TREND ANALYSIS OF GLOBAL CHOCOLATE INDUSTRY USING DATA VIZUALIZATION

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Abstract:

Chocolates are one of the most popular dessert in the world. People around the world (mostly in Europe and the United States) consume more than 3 million tons of cocoa beans, whereas, the Canadians on an average consume about 6.4 kilograms of chocolate a year, which accounts up to 160 chocolate bars per year, per person. However, citizens across the globe have different tastes developed for different kinds of chocolate, each bar having its uniqueness. The purpose of this paper is to highlight customer satisfaction of chocolate bars based on different variables such as the percentage of cocoa, cocoa bean type, bean origin, manufacturer, the country and various other factors and types.

In this paper, the data is analysed from top Chocolate manufacturers in the world to have a visualization about global chocolate industry.

Keywords: Bean Type, Cocoa, Manufacturers, Country, Map, Packages, Ratings

INTRODUCTION:

Chocolate is liked by most of the people across the globe, the love for the chocolates doesn't depends on age, gender, socio – economic status and geographical location. It is one of such fuel that are loved by millions of people across the globe. The preparation of chocolates is basically roasted and ground cacao seeds made in a form of liquid or in paste, that can be used as flavouring ingredient. The flavouring comes from the seeds of cacao tree as it has bitter taste and these seeds are further fermented for chocolate making process. Bitter chocolates contain cocoa solids and cocoa butter in some proportions without further adding any sugar. Powdered baking cocoa contains more fiber, and can be processed with alkali to form dutch cocoa. Today, most of the chocolates are consumed in a form of sweet chocolate, milk chocolate, white chocolate, dark chocolate, unsweetened chocolates (Wikipedia, 2020).

Chocolate industry in world: According to taste and preferences of consumers regarding chocolates depends upon the brands which are famous all over the world like Ferrero Rocher (Italian brand), Ghirardelli (brand of United States partitioned with Swiss confectioner Lindt), Guylian (Belgian chocolate), Patchi (based in Lebanon), Toblerone

(Brand from Switzerland), Cadbury (based in England), Mars (New Jersey), Godiva (Belgium), Lindt & Sprungli (famous brand originated in Zurich and Switzerland), Kit Kat (Part of Hershey's company). Americans are known for their sweet and lighter milk chocolates whereas Europeans are considered for bitter taste as they have low sugar content (gourmetboutique.net, 2020).

Chocolate industry in India: The chocolate industry in India is dominated by two companies one is Cadbury and another is the Nestle followed by Gujarat Co – operative Milk Marketing Federation (GCMMF) - Amul and Central Arecanut and Cocoa Manufactures and processors Co – operative (CAMPCO) these are the major players in the Indian chocolate industry (ukessays.com). Commercial chocolates are found in the form of bars, counts, panned chocolates, Eclairs and assorted chocolates. As Andhra Pradesh, is the top cocoa producer in India, its production is not rising due to lack of awareness about the crop, weather factors and competition with other crops (economictimes.indiatimes.com, 2020).

This research is helpful in understanding the latest trends about global chocolate industry through Kaggle based data visualization and provides insights about top manufacturing companies of the world and global satisfaction index for the chocolates.

LITERATURE REVIEW:

Chocolate is an easy to get luxury for the consumers to treat themselves or to gift to their dear ones. Chocolate industry has undergone a major transformation, since its beginning, going from being a simple drink consumed by local people to a specialty product with variety of flavours. Main ingredient is cocoa, a native to the America. It was an important in the earliest South American cultures and about 70 percent of the world's cocoa beans come from four West African countries namely Ivory Coast, Ghana, Nigeria and Cameroon. Chocolates are consumed all over the world, and the largest chocolate manufacturers are based in North America and Europe. Taste plays a major role for chocolate consumers (Del Prete, 2020).

The Global Chocolate Market size is expected to reach $171.6 billion by 2026, with a CAGR 5.3% over the forecast period. Chocolate is the most widely-consumed sweet dessert or treat in the world (www.globenewswire.com, 2020). According to World Cocoa Foundation cocoa beans have been consumed over 3 million tons every year. One of the reasons that make chocolate a constant favourite dessert globally, is that it makes people feel good, and is beneficial for the human heart and brain. According to Fortune Business (2020), insights the top four countries responsible for the production of chocolate are the United States, Germany, Switzerland, and Belgium. Western Europe accounts for 35% of total world

chocolate production, U.S. accounts for an 30% and remaining 35% of chocolate production comes from rest of the world. In the United States Hershey's are the largest chocolate producer. Swiss chocolates are also world famous. World Cocoa Foundation (WCF) reports that around 50 million individuals depend on cocoa production and the cocoa industry as a source of livelihood.

