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| RESEARCH ARTICLE

Impact of COVID-19 on Consumer Buying Behavior During COVID-19 Pandemic Using Data Analytics

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| ABSTRACT

This research focuses on the impact that Covid-19 had on consumer buying behaviors using data analytics. Covering the impact of fear, uncertainty and changes in lifestyle on shopping decisions and a shift in focus for consumers, it examines how these factors played a role in shifting their priorities. The study employs exploratory data analysis techniques of secondary survey data to identify patterns in spending habits, psychological impacts and digital adoption. The findings demonstrate that consumers were more cautious, more aware of safety needs, and that businesses had to evolve to respond to new demands via digital platforms. The analysis further shows that emotional and psychological factors had a significant influence on the buying behavior. In summary, the study offers significant insights into the use of data analytics to gain insights into consumer adaptation and inform business strategies in crisis situations.

| KEYWORDS

Impact, Covid-19, Consumer Buying Behaviors, Data Analytics, Lifestyle, Exploratory Data Analysis, Demands, Digital, Psychological Impacts

| ARTICLE INFORMATION

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I. Introduction

A. Background of the Study

The COVID-19 pandemic brought about significant shifts in consumer buying behaviors and interactions with businesses globally. Due to lockdowns and social distancing measures, there was no opportunity to engage in normal shopping patterns, and people had to make different decisions as to what to buy [1]. Increased health concerns and uncertainty shifted the focus of consumers on essential products like groceries, hygiene products, cleaning products, medicines, and health-related products. Early on during the pandemic, panic buying of important household items for fear of scarcity was noted. Meanwhile, valueless product categories like cosmetics, travel goods and luxury items fell, as consumers cut down on frivolous spending. The pandemic also helped boost ecommerce as people wanted to online shop in order to stay safe at home. People started using e-commerce as a platform for purchasing goods and started using online delivery services. These shifts suggest that COVID-19 had an impact on not just the products consumers bought, but on how and why they bought them. For businesses, it is crucial to grasp these shifts in behaviour, which will help them to shape appropriate strategies to meet evolving customer needs. As such, when studying consumer buying behaviour in the context of the COVID-19 crisis, data analysis can be helpful to uncover key patterns, trends and factors that influence consumers' decisions during the crisis [1].

B. Problem Statement

The COVID-19 pandemic has had a profound impact on consumers' buying patterns, influencing product demand, preference and the way they shop. While there have been shifts in market demand for vital products and the rise of e-commerce, businesses still need to understand the rationale behind these shifts. Several factors such as health, fear, uncertainty, lifestyle change and economic conditions had an impact on consumer decisions throughout the pandemic. The complex changes can be incompletely captured using traditional approaches to study consumer behaviour. Hence, analysing the consumer data to understand the pattern and how COVID-19 influenced consumer purchase is necessary [1]. The research aims to examine the change in consumer behavior throughout the pandemic using data analytics and understanding what is driving consumer buying patterns.

C. Aim of the Research

The objective of this study is to understand how the COVID-19 has affected the Consumer Buying Behavior using Data Analytics Techniques to determine the changes, patterns, and factors impacting consumers' buying decisions during the pandemic.

D. Objectives of the Research work

The objectives of the research work are mentioned below:

- To assess the changes happening in the behavior of consumers due to the pandemic situation of Covid-19.
- To determine the social and psychological factors of consumers affected during the pandemic situation.
- To explore the preferences of consumer in the time of Covid-19 pandemic situation
- To figure out the paradigm shift in the consumer behavior from traditional shopping to online shopping in terms of purchasing patterns.

E. Significance of the Research

This research is important as it will provide insight into consumer behaviour and choices when subjected to an uncertain period caused by COVID-19. The study gives insights in to how product preferences have changed, how people shop and what factors influence their choices. The data analytics allows the research to uncover meaningful insights from consumer data that can inform decision-making processes. The insights gained can have a positive impact on the business, marketers, and researchers, as they better understand the needs of customers and adjust their strategies to meet market conditions. This study also helps to examine the relationship between crisis situations and consumers' behavior.

II. Literature Review

A. Consumer Buying Behavior and Decision-Making Process

Consumer buying behavior is a significant concept that helps to understand the process in which consumers recognize their needs, compare possible alternatives and make the final buying decision. When it comes to consumer behavior analysis, knowing what affects customers' purchase decisions can help businesses create effective strategies based on customer expectations. Qazzafi [2] identified the following internal and external factors that affect the consumers purchasing decisions and their buying behaviour: The research reveals that personal, psychological, social and cultural factors are significant influences on consumer decision making. A consumer doesn't just buy products for their needs, but might also take into account their personal preferences, motivation, perception and income. All of this leads to dissimilarities in the buying habits of various groups of consumers. The study indicates that the knowledge of consumer behavior will enable the organizations to recognize the needs of the consumers and develop their marketing strategies accordingly.

Digital technology has brought a lot of change in the consumer decision making process in the changing consumer environment. As mentioned by Asmara et al. [3], because of digital technology, millennials are now changing their methods of looking for information, comparing products, and making purchases. The study details how digital platforms allow consumers to have more convenient access to information about the products they are looking for, reviews from other customers, and online purchasing. This change has raised consumers' awareness and raised their expectations of convenience and accessibility. Digital technology has also transformed the customer to business relationship from a passive one to an active one, as customers are now engaged in the buying process online. As the use of digital technologies has grown, the technology is becoming important to the modern consumer buying process.

