Chapter 5:
Customer Analytics Part I
Overview

Topics discussed:

- Traditional Marketing Metrics
- Customer Acquisition Metrics
- Customer Activity Metrics
- Popular Customer-based Value Metrics
## Traditional and Customer Based Marketing Metrics

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Traditional Marketing Metrics

- Market Share
- Sales Growth
Market Share (MS)

- **Share of a firm**’s sales relative to the **sales of all firms** – across all customers in the given market
- Measured in percentage
- Calculated either on a monetary or volumetric basis
  - Market Share (%) of a firm \( (j) \) in a category \( = 100 \times \left[ \frac{S_j}{\sum_{j=1}^{f} S_j} \right] \)
  - Where: \( j = \text{firm}, \)
  - \( S = \text{sales}, \)
  - \( \sum S_j = \text{sum of sales across all firms in the market} \)
- Information source
  - Numerator: Sales of the local firm available from internal records
  - Denominator: Category sales from market research reports or competitive intelligence
- Evaluation
  - Common measure of **marketing performance**, readily computed
  - Does not provide any information about how sales are distributed across customers
Sales Growth

- Compares changes in sales volume or sales value in a given period to sales volume or value in the previous period
- Measured in percentage
  - Indicates the **degree of improvement in sales performance** between two or more time periods
- Sales growth in period t (%) = \( 100 \times \left[ \frac{\Delta S_{jt}}{S_{jt-1}} \right] \)
  - Where: \( j = \text{firm}, \)
  - \( \Delta S_{jt} = \text{change in sales in period } t \text{ from period } t-1, \)
  - \( S_{jt-1} = \text{sales in period } t-1 \)
- Information source
  - Numerator and denominator: from internal records
- Evaluation
  - Quick **indicator of current health** of a firm
  - Does not provide any information about changes in customer size
Customer Acquisition Metrics

- Group of primary customer based metric = customer acquisition metric

- Concepts:
  - Acquisition Rate
  - Acquisition Cost
Acquisition Rate

- Acquisition = first purchase or **purchasing in the first predefined period**
- Acquisition rate (%) = 100*Number of prospects acquired / Number of prospects targeted
- Denotes average probability of acquiring a customer from a population
- Always calculated for a **group of customers**
- Typically computed on a campaign-by-campaign basis

**Information source**
- Numerator: From internal records
- Denominator: Prospect database and / or market research data

**Evaluation**
- Important metric
- Gives a first indication of the **success of a marketing campaign**
- But cannot be considered in isolation
Acquisition Cost

- Measured in monetary terms
- \[ \text{Acquisition cost (\$)} = \frac{\text{Acquisition spending (\$)}}{\text{Number of prospects acquired}} \]
- Precise values for companies targeting prospects through direct mail
- Less precise for broadcasted communication

- Information source
  - Numerator: from internal records
  - Denominator: from internal records

- Evaluation
  - Difficult to monitor on a customer by customer basis
Customer Activity Metrics

- Average Inter-Purchase Time
- Retention & Defection Rate
- Survival Rate
- Lifetime duration
- $P(\text{Active})$
Customer Activity Measurement

- Objectives
  - Managing marketing interventions
  - Aligning resource allocation with actual customer behavior
  - Providing key input for customer valuation models such as the net-present value (NPV)
Average Inter-Purchase Time (AIT)

- Average inter-purchase time of a customer = \( \frac{1}{\text{Number of purchase incidences from the first purchase till the current time period}} \)
- Measured in time periods
- Important for industries where customers buy on a frequent basis

- Information source
  - Sales records

- Evaluation
  - Easy to calculate
  - Useful for industries where customers make frequent purchases
  - Firm intervention might be warranted anytime customers fall considerably below their AIT
Retention and Defection Rate

- \( R_{rt} \) (\%) = 100*Number of customers in cohort buying in (t) | customer in (t-1) / Number of customers in cohort buying in (t-1)
- \( R_{rt} \) (\%) = 100 – Avg. defection rate (\%)
- Avg. lifetime duration = \( [1 / (1 - R_{r})] \)
- Number of retained customers in period (t+n) = number of acquired customers in cohort at time (t)*\( R_{r} \)
- Avg. defection rate in t (\%) = 100 – \( R_{rt} \)
- Where: \( R_{rt} \) = Retention rate in period t,

\( n = \) Number of elapsed periods

Assuming constant retention rates, number of retained customers in any arbitrary period (t+n) = Number of acquired customers in cohort * Retention rate \(^{(t+n)}\)

Given a retention rate of 75\%, variation in defection rate with respect to customer tenure results in an average lifetime duration of four years
Retention and Defection-Example

- If the average customer lifetime duration of a group of customers is 4 years, the **average retention rate** is \(1 \times (1/4) = 0.75\) or 75% per year, i.e., on an average, 75% of the customers remain customers in the next period.