The Indian chocolate market size is expected to reach by USD 1,833.28 million by 2024 with a CAGR 12.8% over the forecast period 2019 – 2024. The consumers in India have been demanding chocolate flavour for baking process and the increase in consumption of cocoa powder has increased as it can be utilized for various roles like flavouring and colouring agent, specifically in beverages, and in baking process. The demand for cocoa powder is increasing as its application can be used in various products like ice creams, milk shakes and desserts (businesswire.com) to improve the quality of chocolates. Indian chocolate industry should use less sugar in chocolates making to enter in the premium chocolate market.

Cocoa and chocolate are rich source in minerals, such as magnesium and iron. It is a short term source for energy due to antioxidants and phenolics, and this energy source was even utilized by soldiers during heavy battle situations. A 40 gram chocolate bar contains the same amount of phenol as a glass of red wine and it can be a positive source of dietary antioxidants (sfu.ca). Dark chocolates were associated with better physical health, body composition and are recommended to have benefits on reducing blood pressure and serum cholesterol, improving insulin sensitivity. It also enhances good mood and improves cognitive performance. Its ingredients include cocoa powder (containing cocoa liquor), cocoa butter and sugar. Milk powder, sweeteners and emulsifier (lecithin) are also added to it for nutritional and textural characteristics (Ravindran, 2020).

A recent study by Samoggia (2020), investigate that health and nutritional aspects for consumers are most important about when they buy chocolate as this may provide insights about the development of new products to satisfy the consumers' increasing health-orientation and explore healthier chocolate reformulation and new product concepts, and innovative chocolate ingredients as per consumer's interest. Aaltonen (2020), talked about replacement of sugar used in chocolate with a milk-based protein for health benefits of the consumers. Henry (2020), found that the consumption of chocolate confectioneries and the shortage in cocoa butter production remains a constant threat to food manufacturers. Therefore, exploring alternative plant sources of cocoa butter is important keeping in mind the increasing growth of global chocolate industry (bbc.com, 2015).

METHODOLOGY

This paper mainly focuses on analysing a chocolate dataset from Kaggle (a secondary data collection software), comprising the data from various parts of the world in accordance to the bean type variation, cocoa percentage containment and their respective visualisation in order to cumulate some idea of making premium quality chocolate or improvising and checking parameters for the existing ones in India to be used for India and also for exporting to the masses.

The paper is made using the R programming language and various packages used to work with the codes, including the ones that need to be installed are given below. The analysis gives an idea, on how a premium chocolate should be made, the precise amount of bean and cocoa used in order to gain the same popularity as an Italian chocolate popular amongst people. This dataset also contains expert ratings of over 1,700 individual chocolate bars, along with information on their regional origin, percentage of cocoa, the variety of chocolate beans used and the agricultural facets involved with its growth. The Flavour - a required criteria about Chocolates, various other factors including the intensity, diversity, purity are taken into account as well along with the harvest techniques, its processing, the aftermelt experience for good ratings and high quality of premium chocolates. The overall experience, plus the last impression from chocolates become the deciding factor, especially the personal evaluation and its impact allows it to rank higher. Therefore, along with this, in the code part we have trained and tested the data in order to fill-up for the null values, minimising data redundancy allowing the visualisation in accordance with countries to depict the actual scenario. So, in order to have a long lasting impact on consumers, the makers should opt for something different that appeals all sectors of people using parameters and tastes that bridge in the best one. Moreover, in this paper we attempt to bring in all such parameters to fit in as ideas worth implementation.
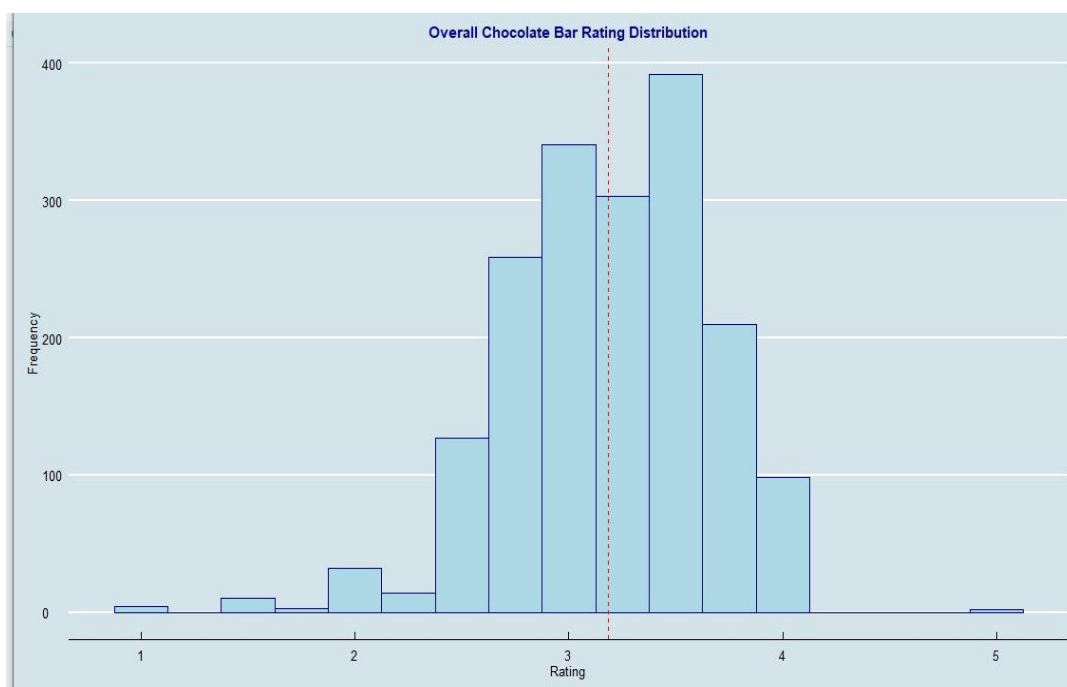
RESULTS & DATA VISUALISATION:

Fig 1: As shown the most rated frequency is 3.5 (approx.). This is how an average chocolate is rated across the globe.
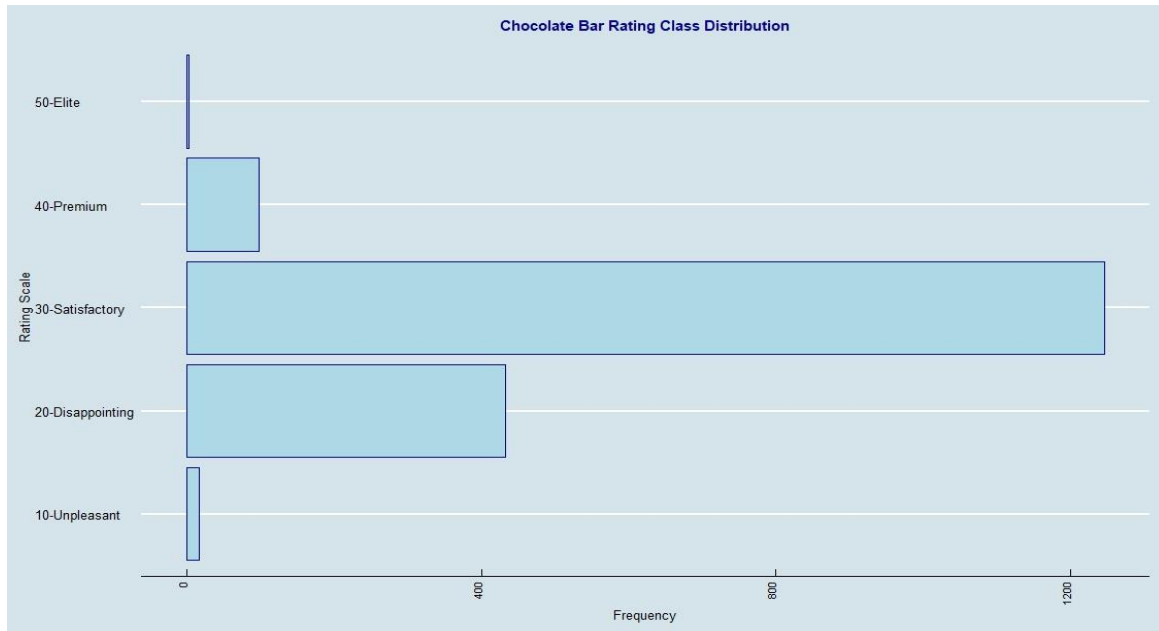