Toussaint et al. [4] also state that social and ethical aspects also play a role in consumer choice when they are buying. The researchers found that when consumers make a purchasing decision, they are starting to have greater awareness on sustainability and responsible business practice. Consumers choices and buying decisions can be affected by factors like environment, social values, and brand reputation. This means not only product price and quality influence consumers' choices; the values attached to products and organizations also do. The study points out the ongoing shift in consumer behaviour as a result of growing awareness and changing expectations. Thus, firms must also take into account broader social dimensions in addition to more conventional marketing to grasp consumer decision making.

To sum up, the existing studies have demonstrated that consumer purchasing is a complex process which can be affected by psychological, social, technological and personal factors. Consumer choices depend on the factors like changing circumstances, information available and external environment. When there is a pandemic like COVID 19, the understanding of these factors become more important because there were significant changes in consumer priorities and buying habits. Data analytics can be used to analyze consumer buying behavior, which can help businesses identify hidden patterns, understand changing consumer preferences, and make effective decisions. Thus, consumer behaviour is a useful area of study to gain insights into the changing nature of consumer buying under varying circumstances and in varying markets.

B. Impact of Covid-19 Pandemic on Consumer Pricing Patterns

COVID 19 pandemic brought about a lot of changes in consumer buying by impacting their buying priorities, spending and shopping behaviors. The pandemic brought uncertainty and fear to consumers, leading to panic buying and altering their normal consumption, according to Loxton et al [5]. The study outlines the reasons for consumers to begin buying larger amounts of necessary products because of a fear of product shortage or future availability. During the crisis period, there was an increase in consumption of goods like food, health and hygiene products, and household goods. The research further underscores the importance of media in influencing consumers' perception, as the frequent news concerning the level of infection and the situation of lock-down created anxiety among consumers. This psycho-social effect has caused consumers to make hasty buying decisions, based on fear and uncertainty, instead of what they should do in a normal buying process.

In the light of the change in consumers' spending habits, Loxton et al. [5] noted that the impact of COVID 19 has been different on essential and non essential products. Economic uncertainty and income concerns affected consumers' financial priorities and they cut back on spending on discretionary products. Demand for travel, entertainment, and luxury products was less, while people prioritized essential items. The study shows that the crisis situation can affect consumers' choice, make consumers pay more attention to their safety needs and survival needs than to regular consumption. The shift in buying habits indicates that external factors have a significant impact on consumer buying decisions and consumer spending.

The COVID 19 pandemic changed consumers' buying habits, making them permanent, as Bausch et al. [6] found. The study reveals that the physical mobility restrictions did lead to new shopping routines on the part of consumers, particularly online shopping. The use of digital platforms increased consumer reliance due to their convenience and health benefits. The pandemic not only impacted the frequency of purchases but also the consumer interaction with brands and products, the research explains. Consumers were more prudent in their buying decisions, and safety, availability, and convenience were among the factors taken into consideration. The changes indicate that there were factors related to health and changes in lifestyle that affected consumer behavior during the pandemic.

However, as stated by Gupta et al. [7] the pandemic also boosted the consumption of stocking and impulse buying. The research found that the ambiguity regarding the conditions of lockdown and product availability made consumers make more purchases than what is needed for them. The main observation of stocking behavior was related to essential goods since consumers desired to have some amount of the essentials stocked at home. The study also illustrates that fear and anxiety were factors in impulse buying decisions. Consumers were quick to buy products without evaluating them in detail because they feared a shortage in the future. The fact that psychological factors, among others, were of importance in shaping purchasing behavior during the pandemic suggests that this was driven by psychological factors.

Previous studies indicated that COVID 19 had a significant impact on consumers' buying behavior, which included the preference they had for products, how they spent money and how they shopped. The pandemic induced a change in purchasing habits to the safety-oriented and need-driven one. Uncertainty and concerns about health made consumers more interested in essential products, online shopping and keeping household supplies. Results of previous studies have suggested that consumer behavior in crises depends on economic conditions, psychological factors and social changes.

C. Psychological Factors Influencing Consumer Behavior During Covid-19

Psychological factors were found to be a significant factor impacting the behavior of consumers during COVID 19 pandemic as consumers had suffered from fear, uncertainty, stress and anxiety during the health crisis. The pandemic impacted consumers' decisions by altering their emotions and perceptions of safety and risk, according to Di Crosta et al. [8]. The study notes that "fear of infection" and "future scenarios" had an impact on purchasing decisions in terms of psychological conditions. It is consumers who became focused on essential goods and health related products as being necessary for protection and daily living. The study shows that consumer behavior during the pandemic period was influenced by both economical and emotional and psychological responses. All these affected individuals and their buying habits and developed new consumption pattern.

Lee et al. [9] indicated that the COVID-19 pandemic led to an increase in herd behavior for people when it comes to their perceptions of risk and social influence. The study points out that in uncertain situations people watch other people and emulate their buying behavior. Increased risk perception and anxiety resulted in consumers being more inclined to buy products which were being bought by others, particularly essential products. The study also clarifies how trust in information sources affected consumers' decisions during the pandemic. Consumers who were continually told about the risk of infection and the lack of product were more anxious and influenced by their purchasing decisions. This indicates that in the crisis period there were close links between psychological factors and social behavior and purchasing trends.

