MARKET SEGMENTATION ANALYSIS

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Chapter : 1 MARKET SEGMENTATION

1.1   Strategic and Tactical Marketing

The aim of market is to provid e a genuine needs and desire of the consumers with the offerings of suppliers. This alignment benefits both parties and is central to an organization's marketing planning process.It is a logical sequence and a series of activity align to the setting of marketing .A marketing plan consists of two componenets

Stretegic Marketing Plan:-

Strategic market plan mainly focuses on the long -term goals,and overall deirections of the organisation. It determine decisions like identifies consumer needs , desires, strength, and weakness to the organisations. . it conducting SWOT (Strength , Weakness, Opportunity , Threats)analysis and determine which market segment to target and how to positions the organisations. The strategy marketing plan is like the choosing the mountain to climb and organise a map and figuring out the location in a hiking epedition .

Tactical Marketing Plan :

 Tactical Marketing plan is like a short term goal basically it converts a strategic plan into detailed ,short term actions, the tactical marketing plan depends on strategy marketing plan but strategy marketing plan does not depends on tactical marketing plan.tactical marketing plan focuses 4P's that is product , price , place , promotion . The tactical plan ensures the organization efficiently reaches its short-term objectives, and to selecting the right gear and timing for the hike. The tactical marketing plan is mainly focuses on the eqipment

1.2 Defination of Market Segementation

Market segmentation is a decision-making tool for the marketing manager in the crucial task of selecting a target market for a given product and designing an appro priate marketing mix Market segmentation is a key building blocks and critical tool in strategic marketing, enabling organizations to identify and target specific consumer groups. Market segmentation is essential for marketing success:It involves dividing a heterogeneous market into smaller, more homogeneous segments, each characterized by distinct consumer needs, behaviors, or preferences.

o **Smith (1956)** : smith was the fist to propose te use of senegmentation as a market strategy, smith defines market segmentation as viewing a diverse market as a collection of smaller, similar markets, each with its own unique characteristics.

o **Haley (1985)** : haley defines the segmentation means cutting markets into slices. Ideally, consumers belonging to the same market segments– or sets of buyers.

o **Tynan and Drayton (1987)** : Tynan and Drayton describe it as a decision-making tool that helps marketers select a target market for a product and design an appropriate marketing mix.

market segmentation can be based on various criteria, such as demographics, psychographics, or behaviors. Effective segmentation allows companies to focus on the most promising segments, thereby maximizing their marketing efficiency and effectiveness.

1.3 The Benefits of Market Segementation

Market segmentation has a number of benefits in strategic and operational advantages to organizations. At a high level, it compels companies to evaluate their current market position and future goals, promoting self-reflection on core competencies compared to competitors and fostering a deeper 3 understanding of consumer needs. Market segmentation offers an opportunity to think and rethink, and leads to critical new insights and perspectives.This introspection often leads to valuable insights and perspectives. When effectively implemented, market segmentation offers tangible benefits:

✚ Micro Marketing or Hyper-Segmentation :

Taking market segmentation to the extreme would mean to actually be able to offer a customised product or service to very small groups of consumers. This approach is referred to as micro marketing or hyper-segmentation

✚ Enhanced Understanding of Consumer Differences:

By identifying distinct consumer segments, organizations can better align their strengths with the specific needs of these segments, creating a foundation for long-term competitive advantage. In some cases, this can lead to market dominance within a niche segment, particularly if that segment aligns perfectly with the organization's capabilities and offers growth potential without attracting significant competition.

✚ Increased ROI on Marketing Efforts:

A marketing mix tailored to the needs of specific segments is more efficient, reducing wasted effort on consumers outside the target segments. For smaller organizations, focusing on distinct needs within a niche segment may be crucial for survival due to limited financial resources.

✚ Improved Sales Management:

Segmentation allows for targeted sales efforts, focusing on specific consumer groups rather than a broad audience, thereby increasing the effectiveness of sales strategies.