Fig 2: Histogram depicting above result in precise manner about 30 being the one with highest Frequency of 30 is the satisfactory rating which we set in our code.
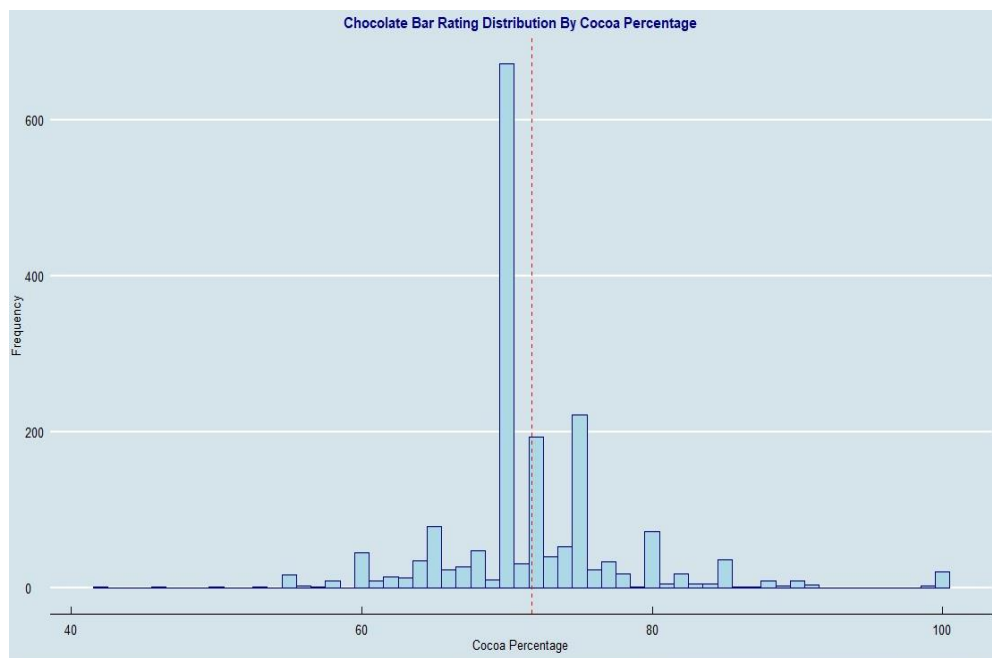

Fig 3: Clearly the 60-70 percent range of Cocoa Percentage has the highest number of occurrences. As percentage of cocoa increases, the chocolate bar rating decreases as it is evident from the above graph.
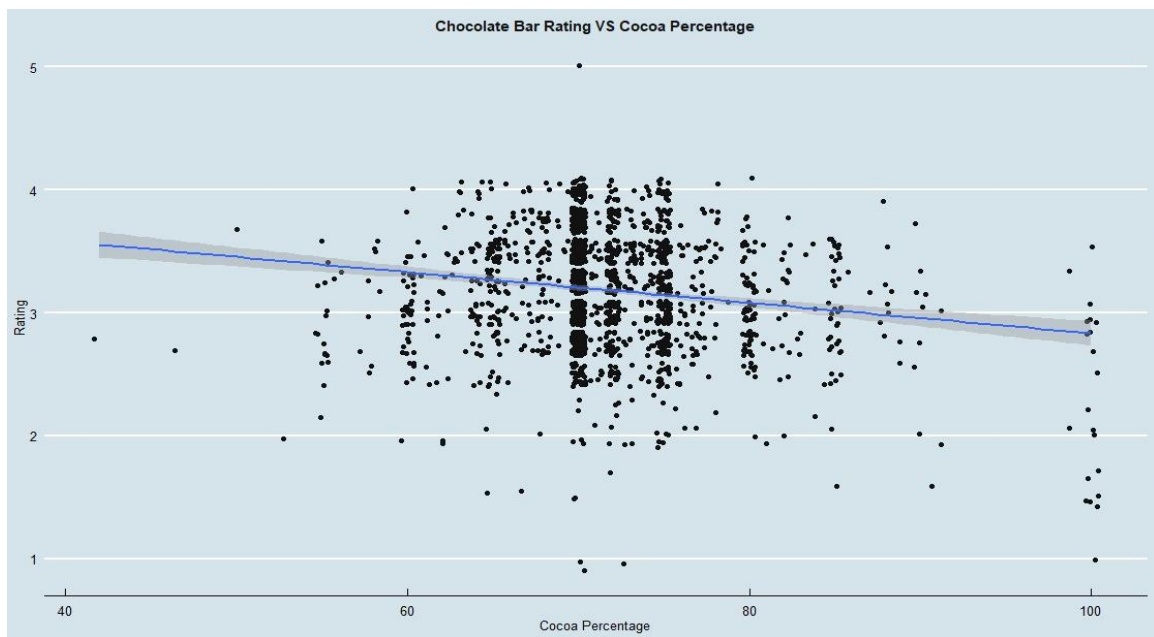
Fig 4: The highest rating achieved is for Cocoa Percentage 60-80 and this signifies that just having Cocoa in the Chocolate making won't affect the customer to buy Chocolate Products and various other factors also comes into picture.
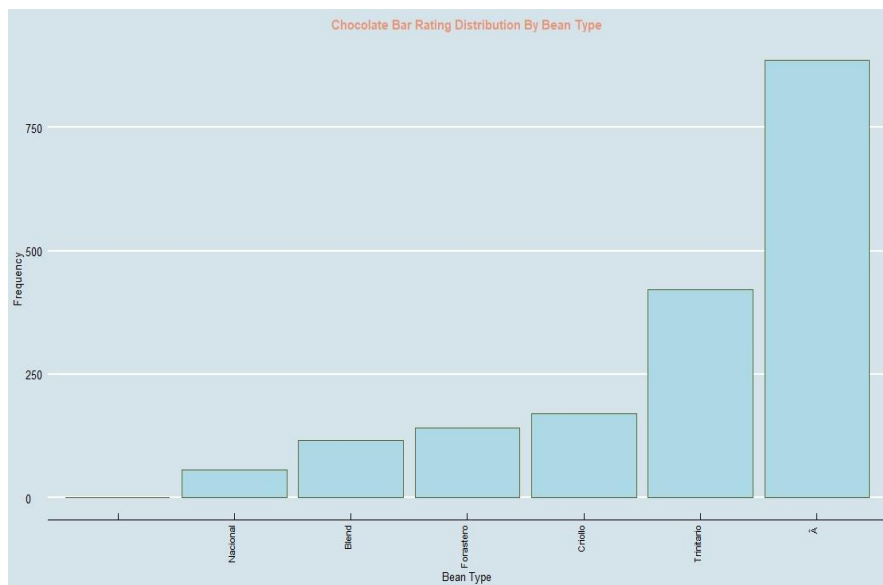