Yuen et al. [10] found that during the health crisis, panic buying is well correlated with fear, uncertainty, and maintaining control during tough times, psychological factors. When the consumer experiences threat or uncertainty about the future availability, the study explains that he or she tends to buy more than needed. Panic buying gives consumers a short-term sense of security as they think they have a better chance of preparing for any problems. The study also finds that social media and news information can raise concerns among consumers, and affect their decisions to purchase. As COVID 19 continues, news of lockdowns and product shortages only added to consumers' emotional reactions.

In summary, the findings from previous research indicate the important roles of psychological factors in consumer behavior in the context of COVID 19. Fear, anxiety, risk perception and social influence influenced consumer assessment of their needs and also influenced their decisions to buy. The psychological changes led to higher demand of essential products, alteration of shopping habits and higher attention to safety related products. It is crucial to consider these aspects when examining consumers' behavior as their buying decisions in times of crisis are not only rational but emotional as well. Hence, using data analytics to study psychological factors can benefit in determining key behavioral patterns and understanding consumer behavior in times of uncertainty.

D. Digital Transformation and Online Shopping Behavior During Pandemic

With the advent of COVID 19, the digital transformation have spurred the change in consumer behavior with respect to the way they interact with businesses and buy products. During the pandemic, e-commerce systems grew at a considerable rate as consumers relied on digital platforms for shopping activities as they became more dependent on them, says Beyari [11]. The study describes why online shopping was convenient, easy, and safe during times of movement restrictions. Another key area of concern for businesses was enhancing their digital offerings to align with evolving customer demands. Online payment methods, availability information, and delivery became vital elements in the items affecting customer satisfaction. Since the study reveals that digital transformation was not only a solution to the pandemic, but also had long-term impact on the consumer buying habits, it is important to acknowledge that.

Likewise, in the context of consumer buying behavior online, Gu et al. [12] explained that the COVID 19 greatly contributed to the acceptance of e-commerce platforms by consumers. The study emphasizes that lockdown measures and health and safety concerns motivated consumers to switch from physical to online shopping avenues. Consumers began buying other product categories online as digital shopping made it easier to buy online, avoiding face-to-face interactions. The study also found that trust in online platforms, service quality, efficiency of delivery and digital payment options had an impact on consumers' acceptance of online shopping. The COVID-19 pandemic has altered how consumers shop, making them increasingly accustomed to digital channels and platforms for their shopping needs.

Hashem [13] found that the COVID pandemic has influenced the attitude of customers towards e-shopping by enhancing their acceptance and preference of buying online. The study gives an explanation of how the consumers who used to like shopping in the stores began to use online platforms during the pandemic period because of safety issues and restrictions. Even online shopping became an important option to obtain essential products and stay at home. Key findings of the research indicate the convenience, usability, and lowered health risk perceived by consumers were factors in their attitudes toward ecommerce. The changes show the pandemic was a significant factor in digital dependency among consumers.

E. Empirical Studies on Covid-19 and Consumer Behavior

In the context of empirical studies of consumer behavior during COVID 19, Laato et al. [14] examined the noticeable consumer behavior in the initial phase of the COVID 19 pandemic using the stimulus organism response approach. The study discussed the influence of external factors like lockdown, uncertainty, health concerns on consumer psychological responses and purchasing decisions. The study revealed that there were changes in consumers' regular shopping patterns as a result of fear and the demand for security. The research revealed that a higher level of concern regarding product availability and pandemic conditions led consumers to buy more essential products. This study demonstrates that the environmental factors have an impact on consumer attitude and that there is a role for individual emotional responses.

Long and Khoi [15] reported an increase in the buying and storage of food products during COVID 19 pandemic, due to customers' intention for greater purchases. The study looked at determinants of food hoarding behavior and how future shortages, uncertainty, and perceived risk influenced consumers' decisions. The study revealed that during uncertain times, consumers tended to make more food purchases to feel prepared. The results suggest that psychological factors and crisis associated conditions were significant factors in altering consumption. The empirical studies showed that COVID 19 had a significant impact on the consumers' buying behavior and resulted in modification of priorities, growing demand for essential goods, and new buying habits. The research highlights the need to explore customer data to gain insights into consumer behavior changes in pandemic contexts and formulate appropriate business strategies.

F. Research Gap

Previous research focused on the effects of COVID 19 on consumer behavior, psychological aspects, and the online shopping habits. Research has not, however, merged these factors with data analytical techniques to investigate consumer buying patterns and behavior change throughout the pandemic.

III. Methodology

A. Research Design

This research adopts quantitative exploratory research design to analyze the impact of covid-19 on consumer buying behavior with the help of data analytics. The exploratory approach is chosen because the study does not aim to test a hypothesis, but to detect patterns, relationships and changes in consumer data. The study aims to explore the impact of psychological factors, pandemic situations and changing preferences in purchasing decisions during the COVID 19 period. The study aims to examine how consumers reacted to the survey and what significant trends there were in relation to consumer buying behavior.

B. Research Approach

The study is conducted based on data driven which is using exploratory data analysis techniques for analyzing consumer behavior data. This method can be useful in identifying a meaningful pattern on the data and in knowing how consumers shifted their buying habits throughout the pandemic. The study is based on secondary quantitative data obtained from the respondents within the period of the COVID 19. The information gathered is analyzed to identify the connections between various factors, including psychological factors, consumer's preferences, and purchasing decisions.

