Critical Literature Review

Design and Creative Technologies

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AI Insights from Customer Feedback: Correlating Sentiment Analysis with Business Performance in Healthcare Clinics

1. Introduction

Artificial intelligence (AI) and natural language processing (NLP) now make it possible to analyze unstructured customer feedback at scale, enabling organizations to translate raw opinions into actionable business intelligence. In the healthcare sector, however, the bridge between patient sentiment and measurable business outcomes such as revenue, retention, or referrals remains under-explored.

This project proposes an ICT-driven research framework that leverages fine-grained sentiment analysis and business-intelligence methods to examine whether emotional patterns in patient feedback can predict financial performance in clinical environments. The study builds directly on the literature gaps identified in Assessment 1 and adopts a mixed-methods design to ensure both computational accuracy and contextual validity.

2. Research Questions, Aim and Objectives

Aim: To investigate the predictive relationship between AI-derived sentiment metrics and business KPIs in healthcare clinics.

Research Questions:

- RQ1: To what extent can AI-driven sentiment analysis predict revenue in healthcare clinics?
- RQ2: Can fine-grained emotion classification (anger, fear, satisfaction) be reliably automated from unstructured patient feedback using NLP techniques?

- RQ3: How does aspect-based sentiment analysis compare to traditional NPS as a predictor of clinic-level financial outcomes?

Objectives:

- Develop an NLP pipeline to quantify sentiment and emotion from patient-feedback text.
- Correlate sentiment and emotional intensity with monthly revenue and NPS scores.
- Validate AI outputs through qualitative review and ethical assessment.
- Recommend an ICT framework linking AI insights to healthcare management decisions.

3. Comparative Analysis of Research Methodologies

Methodology	Description	Strengths	Weakness	Suitability
Qualitative	Explores human meaning through interviews or thematic coding	Rich context and interpretive depth.	Limited generalizability; prone to researcher bias.	Useful to verify how patients express emotions and validate UI outputs.
Quantitative	Employs numerical measurement, hypothesis testing, statistical inference.	Objectivity, replicability, scalability.	May overlook linguistic nuance or cultural tone.	Ideal for correlating sentiment scores with revenue (KPIs)

		Triangulation improves validity; merges AI outputs with human interpretation.	Requires time and data integration skills.	Best suited to AI research involving both algorithms and human review.
Mixed Methods	Integrate both qualitative and quantitative strands.			

Given that this study seeks measurable relationships between NLP-generated sentiment data (quantitative) and their contextual interpretation (qualitative), a mixed-methods approach provides the most appropriate balance of rigor and flexibility. This approach aligns with ICT R&D practice, where prototype systems are iteratively tested and validated through empirical evidence.

3.1. Research Questions

Based on the identified gaps, this research proposes to investigate:

- **RQ1:** To what extent can AI-driven sentiment analysis predict revenue in healthcare clinics?

- **RQ2:** Can fine-grained emotion classification (anger, fear, satisfaction) be reliably automated from unstructured patient feedback using NLP techniques?

- **RQ3:** How does aspect-based sentiment analysis compare to traditional NPS as a predictor of clinic-level financial outcomes?

4. Proposed Methodology and Research Methods

4.1. Design Paradigm

The study adopts a pragmatic paradigm, valuing methodological pluralism to address practical ICT challenges. Quantitative components establish statistical validity, while qualitative insights ensure interpretability and ethical robustness.

4.2. Data Collection

- **Primary Source:** Anonymized operational dataset provided by Pro-Corpo Estetica Avancada (https://procorpoestetica.com.br/), comprising ≈ 27 000 records (2022–2025).

- **Variables**: textual feedback, NPS scores, month/year, clinic ID, and monthly revenue.

- **Data Security**: stored on encrypted drives compliant with the Australian Privacy Act (1988) and Brazilian Data Protection Law.

- **Authorization**: formal company consent letter ensuring confidentiality and academic use only.

The dataset originates from Pro-Corpo's post-service Net Promoter Score (NPS) program, which automatically invites clients to provide feedback within 24 hours of receiving treatment. Respondents can identify themselves or remain anonymous and answer four brief questions: (1) a 1-to-10 satisfaction rating, (2) optional comments, (3) confirmation of the store visited, and (4) optional mention of staff members for praise or concern. This process has generated approximately 27 000 records collected between 2022 and 2025, providing a rich source of structured (scores, store, month) and unstructured (text feedback) data. Monthly revenue data for each store are also available, enabling correlation between customer sentiment, NPS, and financial performance.

