# 📄 Final Root Cause Analysis (RCA) + Hypothesis Validation Report

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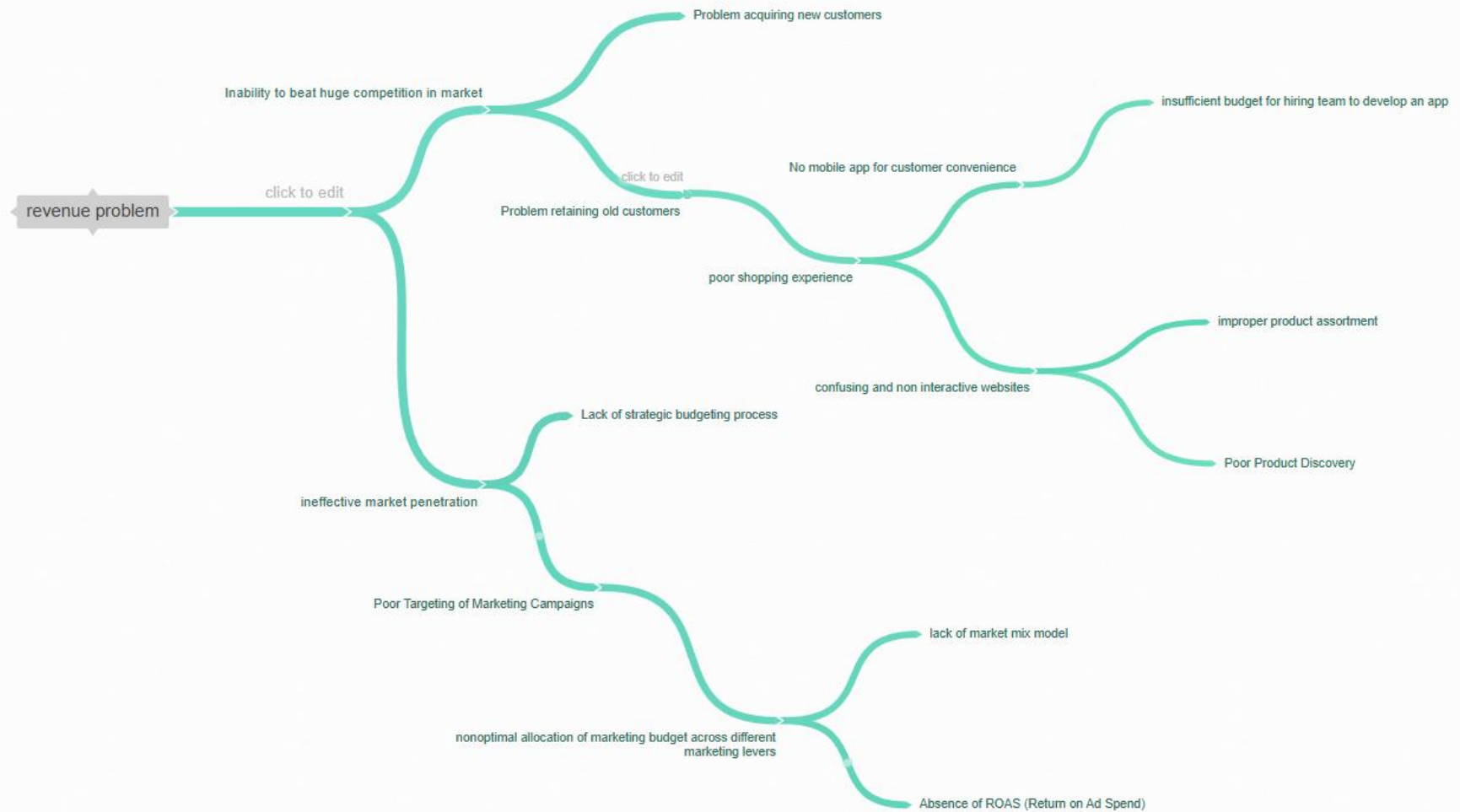
## 📚 Program Details:

Data Science PG Diploma, IIIT Bangalore
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## 🎯 Business Objective

Optimize marketing spends across **Camera Accessories**, **Gaming Accessories**, and **Home Audio** to **maximize GMV** (Gross Merchandise Value), using elasticity-driven insights derived from **Linear** and **Log-Linear (Multiplicative)** regression models.