🞕 Organizational Benefits:

Market segmentation can also contribute to team building and improved communication across different organizational units. The collaborative nature of segmentation tasks often requires input from various departments, fostering a more integrated approach to marketing and business strategy.

1.4 The Costs of Market Segmentation

A large number of people have to dedicate a substantial amount of time to conduct a thorough market segmentation analysis. If a segmentation strategy is pursued, more human and financial resources are required to develop and implement a customised marketing mixMarket segmentation requires significant resource investment. Conducting a thorough analysis and developing a customized marketing mix demands time, human resources, and financial commitment. Additionally, ongoing evaluation and monitoring of the strategy to adapt to market changes require continous effort.

If not executed well, segmentation can waste resources without yielding competitive advantage, potentially demoralizing the team involved. Therefore, organizations must carefully consider whether the potential benefits justify the substantial investment before committing to a segmentation strategy. It is for this very reason, that an organisation must make an informed decision about whether or not to embarkonthelongjourneyofmarketsegmentation analysis, and the even longer journey of pursuing a market segmentation strategy.

Chapter :2 Market Segmentation Analysis

2.1 The Layers of Market Segmentation Analysis

Market segmentation analysis involves grouping consumers into segments based on similar product preferences or characteristics. This process, primarily statistical and exploratory, relies heavily on the decisions made by data analysts and the involvement of organizational users who understand the broader mission of the organization. All these tasks are still primarily technical in nature. Collecting good data, for example, is critically important. The statistical segment extraction process at the core of market segmentation analysis cannot compensate for bad data. The grouping of consumers can always only be as good as the data provided to the segment extraction method

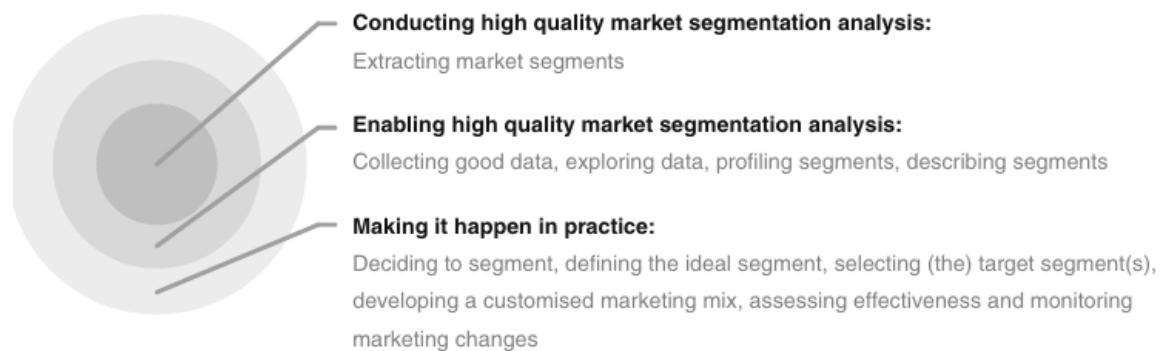### 1. Core Layer: Extracting Market Segments

At its core, market segmentation analysis focuses on extracting segments from consumer data. This technical process requires accurate and relevant data to ensure effective grouping. Poor data quality undermines the effectiveness of the segmentation.

2. Enabling High-Quality Analysis

To ensure high-quality analysis, several technical tasks are essential: data collection, data exploration, segment profiling, and segment description. Profiling and describing segments provide insights necessary for understanding and targeting specific segments, which in turn informs the development of a customized marketing mix

3. Implementation Layer

Beyond the technical aspects, successful market segmentation requires organizational implementation. This includes assessing whether segmentation will offer new market opportunities, committing to a long-term strategy, and making strategic decisions. Users, rather than data analysts, must select target segments based on the organization's strengths and market needs. Subsequently, they develop a marketing plan and customized marketing mix for the chosen segments.