Fig 5: As evident from the above Graph that A' type of Bean has the most number of occurrence and has the highest rating as well as in a single or blend type
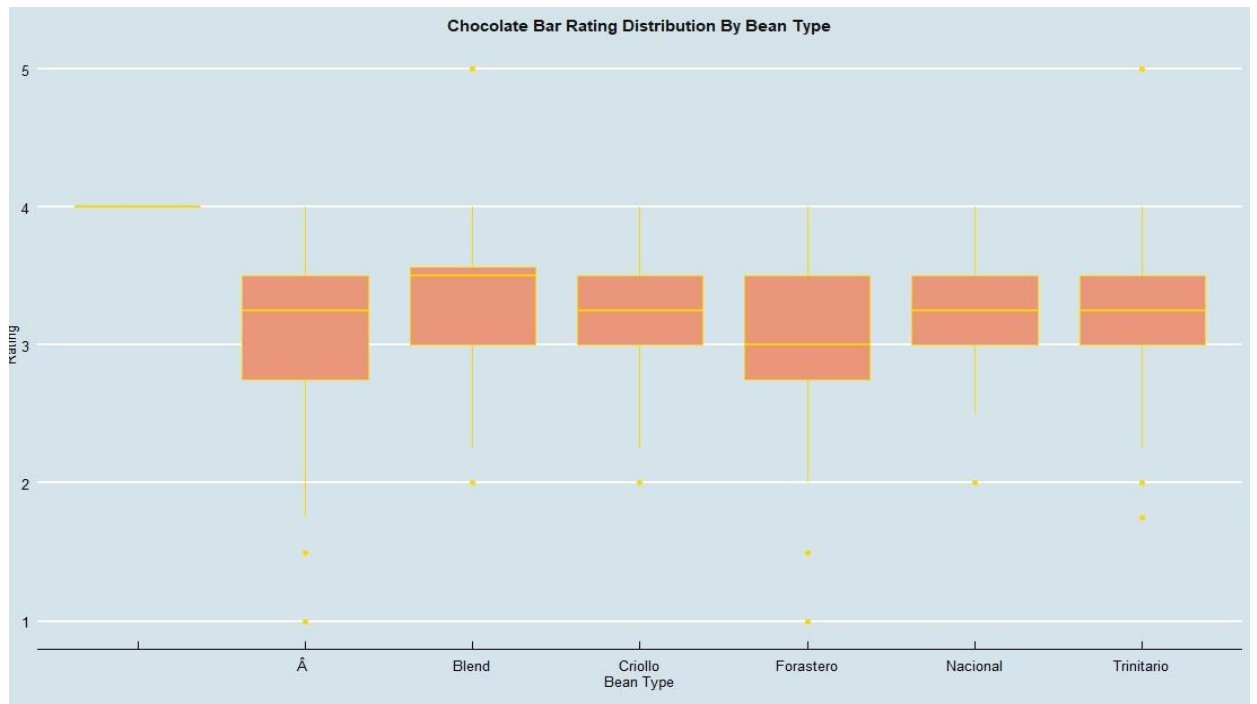
Fig 6: The Blend Bean type seems to have higher average rating which can be due the fact of its low frequency. Conclusion can be made that Trinitario has best average ratings.
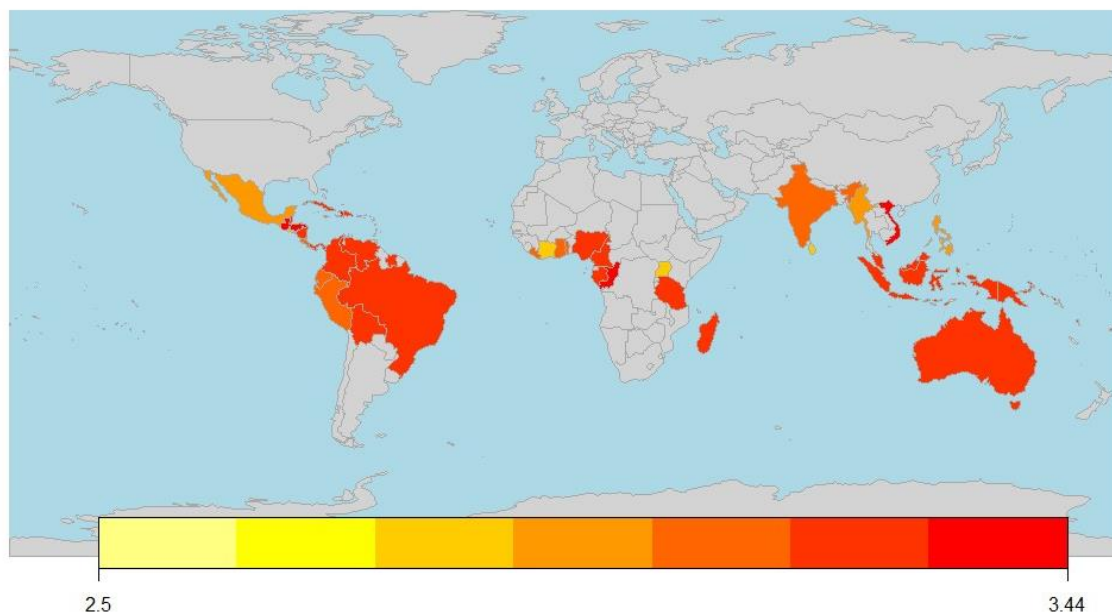