C. Dataset Description

The data set for this research is entitled “Psychological Factors and Consumer Behavior during COVID 19 Pandemic” and the data is from the Figshare research data repository. The dataset comprises responses obtained through surveys to gain insight into the connection between psychological factors and consumer purchasing behavior during COVID 19. It includes data on demographic data, emotional state, Covid-19 concerns, and shopping preferences. The data offers a lot of insights into the impact of factors like fear, anxiety, uncertainty and lifestyle changes on consumer decisions during the pandemic. It aids in understanding the differences in buying habits and in determining trends in consumer behavior among various consumer segments [16]. The data can be used for exploratory data analysis, as descriptive relationships between psychological factors and patterns of consumer behavior can be examined. The gathered data helps determine the factors that influenced buyers' decision making during the global health crisis.

D. Data Preprocessing

Data preprocessing techniques are used to prepare the data for analysis to enhance the quality and reliability of the analysis. In the preprocessing stage, missing data values are examined, duplicate records are detected and removed, and data values are converted into appropriate formats. Categorical variables are examined and recorded if necessary to analyze. Data cleaning can reduce inconsistencies and make sure the data set offers accurate knowledge into the trends of consumer behavior.

E. Exploratory Data Analysis Methods

Exploratory Data Analysis is used to get an overview of the data set and identify any patterns or characteristics. Descriptive statistical techniques are employed to grasp the pattern of the responses and to find major trends within consumers. Relationships between variables are clearly represented using visualization techniques like bar charts, pie charts, histograms, and correlation analysis. The analysis is based on consumer behavior changes, psychological factors and consumer reactions during COVID 19.

F. Tools and Technologies

R Studio is the main research environment used to run R script codes and analyse data. The R Studio offers a range of statistical and visualization packages, which enable the exploration and interpretation of data on consumer behaviour in an effective way. Data is cleaned and analyzed using R programming to detect patterns, relationships, and trends within the data about the purchasing behavior of customers during the Covid 19 pandemic. Using R Studio, data visualization techniques like bar charts, pie charts, histograms and a correlation plot are created to display analytical results in a clear and understandable manner.

G. Ethical Consideration

Throughout this research, ethical issues have been adhered to, ensuring that the dataset is used responsibly, and results are understood correctly. Secondary data has been used from a publicly available research source and no personal identification information of respondents has been used during the analysis of the present study. Data has only been used for academic purposes and the privacy and confidentiality of participants has been respected. The analysis process is objective, not modified nor manipulated the original responses to affect the results. All findings are reported according to the outcomes obtained in the process of data analysis, so that the research work is done transparently, clearly and reliably.

IV. Conceptual Framework

This conceptual model is the explanation of how data analytics contributes to the study of consumers' purchase behavior in the COVID 19 pandemic. The first step is to gather survey data from consumers, including demographic and psychological aspects. Data Analytic Layer: Cleans and analyzes the data to see if there are any patterns or trends, and then visualizes the spending changes. The behavioral analysis layer explains the impact of changing perceptions of the need for fear, uncertainty, and lifestyle changes on necessity and unnecessary spending and online shopping. The interpretation layer bridges between these findings and business and research implications. The final deliverables will include a clear picture of consumer adaptation of their purchasing behavior during the pandemic as well as the strategic value of data-driven analysis for businesses in uncertain times.