- The effect for a cohort of customers over time – out of 100 customers starting in year 1, about 32 are left at the end of the 4th year.

  Customers starting at the beginning of year 1: 100
  
  Customers remaining at the end of year 1: 75 \((0.75 \times 100)\)
  
  Customers remaining at the end of year 2: 56.25 \((0.75 \times 75)\)
  
  Customers remaining at the end of year 3: 42.18 \((0.75 \times 56.25)\)
  
  Customers remaining at the end of year 4: 31.64 \((0.75 \times 42.18)\)

- Assuming constant retention rates, the **number of retained customers** at the end of year 4 is \(100 \times 0.75^4 = 31.64\). (Number of acquired customers in cohort * Retention rate \((t+n)\))

  The **defection rate** is 100-75% = 25%
Plotting the entire series of customers that defect each period demonstrates variation (or heterogeneity) around the average lifetime duration of 4 years.
Projecting Retention Rates

- To forecast non-linear retention rates, $R_{rt} = Rc*(1 - e^{-rt})$
  
- Where: $R_{rt}$ = predicted retention rate for a given future period,
  $Rc$ = retention (rate) ceiling, $r$ = coefficient of retention
  
- $r = (1/t)*\ln(Rc) - \ln(Rc - R_{rt})$
Rc = 0.95 means that managers believe the maximum attainable retention rate is 95%.

The known retention rate in period 9 is 80% while it is 82% in period 10.

The parameter r for period 9 is \(\frac{1}{9} \times (\ln(0.95) - \ln(0.95-0.8)) = 0.205\). The r for period 10 is \(\frac{1}{10} \times (\ln(0.95) - \ln(0.95-0.82)) = 0.198\).

\[\Rightarrow\] for both periods r approximates the value 0.2.
Survival Rate

- Measured for cohorts of customers
- Provides a summary measure of how many customers survived from the beginning of the formation of a cohort up to any point in time afterwards
- \( SR_t \) (%) = 100 * \( R_{r_t} \) * \( SR_{t-1} \)
- Where: \( SR = \) Survival Rate
- Number of survivors for period 1 = survival rate for period 1 * number of customers at the beginning
Survival Rate Computation - Example

Number of customers starting at the beginning of year 1: 1,000

<table>
<thead>
<tr>
<th>Period</th>
<th>Retention rate</th>
<th>Survival rate</th>
<th>Survivors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 1</td>
<td>0.55</td>
<td>0.55</td>
<td>550</td>
</tr>
<tr>
<td>Period 2</td>
<td>0.62</td>
<td>0.341</td>
<td>341</td>
</tr>
<tr>
<td>Period 3</td>
<td>0.68</td>
<td>0.231</td>
<td>231</td>
</tr>
<tr>
<td>Period 4</td>
<td>0.73</td>
<td>0.169</td>
<td>169</td>
</tr>
</tbody>
</table>

Number of survivors for period 1 = 0.55*1000 = 550

Survival rate for period 2 = retention rate of period 2 * survival rate of period 1

Survival rate for period 2 = 0.62*0.55 = 0.341 (=34.1%)
CRM at Work: Amazon

- One of the leaders in implementing customer relationship management programs on the Web
- Unique CRM program increased customer acquisition and retention
- In 1999 Amazon acquired 11 million new customers, nearly tripling its number of customers from 1998
- Greatest success in customer retention: Repeat customers during the year accounted for 71% of all sales
- Success attributed to the attempt to learn about customers and their needs and then using this information to offer value-added features
Lifetime Duration

- Average lifetime duration = \[ \frac{\sum_{t=1}^{T} (t \times \text{Number of retained customers in } t)}{N} \]
  - Where:  
    - \( N \) = cohort size, 
    - \( t \) = time period, 
    - \( T \) = time horizon

- Limitations: information is not always complete making the calculation more challenging
  - Differentiate between complete and incomplete information on customer
    - Complete information = customer’s first and last purchases are assumed to be known
    - Incomplete information = either the time of first purchase, or the time of the last purchase or both are unknown
Customer Lifetime Duration when the Information is Incomplete