Fig 7: The origin of bean by country plays a significant role in the taste of chocolates and high ratings can be seen in parts of USA, Africa and China as well (Vietnam).

BeanOrigin	Rating_Count	Rating_Average
Honduras	15	3.350000
Congo	10	3.325000
Guatemala	28	3.321429
Vietnam	38	3.315790
Papua New Guinea	42	3.291667
Brazil	58	3.284483
Madagascar	145	3.265517
Cuba	11	3.250000
Venezuela	214	3.245327
Belize	49	3.234694

Fig 8: Top 10 ranking of the Chocolate Bar Rating Average by bean origin a table. Honduras is leading the chart in terms of bean origin.
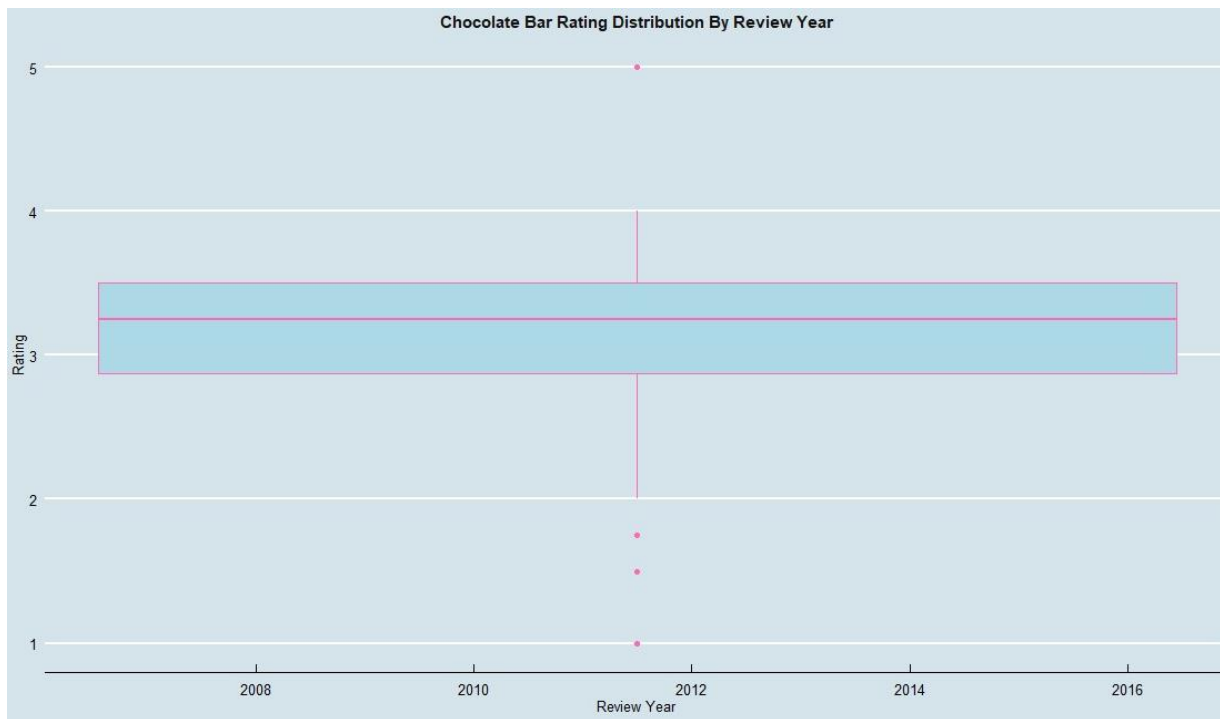