Conducting high quality market segmentation analysis:
Extracting market segments

Enabling high quality market segmentation analysis:
Collecting good data, exploring data, profiling segments, describing segments

Making it happen in practice:
Deciding to segment, defining the ideal segment, selecting (the) target segment(s), developing a customised marketing mix, assessing effectiveness and monitoring marketing changes

Fig 1 The layers of market segmentation analysis

2.2 Approaches to Market Segmentation Analysis

Market segmentation analysis involves the premise that organisations are not in the position to choose any of the available approaches to market segmentation analysis due to organisational constraints. categorizing the market into distinct groups to better target consumers. There isn't a single best approach; rather, different methods are applied based on organizational constraints and the nature of segmentation variables.

2.2.1 Based on Organizational Constraints:

➕ **Segment Revolution:**

This is a radical approach where an organization starts from scratch, entirely rethinking its marketing strategy based on a new segmentation analysis. It involves significant changes and is often not feasible due to organizational limitations. So this appraoch refer to the requiring the most radical change in the organisation as segment revolution.

➕ **Segment Evolution:**

This approach involves refining existing segments rather than starting a new. It's a less drastic change and is usually informed by data and internal workshops. This method adjusts current strategies to better target refined segments.

● **Segment Mutation:**

This approach relies on exploratory research, where segments are discovered unintentionally. In the era of big data, these segments often emerge from data mining and ongoing analysis.

2.2.2 Based on the Choice of Segmentation Variables:

Unidimensional (A Priori) Segmentation:

This approach uses a single segmentation variable, like age or gender, to categorize consumers. It relies on commonsense and pre-existing knowledge rather than extensive data analysis. It's simple but can be effective when the variable is a strong predictor of consumer behavior.

Multidimensional (Data-Driven) Segmentation:

This method uses multiple variables to create segments, making it more complex and data-intensive. It's a posteriori, meaning segments are identified after data analysis. This approach is more proactive and relies on primary research, making it ideal for identifying detailed consumer profiles.

2.3 Data Structure and Data-Drivem Market Segmentation Approaches

Market segmentation assumes that segments naturally exist in the data, but this is rarely the case. Segmentation can be:

Natural Segmentation:

The term natural segmentation reflects the traditional view that distinct market segments exist in the data, and that the aim of market segmentation analysis is to f ind them. Segments are clearly present in the data and are stable across repeated analyses.

Reproducible Segmentation:

The term reproducible segmentation refers to the case where natural market segments do not exist in the data. But the data are not entirely unstructured either., some structure in the data allows for similar segmentation results across repeated analyses. This makes the segmentation more reliable.

Constructive Segmentation:

The term constructive segmentation refers to the case where neither cluster structure nor any other data structure exists, which would enable the data analyst to reproduce similar segmentation solutions repeatedly across replications.When data lacks clear structure, segments are artificially created. Although not naturally occurring, these segments can still be strategically useful.

Understanding the data structure before segmentation is crucial, as it guides the choice of methodology and helps avoid misinterpretation. Data-driven segmentation requires careful planning and often benefits from repeated analysis to ensure stability and strategic relevance.

2.4   Market Segmentation Analysis Step-by-Step

Market segmentation analysis involves a ten-step approach that is applicable to both commonsense an d data-driven segmentation strategies. These steps guide organizations in deciding whether to pursue a segmentation strategy and in implementing it effectively. Below is a summary of the ten steps:

1. **Deciding (not) to Segment:**

Evaluate if the market is suitable for segmentation and whether a long-term commitment is feasible.

2. **Specifying the Ideal Target Segment:**

Define the characteristics of the ideal target segment.

3. **Collecting Data:**

Gather relevant data, focusing on segmentation variables and descriptor variables. 4. Exploring Data: Analyze and pre-process the data to ensure it's suitable for segmentation.

4. **Extracting Segments:**

Divide consumers into segments using appropriate segmentation methods, such as distance-based, model-based, or hybrid algorithms.