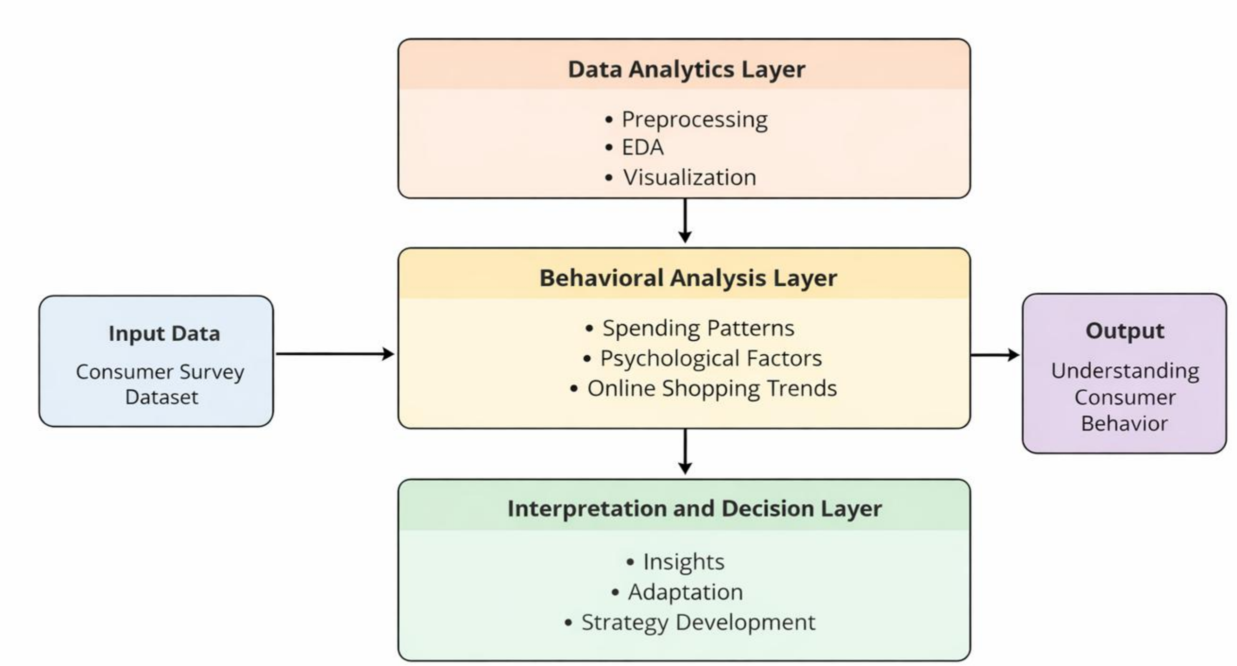

Figure 1. Conceptual Framework Diagram

(Source: Created by learner)

V. Results

A. Demographic Distribution Analysis

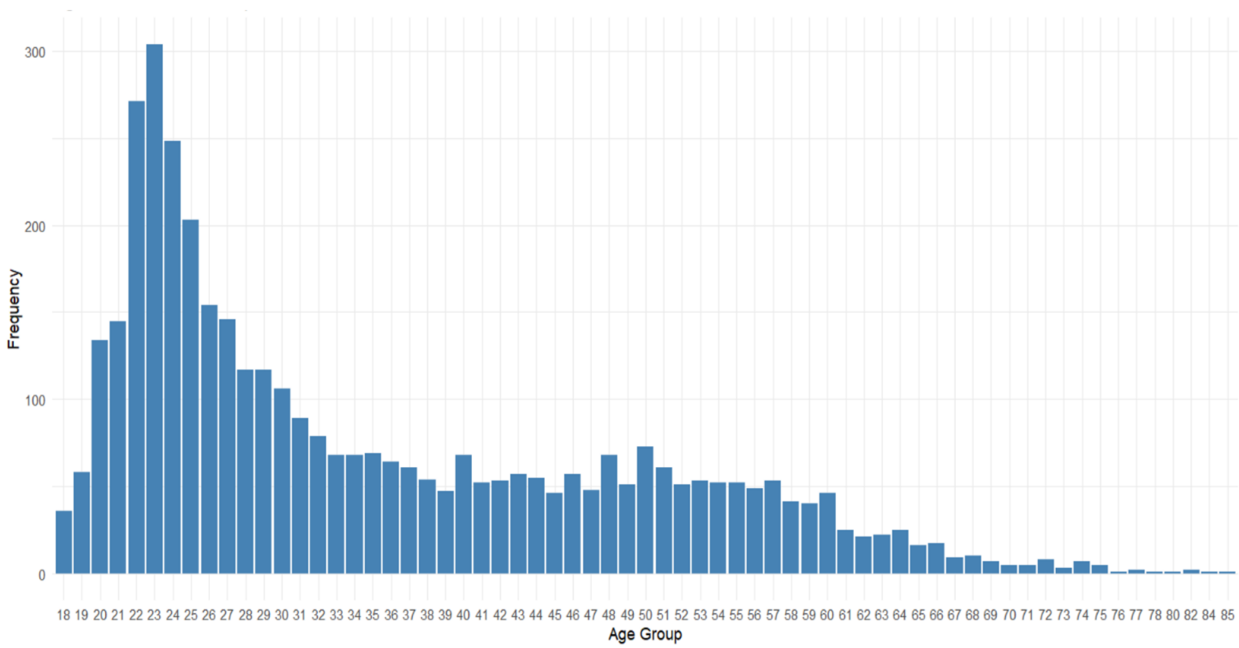

Figure 2. Age Distribution of Respondent

(Source: Created by learner)

The age distribution visualization indicates that most of the respondents were in the younger age group such as from 22 to 30 years. A high rate of participation was seen around the early twenties, suggesting high representation of young consumers. However, the age groups were also included as well, with a gradual decrease in frequency as the age increased. This distribution reflects a diversity of consumer groups and a higher level of participation with younger people.