- Buyer 1: complete information
- Buyer 2: left-censored
- Buyer 3: right-censored
- Buyer 4: left-and-right-censored
Lifetime Duration

- Customer relationships
  - Contractual (“lost-for-good”) = Lifetime duration spans from the **beginning** until the **end** of the relationship (e.g.: mobile phone contract)
  - Noncontractual (“always-a-share”) = Whether a customer is **active at a given point** in time (e.g.: department store purchase)
  - One-off purchases
P(Active)

- Probability of a customer being active in time \( t \)
- \( P(\text{Active}) = \tau^n \)
- Where: \( n \) = the number of purchases in a given period,
  \( \tau \) = is the time of the last purchase (expressed as a fraction of the observation period)

- Non-contractual case
- For an advanced application see: Reinartz, Werner and V. Kumar (2000, 2002)
To compute the P(Active) of each of the two customers in the 12th month of activity

- Customer 1: $T_1 = \frac{8}{12} = 0.6667$ and $n_1 = 4$
  
  $P(\text{Active})_1 = (0.6667)^4 = 0.197$

- Customer 2: $T_2 = \frac{8}{12} = 0.6667$ and $n = 2$

  $P(\text{Active})_2 = (0.6667)^2 = 0.444$
### Comprehensive Example of Customer Activity Measures

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>32.0%</td>
<td>68.0%</td>
<td>32.0%</td>
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<td>2400</td>
<td>2400</td>
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<tr>
<td>2</td>
<td>49.1%</td>
<td>50.9%</td>
<td>15.7%</td>
<td></td>
<td>1178</td>
<td>2357</td>
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<tr>
<td>3</td>
<td>63.2%</td>
<td>36.8%</td>
<td>9.9%</td>
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<td>745</td>
<td>2234</td>
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<tr>
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<td>31.0%</td>
<td>6.9%</td>
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<td>27.4%</td>
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<td>6</td>
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<td>23.3%</td>
<td>3.8%</td>
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<td>7</td>
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<td>22.1%</td>
<td>3.0%</td>
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<tr>
<td>8</td>
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<td>21.5%</td>
<td>2.3%</td>
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<td>175</td>
<td>1400</td>
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<tr>
<td>9</td>
<td>79.0%</td>
<td>21.0%</td>
<td>1.8%</td>
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<td>138</td>
<td>1244</td>
</tr>
<tr>
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<td>80.0%</td>
<td>20.0%</td>
<td>1.5%</td>
<td></td>
<td>111</td>
<td>1106</td>
</tr>
<tr>
<td>11</td>
<td>79.7%</td>
<td>20.3%</td>
<td>1.2%</td>
<td></td>
<td>88</td>
<td>969</td>
</tr>
<tr>
<td>12</td>
<td>79.8%</td>
<td>20.2%</td>
<td>0.9%</td>
<td></td>
<td>70</td>
<td>844</td>
</tr>
<tr>
<td>13</td>
<td>79.9%</td>
<td>20.1%</td>
<td>0.7%</td>
<td></td>
<td>56</td>
<td>730</td>
</tr>
<tr>
<td>14</td>
<td>79.9%</td>
<td>20.1%</td>
<td>0.6%</td>
<td></td>
<td>45</td>
<td>628</td>
</tr>
<tr>
<td>15</td>
<td>80.0%</td>
<td>20.0%</td>
<td>0.5%</td>
<td></td>
<td>36</td>
<td>538</td>
</tr>
</tbody>
</table>

Actual retention pattern of a direct marketing firm

- Cohort of 7500 customers at the outset, maximum retention rate is 0.80 and the coefficient of retention \( r \) is 0.5; after period 10 the company retains approximately 80% of customer base
Popular Customer-Based Value

- Size of Wallet
- Share of Category Equipment
- Share of Wallet
- Transition Matrix
Customer-Based Value Metrics

- Popular
  - Size Of Wallet
  - Share of Category Reqt.
  - Share of Wallet
  - Transition Matrix

- Strategic
  - RFM
  - Past Customer Value
  - LTV Metrics
  - Customer Equity
Size of Wallet

- Size of Wallet ($) of customer i in a category = \( \sum_{j=1}^{J} S_{ij} \)

- Where:
  - i = a particular customer,
  - j = firm,
  - J = all firms offering products in the considered category,
  - Sj = sales value (in category) to customer i by firm j, \( j = 1, \ldots, J \)

- Information source
  - Primary market research

- Evaluation
  - Critical measure for customer-centric organizations based on the assumption that a large wallet size indicates more revenues and profits

