Strategic Framework for AI-Driven Voice of Customer Analytics at Bharat Petroleum Corporation Limited

1. The Strategic Imperative: Customer Centricity in the Age of Energy Transition

The global energy sector is currently navigating a profound structural transformation, characterized by a shift from pure commodity supply to comprehensive service delivery. For Bharat Petroleum Corporation Limited (BPCL), a Maharatna Public Sector Undertaking (PSU) and a Fortune Global 500 entity, this transition is articulated through ambitious strategic frameworks such as "Project Anubhav" and "Project Aspire".[1] These initiatives are not merely operational upgrades; they represent a fundamental pivot toward a "customer-first" philosophy in an industry historically driven by supply chain logistics. As BPCL targets Net Zero emissions by 2040 and expands its footprint in petrochemicals, gas, and green energy, the competitive differentiator is increasingly becoming the quality of the customer experience (CX) rather than the fuel itself.[3]

The contemporary Indian consumer is digitally native, vocal, and platform-agnostic. Their interaction with BPCL is no longer confined to the physical forecourt of a petrol pump; it spans mobile applications like *HelloBPCL*, automated booking systems, social media channels, and loyalty programs like *SmartDrive*.[5] In this ecosystem, the "Voice of the Customer" (VoC) is not just feedback; it is a critical stream of unstructured data that holds the keys to operational efficiency, brand loyalty, and revenue retention. However, a significant dissonance remains between the *volume* of feedback generated and the *velocity* with which it is analyzed and acted upon. Traditional analytics systems, often siloed within specific business units (LPG vs. Retail vs. Lubes), struggle to provide the unified "One BPCL" view mandated by Project Anubhav.[7]

This report outlines a comprehensive, production-ready implementation plan for an AI-driven Voice of Customer Analysis Project. Designed specifically for deployment within an internship capacity, this project leverages modern Large Language Models (LLMs) to bypass the steep learning curve of traditional machine learning engineering. By utilizing Generative AI for both code generation and semantic analysis, this initiative aims to construct a "Hinglish-Native" sentiment engine capable of decoding the complex linguistic reality of the Indian consumer. The ultimate objective is to provide BPCL management with a real-time, unified dashboard that correlates qualitative customer sentiment with quantitative operational metrics, thereby directly supporting the strategic goals of digitalization, customer personalization, and

operational excellence.[1]

1.1 The Convergence of Project Anubhav and Digital Transformation

Project Anubhav was initiated in January 2020 with a clear mandate: to unify the fragmented customer view across BPCL's diverse business units.[7] Historically, a customer's interactions were siloed; the system that tracked an LPG cylinder booking had no visibility into the same customer's petrol consumption or lubricant purchases. This fragmentation prevented cross-selling and created disjointed experiences. To address this, BPCL has invested heavily in foundational technologies, deploying Salesforce Sales Cloud and Service Cloud to digitize the supply chain and engaging Microsoft Azure to modernize the tech architecture.[1]

However, while these enterprise platforms excel at managing structured transactional data (e.g., volume sold, ticket status), they often lack the agility to process high-velocity, unstructured text data from the "wild" internet—specifically app reviews and social media comments that mix languages and sentiments. A customer review stating, *"App se paise kat gaye par gas book nahi hua" (Money was deducted from the app, but gas wasn't booked)*, contains critical information regarding payment gateway latency, app stability, and customer churn risk.[9] Enterprise CRMs often categorize this simply as a "complaint," missing the nuance of *financial anxiety* and *trust deficit*.

The proposed VoC project fills this specific gap. It acts as an intelligent "listening layer" that sits on top of the existing infrastructure. By harvesting and analyzing external feedback data that is currently outside the purview of internal CRMs, this project complements Project Anubhav by feeding "Voice" intelligence back into the "System" view. It aligns with the vision of the "Digital Nerve Center" (IRIS), extending monitoring from physical assets (tank trucks, depots) to intangible assets (brand sentiment and customer trust).[7]

1.2 Project Aspire: The Role of Data in the Energy Transition

"Project Aspire" outlines BPCL's roadmap for the next five years, with a massive capital outlay of ₹1.7 lakh crore aimed at nurturing the core business while investing in future big bets.[4] A significant portion of this—₹20,000 crore—is allocated for marketing expansion and transforming retail outlets into energy hubs.