5. **Profiling Segments:**

Identify the key features of each market segment.

6. **Describing Segments:**

Provide a detailed description of each segment.

7. **Selecting the Target Segment(s):**

Evaluate and choose one or more market segments to target.

8. **Customizing the Marketing Mix:**

Develop a tailored marketing mix for the selected segment(s).

9. **Evaluation and Monitoring:**

Assess the success of the segmentation strategy and continuously monitor the segments for changes in size or characteristics.

While the steps are consistent for both commonsense and data-driven approaches, data-driven segmentation often requires additional decisions and tools to implement the process effectively.

Chapter 3

Step 1: Deciding (not) to Segment

3.1 : Implications of Committing to Market Segmentation

The key implication is that the organisation needs to commit to the segmentation strategy on the long term. Market segmentation is a marriage, not a date. The commitment to market segmentation goes hand in hand with the willingness and ability of the organisation to make substantial changes .Market segmentation is a crucial marketing strategy for many organizations, but it isn't always the best choice.

Before committing resources, it is essential to consider the long-term implications. Market segmentation requires signifiicant changes and investments, as it involves more than just a superficial effort – it is a long-term commitment that may involve developing new products, modifying existing ones, altering pricing, and restructuring the organization to focus on different market segments.

Embracing market segmentation may necessitate various changes, such as developing new products, modifying existing ones, adjusting pricing and distribution channels, and revising communication strategies. These changes can also influence the organization's internal structure, requiring adjustments to align with the targeted market segments.

To maximize the benefits of market segmentation, organizations are advised to organize around market segments rather than product lines. Creating strategic business units focused on specific segments ensures ongoing attention to the changing needs of these segments.

The decision to pursue market segmentation must be made at the highest executive level and consistently communicated across the organization. The strategy should only be pursued if the expected increase in sales justified the costs involved in implementing it. must be systematically and continuously communicated and reinforced at all organisational levels and across all organisational units. , adopting market segmentation demands significant organizational dedication and continuous efforts to reap its rewards effectively.

3.2 Implementation Barriers

 Market segment analysis is a crucial process for businesses to identify and understand their target audience. However, several obstacles can arise during this analysis, hindering the process and impacting the accuracy of results.Several barriers can impede the successful implementation of a market segmentation strategy. These barriers can be grouped into three categories:

1. **Data availability and quality:**
   - Obtaining relevant and reliable data for market segment analysis can be challenging.
   - The data may be scattered, incomplete, or outdated, making it difficult to draw meaningful conclusions about the target market.

2. **Senior Management:**

   - Lack of leadership, pro-active championing, commitment, and involvement from senior management.
   - Insufficient allocation of resources for segmentation analysis and implementation.

3. **Organizational Culture:**

   - Lack of market or consumer orientation, resistance to change and new ideas,, poor communication, and short-tern thinking.
   - A lack of training and understanding of market segmentation among senior management and the segmentation team.

4. **Operational and Process-Related Issues:**

   - Lack of a formal marketing function or qualified marketing and data experts.
   - Insufficient financial resources or inability to make necessary structural changes.
   - Poor planning, unclear objectives, and time pressure can also hinder the process.

5. **Rapidly changing market dynamics:**
   - Markets can evolve quickly due to technological advancements, consumer preferences, or economic shifts.
   - Staying up-to-date with these changes can be demanding, and outdated data may lead to erroneous segment analysis.

These barriers should be identified early and addressed proactively. If they cannot be removed, the organization should reconsider pursuing market segmentation. To overcome these obstacles, businesses should invest in high-quality data collection methods, regularly update their market research, collaborate with domain experts, and be open to adapting their strategies based on new insights and changing market conditions. Additionally, employing advanced analytics and AI driven tools can help in making sense of complex data and identifying meaningful patterns within the market segments.