- Example
  - A consumer spends on average $400 on groceries in different supermarkets per month. Thus his/her size of wallet is $400.
Share of Category Requirement (SCR)

- \( \text{aSCR (\%)} \) of firm (or brand) \( j_0 \) in a category = \( \frac{\sum_{i=1}^{I} V_{ij_0}}{\sum_{i=1}^{I} \sum_{j=1}^{J} V_{ij}} \times 100 \)

- Where:
  - \( j_0 \) = focal firm or brand,
  - \( i \) = customer,
  - \( I \) = all customers buying in focal category,
  - \( J \) = all firms or brands available in focal category,
  - \( V_{ij} \) = purchase volume of customer \( i \) from firm (or brand) \( j \)
Share of Category Requirement (SCR)

- Example
  - Calculation of aSCR – purchases during a 3-month period
    → Brand SAMA has a MS of 33% (i.e., 8 purchases out of a total of 24) and an aSCR of 42.1% (i.e., 8 purchases out of 19, made by its two buyers)
    → This shows that even though SAMA’s MS is already substantial, its aSCR is even higher

<table>
<thead>
<tr>
<th></th>
<th>Brand SAMA</th>
<th>Brand SOMO</th>
<th>Brand SUMU</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer 1</td>
<td>2</td>
<td>8</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Customer 2</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Customer 3</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>12</td>
<td>4</td>
<td>24</td>
</tr>
</tbody>
</table>
Share of Category Requirement (SCR)

- iSCR (%) of customer $i_0$ that a firm $x$ (or brand) $j_0$ satisfies = $\frac{V_{i_0j_0}}{\sum_{j=1}^{J} V_{i_0j}} \times 100$

- Where:
  - $j_0 =$ focal firm or brand,
  - $i_0 =$ focal customer,
  - $J =$ all firms or brands available in focal category,
  - $V_{ij} =$ purchase volume of customer $i$ from firm (or brand) $j$
Example: Individual SCR-ratios

- Customer 3 has the highest iSCR
- PEAR Computers should identify high iSCR customers such as customer 3, and target more of its marketing efforts (mailers, advertisements etc.) towards such customers and their respective requirements
- Also, customer 3’s size of wallet (column A), is the largest

<table>
<thead>
<tr>
<th></th>
<th>A Total requirement of notebook computers per customer in 2010</th>
<th>B Total number of notebook Computers purchased from PEAR Computers per customer in 2010</th>
<th>B/A Share of category requirement for PEAR computers per customer in 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer 1</td>
<td>100</td>
<td>20</td>
<td>.20</td>
</tr>
<tr>
<td>Customer 2</td>
<td>1,000</td>
<td>200</td>
<td>.20</td>
</tr>
<tr>
<td>Customer 3</td>
<td>2,000</td>
<td>500</td>
<td>.25</td>
</tr>
</tbody>
</table>
Share of Category Requirement (SCR)

- Information source
  - Numerator: volumetric sales of the focal firm from internal records
  - Denominator: total volumetric purchases of the focal firm’s buyer base – through market and distribution panels, or primary market research (surveys) and extrapolated to the entire buyer base

- Evaluation
  - Accepted measure of customer loyalty for FMCG categories
  - **SCR controls for the total volume of segments / individuals category requirements**
  - Does not indicate if a high iSCR customer will generate substantial revenues or profits
    → Can only be achieved by knowing the customer’s size of wallet
Share of Wallet (SW)

- **Individual Share of Wallet (iSW)**
  
  \[
  \text{iSW} \text{ (%) of firm } j_0 \text{ to customer } i = \frac{S_{ij_0}}{\sum_{j=1}^{J} S_{ij}} \times 100
  \]

  Where:
  
  - \( j = \text{firm}, \)
  - \( i = \text{customer}, \)
  - \( S_{ij} = \text{sales of firm } j \text{ to customer } i, \)
  - \( J = \text{all firms who offer the category under consideration} \)

- **Example**
  
  - If a consumer spends $400 monthly on groceries, $300 thereof are spend at the supermarket “BINGO”
  
  - Consequently “BINGO”’s iSW for this particular consumer amounts 75%
Share of Wallet (SW)