revenue problem

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Inability to beat huge competition in market
- Problem acquiring new customers
- Problem retaining old customers

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No mobile app for customer convenience
- insufficient budget for hiring team to develop an app

poor shopping experience
- confusing and non interactive websites
  - improper product assortment
  - Poor Product Discovery

ineffective market penetration
- Lack of strategic budgeting process
- Poor Targeting of Marketing Campaigns
  - nonoptimal allocation of marketing budget across different marketing levers
    - lack of market mix model
    - Absence of ROAS (Return on Ad Spend)

## 🧪 Modeling & Assumptions Summary

- **Models Used:** Linear, Log-Linear (Multiplicative), 5-fold Cross Validation
- **Assumptions:**
  - Market conditions remain stable
  - GMV is a valid proxy for revenue
  - Elasticity is a reliable metric for decision-making
  - No external economic or pricing shocks during analysis window

## 📷 Camera Accessories

### ✅ Hypotheses + RCA Insights

| Channel | Elasticity | Action | RCA Insight |
|---|---|---|---|
| Discount | -0.85 (Linear) / -0.0459 (Log) | 🔽 Cut | Erodes premium brand perception. Customers associate discounts with lower quality. |
| TV Ads | -0.17 (Linear) | 🧪 Trial | Weak conversion; recommend festive campaigns only. |
| Affiliate | +1.52 (Linear) / -0.29 (Log) | 🧪 Reallocate | Conflicting signals; clean up poor affiliate sources. |
| Online Ads | -1.63 (Linear) / +0.35 (Log) | 🧪 Recheck | Minor boost in log-linear suggests retargeting may work if better optimized. |
| SEM | +1.01 (Linear) | ✅ Invest | Strong performance, search intent driven. |

📌 **Recommendation:** Focus on **SEM** and cleaned-up **Affiliate marketing**. Avoid discounting. Trial **TV ads** during major events.

# 🎮 Gaming Accessories

## ✅ Hypotheses + RCA Insights

| Channel | Elasticity | Action | RCA Insight |
|---|---|---|---|
| Discount | +2.05 (Linear) / -0.04 (Log) | ✅ Use with Limit | Works well, but don't go overboard. Diminishing returns noted. |
| TV Ads | +0.96 (Linear) | ✅ Continue | Good brand awareness driver, especially for events. |
| Affiliate | -1.18 (Linear) | 🔻 Eliminate | Doesn't convert. Replace with influencers. |
| Online Ads | -1.29 (Linear) / -0.032 (Log) | 🔻 Cut | Poorly aligned creatives for gaming audience. |
| SEM | +0.57 (Linear) | ✅ Maintain | Decent channel, supports search-led intent. |
| Content Marketing | -0.046 (Log) | 🔻 Drop | Weak performance, likely poor content alignment. |

📌 **Recommendation:** Use **discounts tactically**, invest in **TV**, and **replace affiliate/digital** with **influencer-led Twitch/YouTube** strategies.

# 🎧 Home Audio

## ✅ Hypotheses + RCA Insights

| Channel | Elasticity | Action | RCA Insight |
|---|---|---|---|
| **Discount** | +2.05 (Linear) / +0.048 (Log) | ✅ Go Big | Flash sales work great. Time with festivals. |
| **TV Ads** | -0.26 (Linear) / +0.25 (Log) | 🧪 Mixed | Works when paired with discount offers. |
| **Affiliate** | +0.02 (Linear) / -0.21 (Log) | 🔽 Cut | Ineffective in this category. |
| **Online Ads** | +0.26 (Linear) | 🧪 Optimize | Retargeting may yield marginal gains. |
| **FM Radio** | -0.65 (Linear) / +0.69 (Log) | 🔽 Eliminate | Conflicting signals, not worth the risk. |

📌 **Recommendation:** Focus on **discount campaigns**, optimize **online ads**, and highlight **product bundles** (e.g., speakers + docks).

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# 📊 Final Business Takeaways (All Models Combined)

| Category | Increase Spend | Cut Spend | Experiment |
|---|---|---|---|
| **Camera** | SEM, Affiliate (cleaned) | Discounts, Online Ads | TV during festive |
| **Gaming** | Discounts (capped), SEM, Influencer | Online, Affiliate | YouTube/Twitch |
| **Home Audio** | Discounts, Product Bundles | FM Radio, Affiliate | Retargeting Ads |