3.3 Step 1 Checklist

A checklist has been pr ovided to help organizations determine their readiness for market segmentation. Key tasks include:

   - Assessing whether the organization's culture is market-oriented, open to new ideas, and willing to change.

   - Ensuring strong communication across units and the ability to make significant structural changes

- Securing visible and active commitment from senior management, including financial support.

- Ensuring the team understands the market segmentation concept and its implications.

- Assembling a qualified segmentation team, including marketing and data experts, and setting up an advisory committee.

- Clarifying the objectives of the segmentation analysis, developing a structured process, assigning responsibilities, and ensuring there is enough time to conduct the analysis without undue pressure.

These steps are crucial in deciding whether to proceed with market segmentation and in laying the groundwork for a successful implementation.

Chapter : 4

Step 2: Specifying the Ideal Target Segment

For a market segmentation analysis to be valuable to an organization, user input must extend beyond just a brief at the beginning or finalizing the marketing mix. Instead, the user's involvement should span most stages of the process, actively engaging with the technical aspects of market segmentation analysis.

4.1 Segment Evaluation Criteria

Importance of User Input:

The third layer of maket segmentation requires continuous user involvement beyond initial briefing and final marketing mix development. This user input shapes the entire segmentation analysis process.

Role in Segmentation Analysis:

 After committing to a segmentation strategy, the organization must establish two sets of segment evaluation criteria in this step, which guides the data collection (Step 3) and target segment selection (Step 8).

- **Knock-Out Criteria:** These are non-negotiable essential features that segments must meet for consideration.
- **Attractiveness Criteria:** These criteria help evaluate the relative attractiveness of market segments that meet the knock-out criteria.

4.2 Knock-Out Criteria

- **Purpose:** To ensure segments qualify for further assessment based on attractiveness criteria.

● **Key Criteria :**

- **Homogeneity:** Segment members must be similar to one another.
- **Distinctness:** Segment members must differ from members of other segments.
- **Size:** The segment must be large enough to justify targeting.
- **Fit with Organizational Strengths:** The organization must have the capability to meet segment needs.
- **Identifiability**: It must be possible to identify segment members in the marketplace.
- **Reachability:** There has to be a way to get in touch with members of the segment in order to make the customised marketing mix accessible to them.

4.3 Attractiveness Criteria

Attractiveness criteria in market segmentation analysis are not binary but involve rating each market segment on a scale of more or less attractive concerning specific criteria. Rather than simply complying or not complying, segments are evaluated based on their performance against each criterion. The overall attractiveness of a market segment is determined by considering its ratings across all criteria. This comprehensive evaluation process helps in selecting target segments during Step 8 of the market segmentation analysis.

- **Purpose:**

To evaluate and rate market segments based on specific criteria, determining their overall attractiveness for targeting.

- **Nature:**

Unlike knock-out criteria, these are not binary. Each segment is rated on how well it meets each attractiveness criteria.

- **Selection Process:**

The segmentation team selects and assigns relative importance to the most relevant attractiveness criteria for the organization, guiding the final target segment selection in Step8.

4.4   Implementing a Structured Process

- **Approach:**

A structured process, such as a segment evaluation plot, is recommended to assess segment attractiveness and organizational competitiveness.

- **Team Involvement:**

Representatives from various organizational units should be involved to ensure all perspectives are considered, and because the segmentation strategy will impact the entire organization.

- **Outcome:**

At the end of this step, the segmentation team should have selected approximately six attractiveness criteria, each with an assigned weight indicating its importance.

4.5 Step 2 Checklist

- Convene a segmentation team meeting.
- Agree on knock-out criteria (homogeneity, distinctness, size, match, identifiability, reachability).
- Present knock-out criteria to the advisory committee for review.
- Individually and collectively assess available attractiveness criteria.
- Agree on a subset of six attractiveness criteria and their relative weightings.
- Present the final criteria and weightings to the advisory committee for approval.
- This structured approach in Step 2 ensures that the organization is well-prepared for the data collection and target segment selection processes that follow.
- Present the selected segment attractiveness criteria and the proposed weights assigned to each of them to the advisory committee for discussion and (if required) adjustment.