Data analysis is the bedrock of this capital allocation. If customer feedback consistently highlights that "EV charging stations at Highway X are always offline," that qualitative insight is crucial for the Green Energy division's maintenance strategy. Similarly, if rural customers report that "Cylinder delivery boys refuse to check the seal," it signals a safety compliance failure that threatens the core LPG business.[12]

The internship project proposed here is designed to be a low-cost, high-impact diagnostic tool for these capital-intensive strategies. By utilizing "AI-as-a-Service" through LLMs, the project minimizes infrastructure costs while maximizing insight generation. It demonstrates

how "Digital Ventures" (a key pillar of Aspire) can be incubated at the grassroots level, providing a template for agile innovation within the PSU framework.[2]

2. The Operational Landscape: Identifying the Feedback-Action Gap

To design a solution that BPCL will adopt, one must first diagnose the specific operational pain points where current systems are failing to capture or act on customer signals. An exhaustive analysis of public reviews, forum discussions, and operational reports reveals three critical "Friction Zones" where the Voice of Customer is loudest but often unheard by corporate decision-makers.

2.1 The 'HelloBPCL' Super App: A Crisis of Stability

The *HelloBPCL* app is the digital face of the "One BPCL" initiative, designed to offer a seamless experience for LPG booking, fuel payments, and lubricant purchases.[9] However, user reviews paint a picture of a digital interface struggling with technical debt.

The eKYC Bottleneck:
A recurring theme in recent feedback is the failure of the electronic Know Your Customer (eKYC) process. Users report that the app incorrectly routes verification requests to the Umang app instead of Aadhaar-specific applications, leading to a dead-end where "nothing happens".5 This is not merely a technical glitch; it is a regulatory compliance failure. For a PSU, compliance is paramount. A VoC system that identifies a 300% spike in "eKYC failure" keywords after a specific app update allows the IT team to rollback changes immediately, preventing mass account lockouts.
The 'Phantom Deduction' Phenomenon:
Perhaps the most damaging feedback relates to payment failures. Numerous customers report money being deducted from their bank accounts via UPI while the app displays a "Booking Failed" error.9 In the Indian context, where digital adoption is high but trust is fragile, such incidents are viewed not as technical errors but as financial malpractice. Reviews explicitly state, "Complete fraud application... money deducted but no history in app." Current batch-processing analytics might catch these reconciliation errors after 24 hours; a real-time VoC dashboard detects the sentiment storm immediately, allowing customer support to issue proactive communications.
iOS Usability Failures:
Specific technical bugs, such as the mPIN keypad failing to appear on iOS devices, force users to restart the app multiple times.5 These "micro-frictions" accumulate to cause user churn. A customer who cannot log in to book a cylinder will eventually switch to a competitor like Indane or HP Gas, simply because the digital door was locked.

2.2 The LPG 'Last Mile' Challenge: The Human Element

While the digital layer faces technical issues, the physical delivery layer of the LPG business

(BharatGas) faces behavioral challenges. The "Last Mile" is controlled by independent distributors, making it the hardest segment for BPCL HQ to monitor.

The 'Tips' and 'Delivery Charge' Extortion:
A pervasive issue identified in customer narratives is the demand for unauthorized "tips" or delivery charges by delivery personnel. Reviews detail instances where delivery agents refuse to return change or demand ₹20-₹50 extra per cylinder.5 While the monetary value is low, the sentiment cost is high. It contradicts the PSU's promise of fair pricing. The VoC project can aggregate these complaints by geography to identify "Corruption Hotspots"—specific distributor territories where such complaints are statistically anomalous, enabling targeted audits.
Safety Protocol Violations:
Safety is the "License to Operate" in the oil and gas sector. BPCL mandates pre-delivery checks (weighing the cylinder, checking the seal).12 However, customer feedback often highlights that delivery agents skip these checks to save time. A review stating "Seal was broken and weight was less" is a critical safety red flag. Currently, these might be treated as generic service complaints. An AI-driven system can classify them as "HSSE Incidents," escalating them to safety officers immediately.13

2.3 The Fuel Station Experience: Inconsistent Service Standards

For the fuel retail segment, the customer experience is defined by speed, accuracy, and amenities.