Fig 9: Ratings by review years: 2015 is the best year by ratings as evident from the graph

CompanyName	CompanyCountry	Rating_Count	Rating_Average
Amedei	Italy	13	3.846154
Idilio (Felchlin)	Switzerland	10	3.775000
Soma	Canada	47	3.585106
Arete	U.S.A.	22	3.534091
Smooth Chocolator, The	Australia	16	3.515625
Duffy's	U.K.	13	3.500000
Domori	Italy	22	3.477273
Pierre Marcolini	Belgium	14	3.464286
Marou	Vietnam	10	3.450000
Bonnat	France	27	3.435185

Fig 10: Top 10 Chocolate Company (by Rating Average). Amedei from Italy is the top-most Chocolate company with the highest average rating.
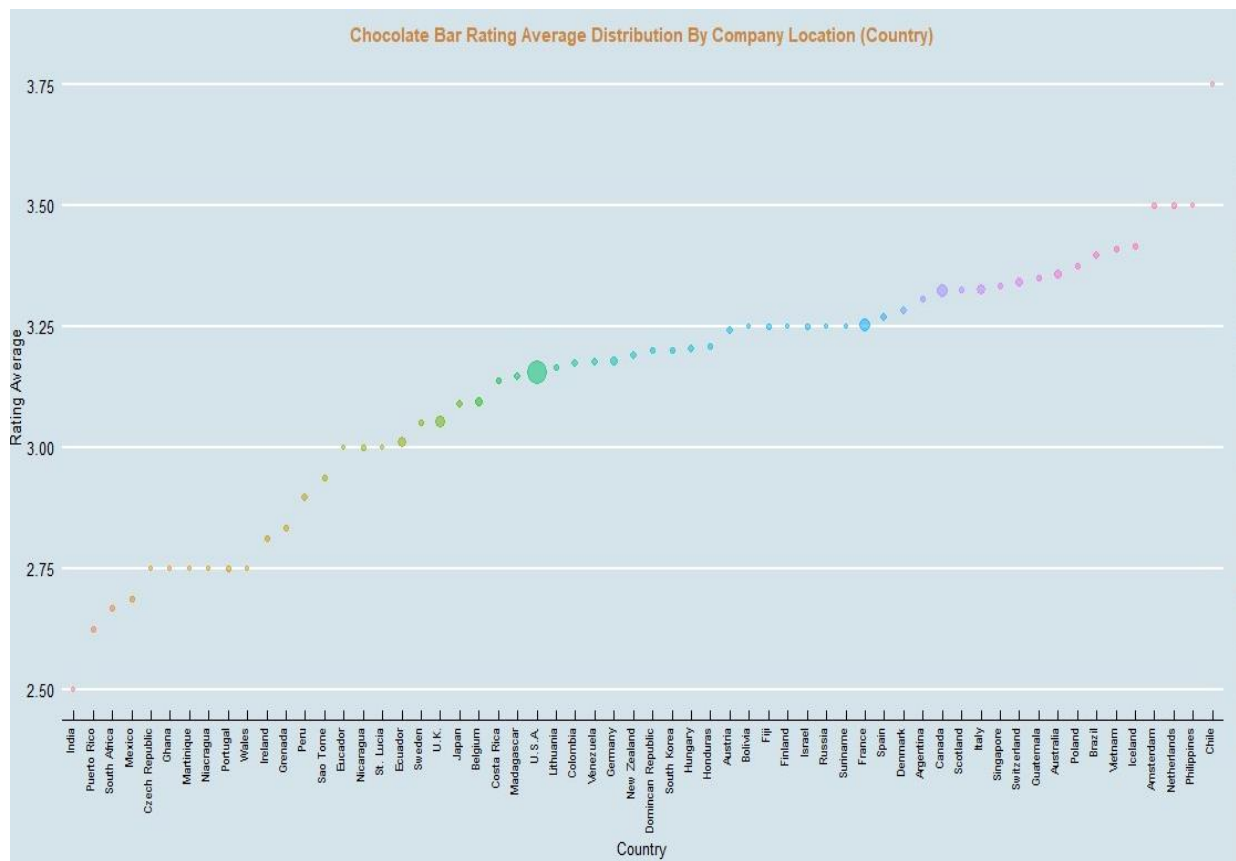

Fig 11: The Graph shows the average rating by Company Location. Italy and Canada are among the top while India is the lowest rated.