Chapter : 5

Step 3: Collecting Data

5.1 Segmentation Variables

Data-driven market segmentation, on the other hand, involves using multiple segmentation variables as the starting point to identify existing or artificially created market segments that are beneficial for the organization.

Market segmentation relies on empirical data to identify and describe market segments. **Commonsense segmentation** uses a single characteristic, like gender, to divide a sample, while other characteristics, such as age or benefits sought, are used to describe the segments.

Data-driven segmentation involves multiple variables to identify segments based on shared characteristics, like vacation benefits.

The accuracy of segmentation depends on the quality of the data used. Reliable data ensures correct segment assignment and effective marketing strategies. Data can come from various sources, but the most useful reflects actual customer behaivour. Surveys are common but may not always capture true behaivour, so exploring multiple data sources is recommended.

5.2 Segmentation Criteria

Before extracting market segments, organizations must decide on a segmentation criterion, which differs from a segmentation variable. While a segmentation variable is a specific, measurable favtor like age or income, a segmentation criterion refers to the broader nature of information used to create segments.

Key Segmentation Criteria:

5.2.1   Geographic Segmentation:

The simplest approach, based on consumers' locations, is useful for targeting specific regions. However, it may not capture other important characteristics that influence consumer behaivour.

5.2.2   Socio-Demographic Segmentation:

 Uses factors like age, gender, income, and education to create segments. It's easy to implement and can sometimes explain product preferences, but it often lacks depth, as these factors alone explain only a small percentage of consumer behaivour variance.

5.2.3   Psychographic Segmentation:

Groups people based on psychological factors like beliefs, interests, and lifestyle. This approach provides deeper insights into consumer behaivour but is more complex to implement and relies heavily on the accuracy of the data.

5.2.4   Behavioural Segmentation:

Focuses directly on consumer behaviour, such as purchase history or spending patterns. It's highly relevent for understanding consumer actions but may be limited by the availability of data, especially for potential customers who haven't yet engaged with the product. Each criterion has its advantages and drawbacks, and the choice depends on the specific product or service being marketed and the data available.

5.3 Data from Survey Studies

Survey data is popular for market segmentation due to its low cost and ease of collection, but it can be biased, affecting results. Key considerations include choosing appropriate variables, suitable response options, minimizing biases, and ensurin a sufficient sample size.

Collecting data through survey studies is a common and effective method in market segment analysis. Surveys allow you to gather valuable insights directly from consumers and can be tailored to specific segmentation variables to understand different market segments. Here's a step-by-step guide on how to collect data from survey studies for market segment analysis:

5.3.1   Choice of Variables

- **Importance:**

Selecting the right variables is crucial for effective market segmentation

- **Challenges:**

 Including unnecessary variables can cause respondent fatigue, lower response quality, and complicate data analysis. Unnecessary variables, known as "noisy variables", can mask the correct segmentation solution.

- **Recommendations:**

Ask all necessary and unique questions while avoiding redundant or unnecessary ones. Conducting exploratory research can help identify key variables for inclusion.

5.3.2 Response Options

Types of Data:

- **Binary/Dichotomous Data:** Clear and well-suited for segmentation analysis.
- **Nominal Variables:** Can be transformed into binary data.
- **Metric Data:** Allows for any statistical procedure, making it ideal for segmentation analysis.
- **Ordinal Data:** Common in surveys but not ideal for segmentation due to undefined distances between options.
- **Recommendation:** Prefer binary or metric response options to avoid complications in data-driven segmentation analysis. Visual analogue scales can be used when finer nuances are needed.

5.3.3 Response Styles

- **Biases:**

Survey data is prone to response biases, which can distort segmentation results. Common biases include tendencies to use extreme options or agree with all statements.