B. Psychological Impact Analysis

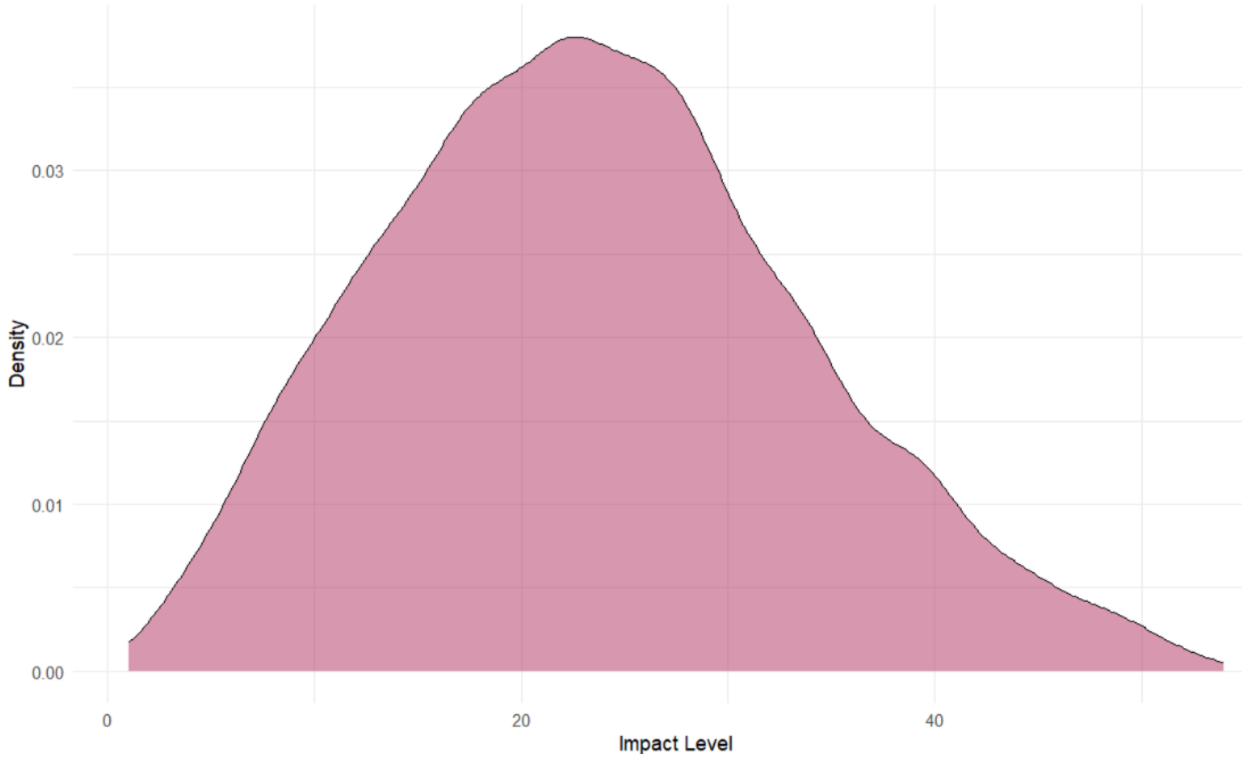

Figure 3. Psychological Impact Distribution

(Source: Created by learner)

It is revealed that during the COVID 19 pandemic, consumers' responses were observed at various levels of psychological impact from the distribution visualization. The density curve shows that the majority of the respondents reported a moderate level of psychological influence, with the highest peak located in the middle range of impacts. In addition, there are differences in the distribution of the consumers, indicating that the fear, uncertainty, and emotional responses had different effects on different people during the pandemic period.

C. Consumer Buying Behavior Pattern Analysis

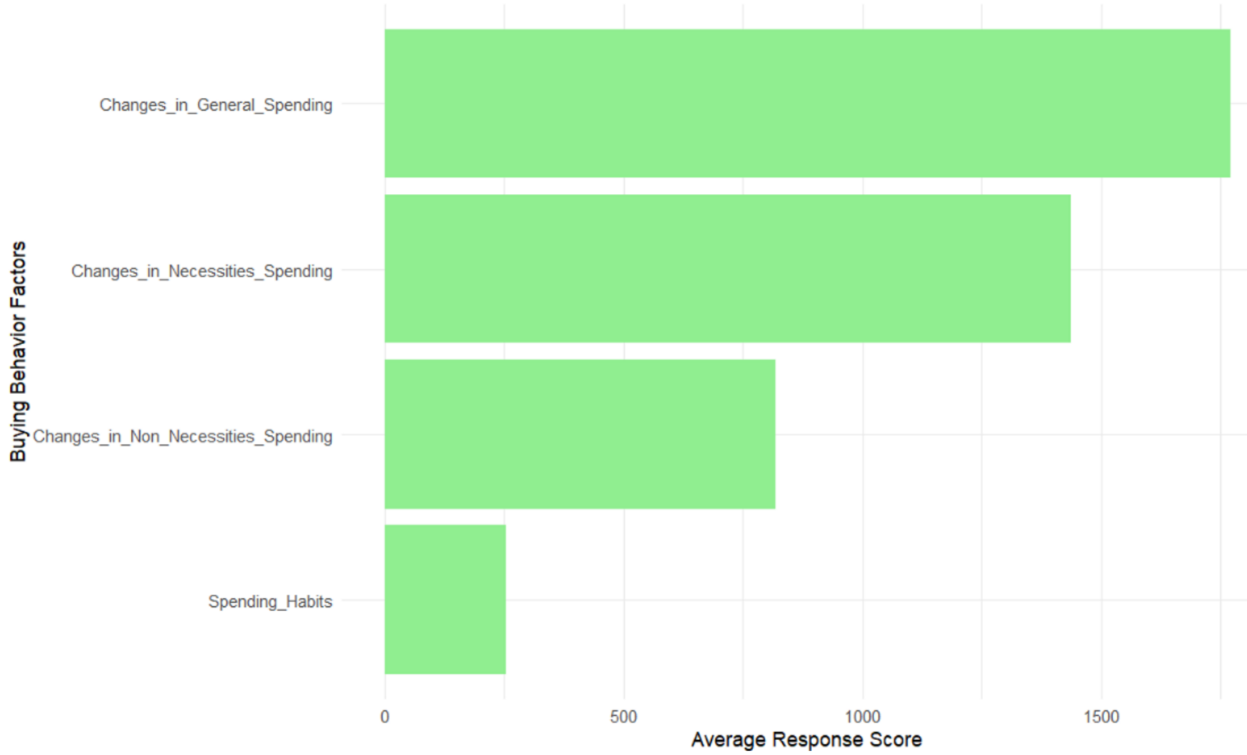

Figure 4. Consumer Buying Behavior Pattern During Covid-19

(Source: Created by learner)

The visualization of the consumer buying behavior pattern shows that there were clear variations in the spends during the COVID 19 pandemic. The average response was the highest for changes in general spending followed by changes in necessity spending. That indicates consumers made substantial changes to how they shopped overall during the crisis. Responses for non-necessity spending and general spending habits were relatively low, suggesting a shift in consumer priorities towards essential spending activities.