4.3. Data Processing Timeline

- Pre-processing: tokenisation, and stop-word removal using TextBlob.

- Emotion Classification: map outputs to categories—anger, fear, satisfaction—following Angelis et al. (2024).

- Aspect Extraction: identify service features (staff, pricing, facilities) with dependency parsing.

- Data Integration: merge monthly sentiment aggregates with revenue and NPS tables.

4.4. Quantitative Analysis

- Descriptive Statistics: mean sentiment and NPS per clinic, variance, and distribution trends.

- Correlation Tests: If normality assumptions are met, Pearson correlation will be applied. Otherwise, Spearman rank correlation will ensure non-parametric robustness.

5. Rationale for Method Choice

A purely quantitative design would capture numerical correlations but ignore linguistic subtleties such as sarcasm or emotional tone, while a purely qualitative study would lack statistical generalizability. A mixed-methods design therefore aligns with both AI engineering practice and ICT research methodology by combining algorithmic evaluation with human oversight. This dual approach ensures technical validity (accuracy $\geq 90\%$) and contextual reliability, providing a comprehensive understanding of how AI-interpreted sentiment translates into tangible business outcomes.

This study follows a correlational quantitative design complemented by qualitative validation, reflecting the mixed-methods principles described by DATAtab (2022) and Ortlieb (2021).

6. Ethical Considerations

- **Anonymity & Consent**: No personally identifiable data will be used. Pro-Corpo's written authorization ensures institutional consent.

- **Data Governance**: Compliance with the Australian Privacy Act (1988), GDPR, and HIPAA standards.

- **Responsible AI Design**: Any outputs will be advisory, not decision-making.

- **Transparency**: All code and analysis scripts are documented for audit and open-sourced for learning purposes.

7. Data Analysis Strategies and Tools

Purpose	Tool / Technique	Outputs
Text processing	Python (Text Blob and/or Transformers)	Rich context and interpretive depth.
Statistical Analysis	Pandas, Numpy	Correlation and regression results
Qualitative coding	Word Cloud or manual thematic analysis	Verified emotion themes
Visualization	Streamlit, Matplotlib	Trend plots and correlation heatmaps
Triangulation	Combine AI, NPS and revenue metrics	Composite predictive model

Data will be visualized as scatterplots and heatmaps linking net promoter score to revenue trends. The mixed-methods output will reveal whether specific behaviors (e.g., satisfaction vs growth in sales) predict measurable changes in clinic income.

The workflow below reflects core ICT research competency by combining Python-based statistical analysis with data visualization pipelines, aligning with software engineering R&D practices.

8. Limitations and Delimitations

- **Scope**: Restricted to one clinic group (Pro-Corpo), limiting cross-industry generalizability.

- **Data Bias**: Feedback may be skewed toward extreme experiences.

- **Time Frame:** Analysis limited to 2022–2025 data.

- **Delimitation**: Study focuses on correlational evidence, not causal inference.

While data are anonymized, reflexivity remains essential: as an ex-internal collaborator, the researcher must remain aware of interpretive bias when analyzing familiar organizational contexts.

9. Conclusion

This research framework investigates the correlation between Net Promoter Score and revenue growth, establishing a practical foundation for understanding customer experience as a business performance driver in healthcare. By combining quantitative correlation modelling with qualitative verification, the study aligns technical data analysis with managerial relevance and ethical governance. The mixed-methods approach reflects ICT R&D principles - iterative experimentation, data integration, and responsible innovation - and sets the groundwork for future applications that integrate automated feedback analytics into clinical decision-support dashboards. This focused exploration of NPS–revenue relationships offers a measurable baseline

for subsequent research, where sentiment analysis and predictive modelling can progressively enhance business intelligence and patient-centered decision-making.

Statement of Acknowledgment

I acknowledge that I have used the following AI tool(s) in the creation of this report:

- OpenAI ChatGPT (GPT-5): Used to assist with outlining, refining structure, improving clarity of academic language, and supporting with APA 7th referencing conventions.

I confirm that the use of the AI tool has been in accordance with the Torrens University Australia Academic Integrity Policy and TUA, Think and MDS's Position Paper on the Use of AI. I confirm that the final output is authored by me and represents my own critical thinking, analysis, and synthesis of sources. I take full responsibility for the final content of this report.

10.   References

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