- **Impact:**

Response styles can mislead segment extraction algorithms, resulting in incorrect segmentation solutions.

- **Recommendation:**

Minimize the risk of capturing response styles during data collection and remove respondents with strong biases if identified.

5.3.4 Sample Size:

- **Importance:**

A sufficient sample size is critical for accurate market segmentation. • Recommendations:

- **General Guidelines:**

For simple latent class analysis, the sample size should be at least 2p (where p is the number of segmentation variables). For more complex scenarios, a sample size of at least 60 to 100 times the number of segmentation variables is recommended.

- **Market and Data Characteristics:**

Larger sample sizes improve the accuracy of segmentation, but highly correlated variables or other challenging characteristics may still hinder the algorithm's performance.

5.4 Data from Internal Sources

Internal data, such as scanner data, booking records, and online purchase history, is valuable for market segmentation as it reflects actual consumer behavior, avoiding biases like imperfect memory or social desirability. This data is often automatically generated, reducing collection effort. However, a key limitation is that it may over-represent existing customers, missing insights on potential future customers who may have different behaviors.

it may be biased towards existing customers, lacking information about potential new customers and their consumption patterns.

5.4 Data from Experimental Studies

Experimental data can serve as a valuable source for market segmentation analysis. These data can originate from field or laboratory experiments.Experimental data, derived from field or laboratory experiments, can be a valuable source for market segmentation. For instance, consumer responses to advertisements or results from identify how specific product attributes and their levels influence consumer preferences, offering insights that can guide segmentation strategies.

Consumers then indicate their preferences among different product combinations. This information provides insights into how each attribute and attribute level influence consumer choice, which can be utilized as segmentation criteria.

5.6 Step 6 Checklist

- Convene a team meeting to discuss potential segmentation variables.
- Identify additional consumer characteristics necessary for a detailed understanding of market segments.
- Determine data collection methods to accurately capture both segmentation and descriptor variables.
- Design the data collection process to minimize bias and systematic errors.
- Collect the data based on the established plan.

Step 4:

Exploring Data

6.1 A First Glimpse at the Data

After data collection, the exploratory data analysis stage involves cleaning and preprocessing the data to prepare it for segmentation analysis. This step helps in identifying the measurement levels of variables, examining univariate distributions, and assessing

dependencies between variables. It may also include preprocessing the data to ensure compatibility with segmentation algorithms.

 For instance, in a dataset containing travel motives of 1,000 Australian residents, variables like age, income, and travel preferences are examined. The data is inspected for completeness, identifying missing values or inconsistencies, and transforming variables when necessary. This exploration guides the selection of appropriate segmentation methods and provides initial insights into potential market segments.

At a more technical level, data exploration accomplishes the following tasks:

- identifying the measurement levels of the variables,
- investigating the univariate distributions of each variable, and
- assessing the relationships between variables.

Additionally, data may need preprocessing and organization to make it suitable for input into various segmentation algorithms.

6.2   Data Cleaning

Before data analysis, it's crucial to clean the data by verifying that all values are correctly recorded and categorical variable labels are consistent. For example, age should fall within a plausible range, and gender should only include permissible values. In the Australian travel motives dataset, no errors were found for gender and age, but the income variable required reordering. This was addressed by converting the income categories into an ordered factor in R.

The cleaning process was verified through cross-tabulation to ensure accuracy. All steps were documented for reproducibility, allowing for consistemt future analyses. The cleaned dataset was then saved for future use.

In a similar manner, the levels of categorical variables need scrutiny to ensure they only contain valid values. For example, in surveys, gender typically has two values: "female" and "male." Unless the questionnaire provided a third option, the data should only reflect these two choices. Any other values present in the data would be considered impermissible and must be rectified during the data cleaning process.

6.3 Descriptive Analysis

Understanding the data through descriptive analysis Is crucial to avoid misinterpretation during more complex analyses. Descriptive numeric and graphical representations, such as histograms, boxplots, and scatter plots, provide valuable insights.