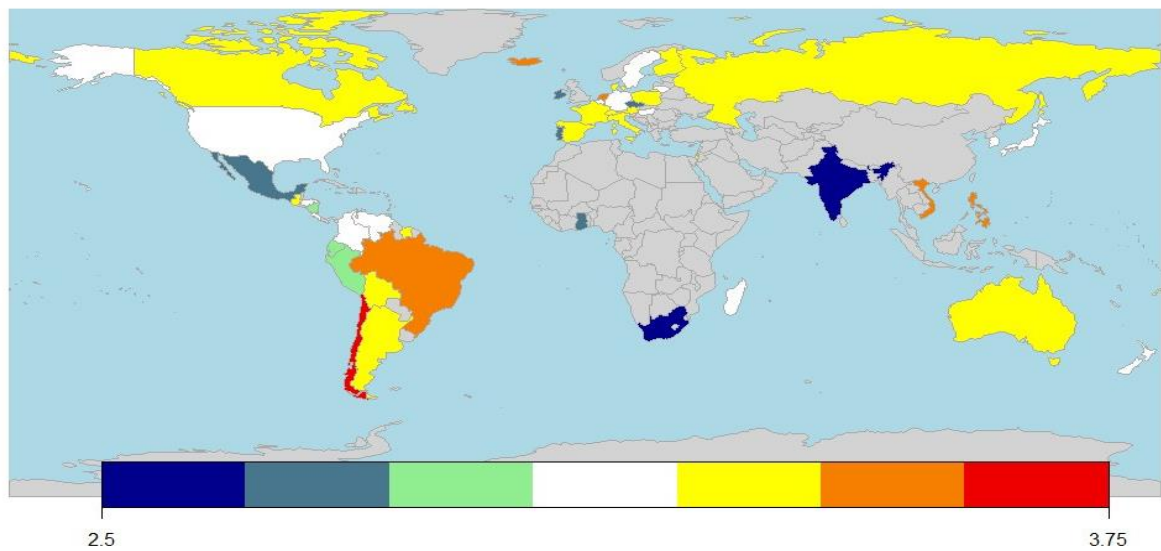Chocolate Bar Rating Distribution By Company Location (Country)

Fig 12: The above scenario depicted in map. The rating of India is lowest with average at 2.5 and Russia and Europe ranks among the most premium in terms of average rating for company in different parts of the world.

CompanyCountry	Rating_Count	Rating_Average
Vietnam	11	3.409091
Brazil	17	3.397059
Australia	49	3.357143
Guatemala	10	3.350000
Switzerland	38	3.342105
Italy	63	3.325397
Scotland	10	3.325000
Canada	125	3.324000
Denmark	15	3.283333
Spain	25	3.270000

Fig 13: Top 10 ranking of the Chocolate Bar Rating Average by Company Geo-Region

DISCUSSION:

Studies associated with the U.S. highlight Amedei and Soma as the best companies, offering the most premium chocolates. In fact, even the datasets depicted above in all the 14 figures clearly signify factors associated with Amedei to make it the most premium chocolate brand, be it the bean type, its origin, cocoa percentage and a lot of other factors associated with the quality of the chocolates produced. Additionally, the graphs presented above also highlight that, the percentage of solid cocoa acts as a major factor to signify the ratings of the chocolates. Thus, sharing an inverse relation in most cases. Although, these results are still debatable based on individualistic tastes and choices. Our analysis helps us to identify the most premium chocolate manufacturers, the producers and the countries associated.

Chocolates being the mood changer act as game changers today. The Indian market has a chocolate solution for every mood and palate, be it imported Swiss, Belgian or fair trade bars from Madagascar. However, the fastest growing economy of the world which is also a major consumer of Chocolate Products has to unfortunately, import these premium quality chocolates. Sadly, even after 11 out of 16 manufacturing markets being from South India, the graphical trends depict that factors like Cocoa Percentage, Bean type are factors that restrict India to reach the quality products liked by the masses. Therefore, with all the rightly addressed factors, and the country's focusing towards "MAKE IN INDIA", Chordia predicts about 40 bean-to-bar makers in India by the end of 2020. Be it regular chocolates to the dark chocolate, even companies like "Cadbury" should give India a chance to be the platform for high quality, budget friendly, affordable Premium chocolates – a place of immense possibility and major work.

Finally, we would like to conclude that based on our analysis, chocolate bars made with one of the five bean types included in our data, along with the right percentage of cocoa i.e., 60-70% range, premium chocolates could be manufactured in India at a reasonable price through mass production.

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