Infrastructure Reliability:
Drivers often use apps to find stations with specific amenities like nitrogen air or clean toilets. Feedback often indicates discrepancies between the digital promise (e.g., "Open 24 Hours") and physical reality ("Station closed at 10 PM"). Such disconnects erode trust in the SmartDrive platform.
Pure for Sure (PFS) Integrity:
BPCL's "Pure for Sure" campaign guarantees fuel quality. Any customer review mentioning "mileage drop" or "engine knocking" after fueling at a specific outlet is a direct challenge to this brand promise.14 Aggregating these signals allows the Quality Assurance team to dispatch mobile labs to specific retail outlets for surprise inspections, moving from a scheduled audit model to a data-driven audit model.

3. The Linguistic Barrier: Why Traditional NLP Fails in India

The primary reason many VoC projects fail in the Indian context is the linguistic complexity of the data. Indian consumers rarely write reviews in Queen's English. They use "Hinglish"—a code-mixed blend of Hindi and English, often written in Latin script.

3.1 The Code-Switching Complexity

Consider the phrase: *"Gas late aaya par banda acha tha."*

- **Literal Translation:** "Gas came late but the guy was nice."
- **Linguistic Structure:** English nouns ("Gas," "late") mixed with Hindi verbs and grammar ("aaya," "par," "banda acha tha").

Traditional Natural Language Processing (NLP) libraries like Python's TextBlob or NLTK, which are trained on standard English corpora, fail catastrophically here.

- TextBlob might focus on the word "late" and classify the sentence as **Negative**.
- In reality, the sentiment is **Mixed**: Negative towards the process (timing), but Positive towards the personnel (staff behavior).

Furthermore, transliteration poses a massive challenge. The word "bad" in English means "poor quality." The word "baad" in Hindi (transliterated) means "later." A rule-based system cannot distinguish between *"Very bad service"* (Negative) and *"Call me baad mein"* (Neutral/Procedural).

3.2 The Limitations of Standard Sentiment Analysis

Standard sentiment analysis provides a single scalar score (e.g., -0.5 to +0.5). For BPCL, this is insufficient. A review might say: *"App is terrible, payment failed twice. But the petrol pump service was fast."*

- **Aggregate Score:** Neutral (0.0).
- Business Reality: Critical Failure in App (IT Issue) + Success in Retail (Operations Success).
  A neutral score hides the IT failure. This necessitates Aspect-Based Sentiment Analysis (ABSA), which dissects the sentence into components ("App" and "Petrol Pump") and assigns distinct sentiments to each.

3.3 The GenAI Opportunity: LLMs as Linguistic Decoders

This is where the proposed internship project leverages the cutting edge. Modern Large Language Models (LLMs) like GPT-4o, Claude 3.5, or Google's Gemini 1.5 Pro have been trained on vast swathes of internet text, including Indian social media. They possess an emergent capability to understand Hinglish, slang, and context without requiring the user to train a custom model from scratch.[15]

By using "Prompt Engineering"—giving the LLM specific instructions in natural language—we can achieve state-of-the-art results in decoding Indian feedback. This allows an intern, who may not be a machine learning engineer, to build a system that outperforms legacy enterprise NLP tools. This "AI-assisted development" approach is central to the project's feasibility and success.

4. Proposed Solution Architecture: The 'Voice of BPCL'

Engine

To meet the requirement of a "production-ready" plan, we propose a modular architecture that follows the industry-standard **ETL (Extract, Transform, Load)** paradigm, enhanced with a **GenAI Cognitive Layer**.

4.1 System Components Overview

The solution is composed of four distinct modules:

1. **The Harvester (Data Ingestion):** Automated bots that scrape public feedback.
2. **The Cognitive Processor (GenAI Agent):** The brain of the system, using LLMs to clean, translate, and analyze text.
3. **The Knowledge Store (Database):** A structured repository for the processed insights.
4. **The Command Center (Visualization):** An interactive dashboard for BPCL stakeholders.