- **Numeric Summary:**

In R, the 'summary()' function gives a range, quartiles, mean for numeric variables, and the frequency counts for categorical variables, along with missing values.

- **Histograms:**

These visualize the distribution of numeric variables, showing the frequency of observations within certain value ranges. They help identify if a distribution is unimodal, symmetric, or skewed. The R package 'lattice' can be used to create histograms, including segmented ones.

- **Boxplots:**

Box-and-whisker plots summarize data into minimum, first quartile, median, third quartile, and maximum values, providing insight into distribution characteristics. They are particularly useful for identifying outliers.

- **Dot Charts:**

These charts can be used to visualize the percentage of agreement with various travel motoves, providing an intuitive overview of data structure.

Graphical methods reveal important aspects of data distribution, helping to confirm the suitability of variables for market segmentation analysis by showing differences in responses among individuals.

6.4 Pre-Processing

In data analysis, pre-processing is a crucial step to prepare the data for further analysis. This section covers the pre-processing of both categorical and numeric variables.

6.4.1 Categorical Variables

- **Merging Levels:**

When categorical variables have too many categories, merging them into fewer, more balanced groups can simplify analysis

- **. Converting to Numeric:**

Ordinal variables, like income levels or Likert scales, can be converted to numeric if the categories are assumed to have equal intervals. This is useful for methods requiring numeric data but requires careful consideration due to potential response biases.

- **Binary Variables:**

Binary variables (e.g., yes/no responses) can be converted to numeric values (0/1) for analysis, making them easier to use in statistical procedures.

Binary answer options, on the other hand, are less susceptible to capturing response styles and do not require pre-processing. Binary variables can be easily converted to numeric form, and most statistical procedures work effectively with two categories (0 and 1).

6.4.2 Numeric Variables

- **Standardization:**

Standardizing numeric variables, by adjusting them to have a mean of 0 and a standard deviation of 1, ensures equal influence in analysis, particularly in distance-based methods.

The typical standardization method in statistics involves subtracting the empirical mean (x) from each observation and dividing by the empirical standard deviation (s) of the variable. This process is represented as follows for a set of n observations of a variable

$x = \{x1, ..., xn\}$:

$z = (x - x) / s$

After standardization, the empirical mean of the transformed variable (z) becomes 0, and the empirical standard deviation becomes 1.

6.5 Principal Components Analysis

Principal Components Analysis (PCA) is a technique used to transform a multivariate dataset with metric variables into a new dataset with uncorrelated variables known as principal components. These components are arranged in order of importance, with the first component capturing the most variability,

Principal Component Analysis (PCA) is a technique that transforms multivariate data into a set of uncorrelated variables caalled principal components, ordered by the amount of variance they explain. The first principal component captures the most variance, the second captures the next most, and so on. PCA maintains the relative positions of observations and generates as many new variables as the original ones, providing a different perspective on the data.

PCA relies on the covariance or correlation matrix of the numeric variables. If all variables are measured on the same scale and have similar data ranges, the choice between covariance or correlation matrix is not critical.

PCA uses the covariance or correlation matrix of numeric variables. If variables are on different scales, the correlation matrix is preferable. PCA is often used to reduce data dimensionality for visualization by selecting the first few principal components, which capture the most variation.

PCA is useful for visualizing high-dimensional data in lower dimensions, such as plotting the second and third principal components to reveal patterns. It's better for exploring data and identifying correlations than for reducing dimensionality for segmentation, as this might alter the analysis. PCA helps identify redundant variables by highlighting correlations, refining the segmentation base.

6.6 Step 4   Checklist

- Explore the data for inconsistencies and contamination; clean if needed.
- Pre-process the data if necessary.
- Ensure at least 100 consumers per segmentation variable.
- Select a subset of variables if there are too many.
- Choose a subset of uncorrelated segmentation variables