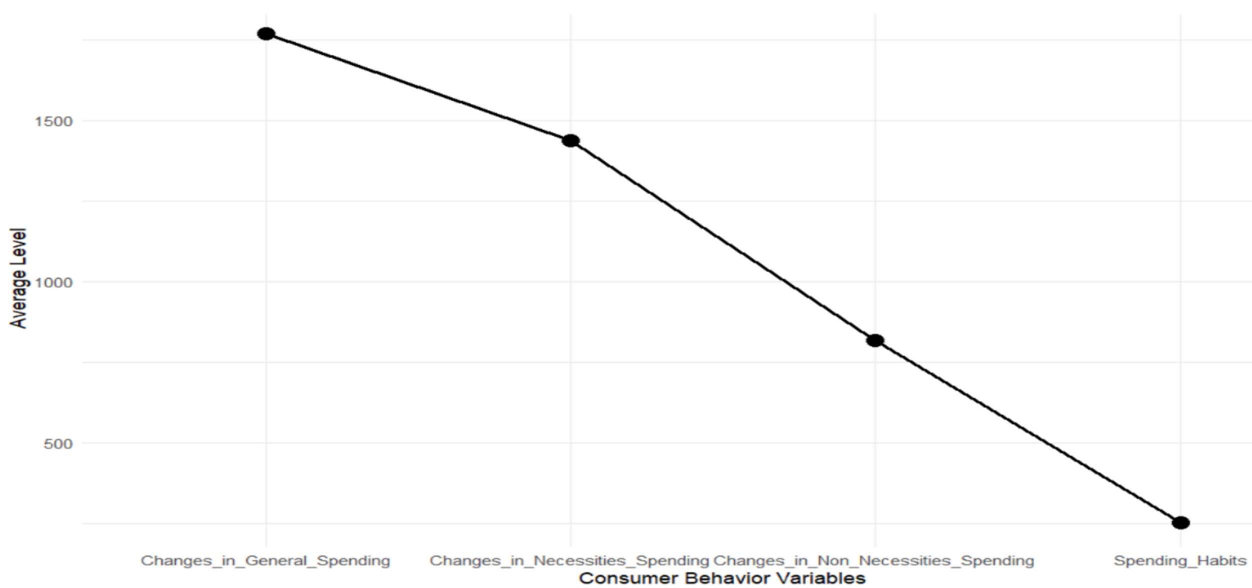

Figure 5. Consumer Purchasing Preference Pattern

(Source: Created by learner)

The consumer purchasing preference pattern visualization indicates that there is a downward trend in each of the consumer behavior variables. General spending experienced the highest average change as there was significant modification in spending during COVID 19. There was also a high degree of influence for necessity spending, while non necessity spending and regular spending habits were lower in influence. The pattern shows that the pandemic conditions resulted in consumers changing their buying habits and making essential products their top priority.