4.2 Module 1: Data Acquisition (The Harvester)

The first step is gathering raw data. While BPCL has internal data, an intern can demonstrate immediate value by aggregating *public* data, which serves as a proxy for broader sentiment.

Target Data Sources:

- **Google Play Store:** Reviews for *HelloBPCL* and *BharatGas* apps. (Package IDs: com.cgt.bharatgas, com.bpcl.hellobpcl).[9]
- **Apple App Store:** Reviews for *HelloBPCL* (App ID: 594797915).[5]
- **Social Media:** Twitter/X mentions of @BPCLimited, #BharatGas, #PureForSure.

Technical Implementation Strategy (Python):
Since the user is not a coding expert, they will use an LLM to generate the Python scripts. The core library recommended is google-play-scraper.17

- **Logic:** The script will query the Play Store API for the latest 2,000 reviews. It must handle *pagination* (loading more reviews automatically) and *error handling* (retrying if the connection drops).
- **Metadata Extraction:** It is crucial to capture not just the review text, but also:
  - reviewCreatedVersion: To correlate bugs with specific app updates.
  - at (Date/Time): To track sentiment trends over time.
  - thumbsUpCount: To weight the importance of a review (a review with 100 likes is a viral complaint).

4.3 Module 2: The Cognitive Processor (GenAI Layer)

This is the core innovation of the project. Instead of training a model, we access intelligence via API.

The "Translation-Augmented Aspect Detection" Pipeline:

The LLM will be instructed to perform a multi-step cognitive task on every review:

1. **Language Identification:** Detect if the text is English, Hindi (Devanagari), or Hinglish (Latin).
2. **Normalization:** Translate Hinglish/Hindi into standard Business English.
3. **Intent Classification:** Categorize the review into:
    - *Complaint* (Actionable issue)
    - *Praise* (Validation of strategy)
    - *Query* (Customer support need)
    - *Suggestion* (Feature request)
4. **Aspect-Based Sentiment Extraction:** Identify specific entities and their polarity.
    - *Input:* "App failed but gas came."
    - *Output:* {'App': 'Negative', 'Delivery': 'Positive'}

The Prompt Engineering Strategy:
To get consistent results, the intern must use Few-Shot Prompting. This involves giving the LLM examples of "good" and "bad" analysis in the prompt itself.

- *Template Prompt:*"You are an expert Data Analyst for an energy company. Analyze the following review.
  Review: 'Paise kat gaye par booking fail ho gayi.'
  Output JSON: {
  'original_language': 'Hinglish',
  'translated_text': 'Money was deducted but the booking failed.',
  'intent': 'Complaint',
  'aspects': [
  {'aspect': 'Payment Gateway', 'sentiment': 'Negative', 'severity': 'High'}
  ]
  }"

This JSON output ensures the unstructured text is converted into structured data that can be queried mathematically.

4.4 Module 3: Storage & Data Management

For an internship project, the architecture should be lightweight but scalable.

- **Development Phase:** Use **SQLite**. It is a serverless, file-based database that requires no installation. Python has built-in support (sqlite3 library). It can easily handle 50,000+ reviews, which is sufficient for a proof-of-concept.[18]
- **Production Pitch:** The report will note that for full deployment, this SQLite file can be migrated to **Snowflake** or **Microsoft Azure SQL** (aligning with BPCL's partnership with Microsoft).[8] This shows the intern understands enterprise scalability.

4.5 Module 4: The Command Center (Streamlit Dashboard)

Visualization is where the value becomes visible to stakeholders. **Streamlit** is the chosen

technology because it allows creating beautiful, interactive web applications using pure Python, without needing HTML/CSS/JavaScript knowledge.[20]

Dashboard Sections:

1. **Executive Overview:** Top-level KPIs – Net Promoter Score (NPS), Total Ticket Volume, Sentiment Trend (Last 30 Days).
2. **The "Pulse" Heatmap:** A geographic map (using the user's city data) showing where negative sentiment is clustering. (e.g., "Why is Pune showing 80% negative sentiment regarding LPG delivery today?")
3. **Operational Deep Dive:**
   - *Filter by App Version:* Is Version 4.2 better than 4.1?
   - *Filter by Topic:* Show me only "Payment" related complaints.
4. **The "Safety Watch" Module:** A dedicated section that filters for high-risk keywords ("Leak", "Fire", "Blast", "Smell"). These are flagged in red for immediate attention.

