the objective results are the same, that is, the performance of the economic ups and downs. Enterprises should seize the opportunity to develop during the economic upswing, expand sales and increase profits; during the economic contraction period, they should pay more attention to marketing, and use marketing flexibly in response to the new characteristics of changes in consumer behaviour, so as to develop effective marketing strategies that can stimulate consumption, expand consumption and achieve reasonable returns for the enterprise, so that the enterprise can avoid market risks and maintain sound operation. (Woodall, 2007)Analyzing from the perspective of orders, we can see that from 2012 to 2016, except for one small drop in 2014, all other times have maintained a flat rise, which indicates that the retail industry is in a steady progress in recent years with good market prospects, which is undoubtedly a good news for the retail industry.

The month time series chart shows that orders are lowest in February and September and peak between April and August, so we suggest that multinational retail companies should follow this pattern and purchase products before the peak order period, to effectively ensure the timeliness of the products on the one hand and avoid the embarrassing situation of oversupply on the other. At the same time, companies need to create sufficient inventory turnover to minimise total inventory costs by purchasing the right amount of goods. The report therefore uses a decision tree with order month and order country as forecast values to predict order quantities, with order month having the greatest impact on order quantities, again confirming that choosing the right time of year for retailers to purchase products is important for order quantities, so retailers are advised to purchase a certain amount of products based on month.

 Retailers should use scientific methods and approaches to anticipate and project future market demand, supply and their changing patterns. In the changing consumer demand, it is necessary to identify the unmet needs of the market in order to expand the market sales in the satisfaction of the customers and to obtain a good profit in the long term. (Woodall, 2007)The report therefore uses a pie chart to show the top ten countries in terms of product frequency, with the United States still at the top of the list. We therefore recommend that multinational retailers focus on the US, monopolise the local retail industry and form an integrated industrial chain. At the same time, while maintaining the US market, they should focus on other regions that are currently underdeveloped, taking advantage of the different preferences of each region in terms of product types and focusing their marketing on preferred products.

In marketing to different countries, it is also necessary to correctly handle the relationship between global standardisation and local adaptability, to grasp the operating rules of global thinking and local operation, to achieve economies of scale by virtue of standardisation for low-cost operation, and to enter foreign markets by virtue of localisation, to integrate local culture and to show competitive strength. The standardised mode of operation is the norm that multinational retailers have always adhered to. They have an overall marketing management system and a relatively solid pattern in terms of business philosophy, organisation, business processes, shop location and shop display. In addition to the standardisation of their operations, multinational retail companies also have a localised approach to their operations, and their competitive advantage is based on national conditions.(Palmer, 2005)

Most importantly, in terms of order types, traditional retail orders still dominate, but we can see a small increase in online orders as the years go by. With the advent of the internet society, people are able to learn a lot of information without leaving home, communicate online through the internet and pay online through the internet, all of which contribute to the general environment of online shopping. （Tollington&Wachter,2001）As a traditional retailer it is important to keep up with the times, especially for multinational retailers, entering the e-commerce sector can easily solve the problem of geographical limitations and save a lot of physical costs. At the same time, the traditional retail industry has certain self-advantages, such as stable purchasing channels, strong brand influence, and the influence of its brand can naturally be transitioned to the online retail business. Therefore, we suggest that retail enterprises can choose the O2O model and carry out business online and offline at the same time, which will be the core advantage of future competition.

Product analysis

Finally, as the most important pivot in the trading chain, analysed from a product perspective, overall, Figure 5 shows the cluster analysis of product lines, product categories and product groups, with 16 product categories and 56 product classes under four product lines, the results show a high degree of aggregation of the three variables, which provides a strong basis for the analysis that follows. Specifically, the butterfly chart shows the four product lines ranked by order frequency and quantity, while the biaxial bar chart shows the number of suppliers and the number of orders for each product line in descending order by order quantity. The most popular product line is the sports line and the least popular line is the children's line. The tree diagram shows the total frequency and total profit for each product category, and in terms of combined profit and frequency,

the categories 'outdoor', 'shoes' and 'clothing' stand out as being more frequent and profitability. The report also shows the word cloud of product names in terms of frequency for the reader's reference.

This clear trend is a clear indication of market preferences and we suggest that multinational retailers could source more outdoor clothing and footwear and, in addition to ensuring that they are sourcing sufficient sports products, could try innovative marketing strategies for children's products. This is due to the fact that although the market for sports products is vast, it also means that total market demand is increasing dramatically, with many opportunities for growth and market appeal. This scenario can lead to lower sales growth for companies than for the industry and subsequently to a decrease in the number of market shares. Children's products, on the other hand, are not as competitive and companies can quickly capture a large share of the market through brand name strategies, price competition and aggressive promotions, creating a leadership position and sovereignty. Multinational retail companies need to be equipped with effective sales promotion techniques, to study the characteristics of local market demand in conjunction with Figure 4, to create an atmosphere in the store with appropriate product mix, flexible price system, rich and varied product display and layout, to stimulate shopping emotions, to grasp the psychological dynamics of consumption, to co-ordinate the product mix and its price plan with demand-oriented, and to control the cost of import, sales and storage by using modern information technology, We also use modern information technology to control the cost of purchasing, selling and storage, and to improve the performance of our stores, so as to maintain the vitality and dynamism of the marketing competition.

Most importantly, as the monetary expression of the value of consumer goods and the most dynamic factor in the marketing mix, it is particularly important to set a relatively balanced and forward-looking product price. For product pricing, the correlation matrix shows the relationship between order quantity, cost, retail price and discount, where cost and retail price have the strongest correlation, order quantity and retail price have a medium correlation, while cost, order quantity have a weak relationship relative to discount, so we suggest that multinational retail companies should mainly consider cost and order quantity when pricing their products. If the market demand is high and the product is competitive, the price should be relatively high, and if not, it should be low. At the beginning of a product launch, the cost of the product should be calculated. Not only should the static costs of the product be analysed, but also the variable costs, because as sales rise and production efficiency improves, production costs will further reduce production costs and expenses. If the objective of the new product is to replace an existing product in the market, the company also needs to set target costs so that the new product can meet the requirements of the target price and be competitive in the market. For discounts you can refer to the order trends in the year above and run promotions to boost consumption during the two slow sales seasons of February and September.

Conclusion

In summary, the analysis of peer review data using SAS data analysis tools has led to the identification of data patterns in the retail sector and the development of effective recommendations for multinational retailers. However, as economic development levels and incomes rise, consumer demand for retail services is diversifying, which inevitably requires retail formats to be diversified to match. For multinational retailers in particular, it is still a challenge to seek their long-term sustainable development in a new situation where international economic ties are strengthening, structural contradictions between supply and demand are prominent, consumption levels are evident and resource factors are complementary. Multinational retailers must follow the laws of competition, stay ahead of the times with innovation, pursue the achievements of science and technology, use high technology to improve the speed of business, logistics and information flow, and realise industrialised business process management.

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