D. Relationship Between Covid Factors and Purchasing Behavior

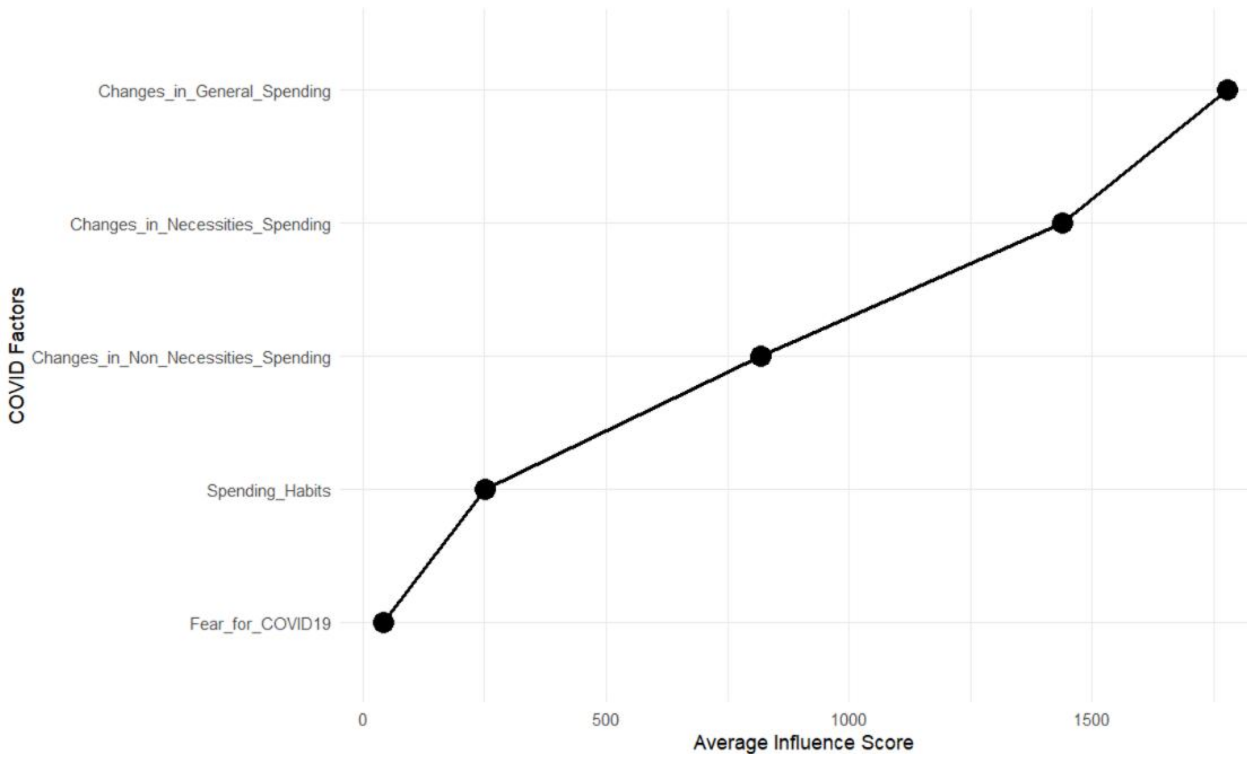

**Figure 6. Influence of Covid-19 Related Factors on Consumer Behavior **

(Source: Created by learner)

This visualization indicates COVID-related factors had different degrees of impact on consumer behavior. The upward trend suggests that the average influence score continued to rise as spending moved away from the fear of COVID-19 and towards changes in general spending. The report indicates that the overall spending growth was most impacted, whereas COVID-19 related fear was least, showing the gradual adaptation of spending patterns and priorities during COVID-19.

VI. Discussion of Results/Findings

This study's findings indicate that young consumers were the key players and were psychologically affected in varying magnitudes during the Covid-19 pandemic. The age segment of 22–30-year-olds had the highest number of respondents, proving that millennials are active users of digital technology and online shopping, as reported in prior studies. Psychological effects of visualization with moderate levels are comparable to literature, in which there was fear anxiety and uncertainty, but these were different for each participant. Other studies by Di Crosta and Yuen also attributed emotional reactions and panic buying to fear and the desire to feel safe, as evidenced by the complex psychological reaction in the results.

Consumer spending and consumer preferences in the visualisations strongly reinforce the findings of the literature. The findings indicate an increase in the number of changes in total and necessity spending, and a decrease in the number of changes in non-necessity spending and regular habits. This is in line with Loxton and Bausch reporting that consumers prioritised essential products like food health & hygiene but cut back on luxuries and entertainment products. The downward trend in unnecessary spending and the priority on essential products in the visualizations have confirmed that during the pandemic consumers have turned towards a purchase that is more oriented towards safety and the needs. This also helps to confirm that economic and lifestyle issues drove the emergence of new spending habits.

This correlation between Covid factors and purchasing behaviour only further reinforces the correlation between the visual outcomes and previous research. This indicates that over time consumers were adapting their shopping habits to more generally shift in spending habits, rather than simply adapting to Covid-19, and that they became more accustomed to new shopping routines, particularly online. This aligns with research conducted by Beyari Gu and Hashem, which found that digital platforms became more accepted and trusted, and that online shopping became a habit. The overall results discussion confirms that the results of the visual findings and literature reported above are supporting the research direction on the psychological aspects of digital transformation and consumer buying behaviour during Covid-19.

VII. Future Work

The study can be extended to consumer behaviour of different age groups, income levels and regions with a larger and more diversified sample. The current study primarily captures the attitudes of the younger consumers implying that older consumers, families and consumers from other economic backgrounds can be included in future research. This will enable researchers to gain insights into the responses of various groups to the pandemic and if purchases were affected similarly or differently. Primary data collection can also be done in the future, by conducting surveys or interviews to get real-time thoughts and emotions from consumers. This will provide more insight into decision making in uncertain circumstances.

Another key area of research is the examination of the effects of the pandemic on consumer behaviour in the long-term. It is important to understand what people have learned to do online and whether they will do it again, as many people felt comfortable dealing with online shopping and digital payments. Additionally, researchers can examine how companies can leverage data analytics in anticipation of consumer needs in future crises. The study will also help to understand the consumer's adaptation to new shopping methods, which involves researching the role of technology trust and digital literacy. Future research may also be used to compare consumer behaviour during Covid-19 with other crisis scenarios to provide a pattern of behaviours. This will aid in the development of more effective plans for future disasters on the part of the business and the policy makers.

IX. Conclusion

The study shows that the Covid-19 pandemic created clear changes in consumer buying behavior and these changes were strongly influenced by psychological factors and digital transformation. The results indicate that consumers focused more on essential products and reduced spending on less essential items which supports the findings from previous studies. The shift toward online shopping also became stronger as people preferred safer and more convenient ways to buy products. The analysis of the dataset shows that fear uncertainty and emotional responses played an important role in shaping buying decisions. The study highlights that consumer behavior during a crisis is guided by both practical needs and emotional reactions. Overall, the research provides useful insights for businesses and researchers to understand how consumers respond during uncertain times and how data analytics can help identify important patterns in their behavior.

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