- Aggregate Share of Wallet (aSW) (brand or firm level)
  \[
  aSW(\%) \text{ of firm } j_0 = \frac{\sum_{i=1}^{I} S_{ij0}}{\sum_{i=1}^{I} \sum_{j=1}^{J} S_{ij}} \times 100
  \]
  Where:
  - \( j = \) firm,
  - \( i = \) customer,
  - \( S_{ij} = \) sales of firm \( j \) to customer \( i \),
  - \( J = \) all firms who offer the category under consideration,
  - \( I = \) all customers

- Example
  - The aSW is “BINGO”’s sales (value) in period t ($750,000) divided by the total grocery expenditures of “BINGO”’s customers in the same period ($1,250,000)
    \[
    750,000 / 1,250,000 = 60\%
    \]
Share of Wallet (SW)

- **Information source**
  - Numerator: From internal records
  - Denominator: Through market and distribution panels, or primary market research (surveys) and extrapolated to the entire buyer base

- **Evaluation**
  - Important measure of *customer loyalty*
  - The iSW sheds light on how important the firm is for an *individual customer* in terms of his expenditures in the category
  - The aSW indicates how important (value wise) a specific firm is for its *customer base* in terms of their expenditures in the category
Applications of SCR and SW

- SCR – for categories where the variance of customer expenditures is relatively small
- SW – if the variance of consumer expenditures is relatively high
- Share of wallet and size of wallet simultaneously – with same share of wallet, different attractiveness as customers
- Example:

<table>
<thead>
<tr>
<th></th>
<th>Share-of-Wallet</th>
<th>Size-of-Wallet</th>
<th>Absolute expenses with firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buyer 1</td>
<td>50%</td>
<td>$400</td>
<td>$200</td>
</tr>
<tr>
<td>Buyer 2</td>
<td>50%</td>
<td>$50</td>
<td>$25</td>
</tr>
</tbody>
</table>

- Absolute attractiveness of Buyer 1 is eight times higher even though the SW is the same as for Buyer 2
Segmenting Customers Along Share of Wallet and Size of Wallet

- The matrix shows that the **recommended strategies** for various segments **differ substantively**
- The firm makes optimal resource allocation decisions only by **segmenting customers along the two dimensions simultaneously**
Share of Wallet and Market Share (MS)

- **MS of firm \( j_0 \) (%) = \( \frac{\sum_{i=1}^{I} (iSW \text{ of customer } i \text{ to firm } j_0 \times \text{Size of Wallet of customer } i)}{\sum_{i=1}^{I} \sum_{j=1}^{J} S_{ij}} \)**
  - Where:
    - \( j = \text{firm} \),
    - \( i = \text{customer} \),
    - \( S_{ij} = \text{sales of firm } j \text{ to customer } i \),
    - \( J = \text{all firms who offer the category under consideration} \),
    - \( I = \text{all customers} \)

- **Difference of share of wallet to market share:**
  - MS is calculated **across buyers and non-buyers**, whereas SW is calculated only among **actual buyers**
Share of Wallet and Market Share (MS)

- Example
  - The supermarket “BINGO” has 5,000 customers with an average expense of $150 at “BINGO” per month (SW*size of wallet)
  - The total grocery sales in “BINGO”’s trade area are $5,000,000 per month “BINGO”’s market share is \( \frac{5,000 \times 150}{5,000,000} = 15\% \)
  - Implication: although “BINGO” has an overall low MS, it has a high SW for those consumers buying “BINGO”
    - “BINGO” is a niche player with very loyal customers
Transition Matrix

- Characterizes a customer’s likelihood to buy over time or a brand’s likelihood to be bought

- Example
  
  - The probability that a consumer of Brand A will switch to Brand B and then come back to Brand A in the next two purchase occasions is $20\% \times 10\% = 2\%$

- If, on average a customer purchases twice per period, the two purchases could be composed as: AA, AB, AC, BA, BB, BC, CA, CB, or CC

- It is possible to compute the **probability of each of these outcomes** if the brand that the customer bought last is known
Summary

- In the absence of individual customer data, companies used to rely on traditional marketing metrics like **market share** and **sales growth**
- Acquisition measurement metrics detect the **customer level success** of marketing efforts to acquire new customers
- Customer activity metrics track **customer activities** after the acquisition stage
- **Lifetime duration** is a very important metric in the calculation of the customer lifetime value and is different in **contractual** and **non-contractual situations**
- Firms use different **surrogate measures** of customer value to prioritize their customers and to differentially invest in them
- Firms can use information about **size of wallet** and **share of wallet** together for the optimal allocation of resources
- **Transition matrix** measures the probability for a customer to purchase a particular brand providing the previous purchased brand is known