5. Detailed Implementation Roadmap (8-Week Plan)

This roadmap is designed to be executed by a single intern using LLM assistance for code generation.

Phase 1: Foundation & Data Ingestion (Weeks 1-2)

Objective: Set up the environment and build the "Harvester."

- **Week 1: Environment Setup.**
  - Install Python, VS Code, and Git.
  - *LLM Task:* "How do I set up a virtual environment in Python and install pandas, streamlit, and google-play-scraper?"
  - **Deliverable:** A working Python environment.
- **Week 2: The Scraper Script.**
  - *LLM Task:* "Write a Python script to scrape the last 5,000 reviews of the 'HelloBPCL' app from the Google Play Store. Save the data to a CSV file called raw_reviews.csv. Handle emojis and special characters correctly."
  - **Deliverable:** A CSV file containing raw customer feedback.

Phase 2: The Cognitive Engine (Weeks 3-5)

Objective: Process the raw text into intelligent insights.

- **Week 3: API Integration.**
  - Register for an OpenAI API key (or use a local model like Ollama if data privacy is a strict constraint).
  - *LLM Task:* "Write a Python script to read raw_reviews.csv. For each row, send the text to the GPT-4o API to extract sentiment. Save the response in a new column."
- **Week 4: Prompt Engineering & Refinement.**

    - Test the prompt with difficult Hinglish examples.
    - *LLM Task:* "The model is failing to understand 'paisa kat gaya'. Improve the system prompt to explicitly handle Hinglish financial terms."
    - **Deliverable:** A refined prompt template that achieves >90% accuracy on test data.
- **Week 5: The ETL Pipeline.**
    - Automate the flow.
    - *LLM Task:* "Create a master script run_pipeline.py that first runs the scraper, then the analysis, and finally saves the data to a SQLite database."
    - **Deliverable:** A fully automated data processing script.

Phase 3: Dashboard & Visualization (Weeks 6-7)

Objective: Make the data usable for management.

- **Week 6: Basic Dashboarding.**
    - *LLM Task:* "Create a Streamlit app that connects to the SQLite database. Display a line chart of 'Average Sentiment' over time using plotly."
    - **Deliverable:** A functioning web app running on localhost.
- **Week 7: Advanced Features.**
    - Add filters (Date, Category, Star Rating).
    - *LLM Task:* "Add a sidebar filter to the Streamlit app that allows the user to select 'Payment', 'Service', or 'App' and updates the charts accordingly."
    - **Deliverable:** A polished, interactive dashboard.

Phase 4: Production Readiness & Presentation (Week 8)

Objective: Package the project for handover.

- **Week 8: Documentation & Docker.**
    - *LLM Task:* "Write a requirements.txt file for this project. Also, write a Dockerfile so this app can be deployed on a server."
    - **Deliverable:** A final report (this document), the source code, and a deployment guide.

6. Business Impact Analysis: ROI and Strategic Alignment

To ensure adoption, the project must be framed not as a "coding experiment" but as a "business solution." The following metrics demonstrate the Return on Investment (ROI) for BPCL.

6.1 Unlocking Customer Lifetime Value (CLV)

In the LPG sector, the relationship is sticky but fragile. A typical household consumes ~8-10 cylinders annually. Over a 20-year lifecycle, a single customer represents a revenue stream of

approximately ₹2.5 - ₹3 lakhs (adjusted for inflation).[21]

- **The Cost of Churn:** Losing a customer due to a petty "tipping" dispute or a failed payment is not a loss of ₹1,000; it is a loss of ₹3 lakhs in CLV.
- **The VoC Impact:** By identifying and rectifying a "tipping hotspot" (a specific distributor), this project can prevent the churn of hundreds of customers, preserving crores in CLV.

6.2 Reducing the Cost of Acquisition vs. Retention

Acquiring a new customer in the saturated fuel market is expensive (marketing costs, loyalty bonuses). Retention is significantly cheaper—often 5 to 25 times cheaper.[22]

- **Impact:** This project is a *Retention Engine*. It identifies at-risk customers (those leaving 1-star reviews about technical failures) *before* they switch to a competitor. Proactive resolution (e.g., an automated apology email triggered by the sentiment engine) can recover these customers at near-zero cost.

6.3 Operational Efficiency and HSSE Compliance

BPCL's commitment to Health, Safety, Security, and Environment (HSSE) is non-negotiable.

- **The Safety Radar:** Manual monitoring cannot read 10,000 reviews a day. This AI system can. By flagging safety-related terms ("Gas smell", "Leak", "Fire hazard") in real-time, the system acts as an early warning radar, potentially preventing accidents and the associated reputational catastrophe. This aligns the project directly with the highest priorities of BPCL's board.[13]

7. Technical Appendix: Code Structure & Logic for the Intern

This section provides the *logic* you will need to ask the LLM to generate. Understanding the structure allows you to prompt the LLM effectively.

7.1 Data Ingestion Logic (The Scraper)

- **Constraint:** You cannot scrape infinitely. You need to sleep (pause) between requests to avoid getting banned.
- **Prompt Idea:** "Write a Python loop to scrape reviews. After every 100 reviews, pause execution for 5 seconds using time.sleep(). This is to be polite to the server." [24]

7.2 The Sentiment Analysis Function

This is the most complex part. You will use a JSON structure to force the LLM to be disciplined.

JSON

```
{
  "review_id": "gp:AOqp...",
  "text": "App se paise kat gaye",
  "analysis": {
    "language": "Hinglish",
    "translation": "Money was deducted from the app.",
    "sentiment_score": -0.9,
    "category": "Payment_Failure",
    "urgency": "High"
  }
}
```

Table 1: Proposed Sentiment Taxonomy for BPCL

Category	Keywords (Hinglish/English)	Sentiment Implication	Business Action
Payment Integrity	Paise kat gaye, deducted, refund, fraud, failed	**Critical Negative**	Trigger IT Ticket, Auto-reply
LPG Delivery	Late, tip, extra money, rude, seal broken	**Operational Negative**	Notify Territory Manager
App Usability	OTP, login, hang, slow, update, bug	**Functional Negative**	Log in Bug Tracker (JIRA)
Fuel Quality	Mileage, engine noise, kam daala, quantity	**Trust Negative**	Trigger Quality Audit
Staff Behavior	Good service, polite, helpful, fast	**Positive**	Reward/Recognition for Staff

7.3 Dashboard Logic (Streamlit)

Streamlit works on a "reactive" model. When you change a filter, the whole script re-runs.

- **Prompt Idea:** "I want to use st.columns to create a row of 3 metric cards at the top of my dashboard. They should display 'Total Reviews', 'Positive %', and 'Negative %'. Use CSS to color the negative card red."

7.4 Handling Data Privacy

Since you are an intern, you must be careful with PII (Personally Identifiable Information).

- **Anonymization Rule:** Before sending any review to the OpenAI API, you should ask the LLM to write a function that removes phone numbers and email addresses from the review text using Regular Expressions (Regex).
- **Prompt Idea:** "Write a Python function using re module to find and replace all 10-digit mobile numbers in a string with ''."

8. Future Outlook: Scaling to 'One BPCL'

While this project starts as a standalone dashboard, its architecture is designed for integration.

- **Integration with IRIS:** The JSON output from this engine can be ingested by BPCL's IRIS platform, adding a "Social Sentiment" layer to the existing operational monitoring.
- **Multilingual Expansion:** The same LLM pipeline can be easily adapted to handle Tamil, Malayalam, or Bengali reviews, supporting BPCL's pan-India presence.[15]
- **Predictive Analytics:** With enough historical data, the system could eventually *predict* churn before it happens, moving from descriptive analytics ("What happened?") to predictive analytics ("What will happen?").

9. Conclusion

This proposal offers a concrete, technically sound, and strategically aligned project for a BPCL internship. It respects the constraints of the user (using LLMs for code) while delivering a "production-ready" artifact that solves a real business problem. By bridging the gap between raw, Hinglish customer feedback and actionable corporate strategy, this project contributes directly to the "One BPCL" vision, ensuring that as BPCL transitions into the future of energy, it takes its customers along with it.

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