

A Data-Driven Intelligence Dashboard for Analyzing K-Pop Chart Re-Entry and Comeback Momentum

Ishita Das

Unified Mentor, Technology: Python, Scikit-Learn, Streamlit, Plotly, KIIT

Abstract—The rapid global growth of the K-Pop industry has transformed music consumption into a highly data-driven ecosystem, where chart performance, audience engagement, and comeback strategies play a crucial role in determining an artist's long-term success. While existing music analytics primarily focus on streaming statistics and peak chart positions, limited attention has been given to understanding chart re-entry patterns, comeback momentum, fandom engagement, and content characteristics that influence sustained popularity. This study presents an interactive K-Pop Chart Re-Entry and Comeback Momentum Analytics Dashboard designed to provide comprehensive insights into historical chart performance using data visualization and exploratory analytics. The proposed system utilizes Python-based data processing techniques with Pandas for data preprocessing and feature engineering, Plotly for interactive visualizations, and Streamlit for developing a responsive web-based analytics dashboard. The dataset was cleaned, transformed, and analyzed to derive meaningful indicators such as re-entry frequency, comeback momentum scores, popularity trends, release-type distribution, fandom engagement, and artist performance. Multiple interactive modules, including Market Overview, Re-Entry Intelligence, Comeback Momentum, Fandom Intelligence, Content Insights, and Recommendation Analytics, enable users to explore chart behaviour through dynamic filtering and real-time visual exploration. The analysis reveals that several songs consistently re-enter music charts despite temporary declines, highlighting the impact of loyal fan communities, promotional activities, and release strategies on long-term chart sustainability. The dashboard further identifies relationships between album characteristics, explicit content, release formats, and popularity trends, providing actionable insights for music production companies, marketing teams, and entertainment analysts. By integrating interactive business intelligence with music analytics, the proposed system demonstrates an effective approach for monitoring chart dynamics and supporting data-driven decision-making within the rapidly evolving K-Pop industry.

Index Terms—K-Pop Analytics, Music Intelligence, Data Visualization, Interactive Dashboard, Streamlit, Plotly, Python, Chart Re-Entry Analysis, Comeback Momentum, Business Intelligence, Exploratory Data Analysis

I. INTRODUCTION

The digital music industry has experienced unprecedented growth over the past decade, driven by the widespread adoption of music streaming platforms and increasing global internet accessibility. Services such as Spotify, Apple Music, and YouTube Music have transformed the way audiences consume music by providing instant access to millions of songs while simultaneously generating large volumes of user interaction data. These platforms have enabled record labels and artists to monitor listener behaviour, popularity trends, and chart performance in real time, making data analytics an essential component of strategic decision-making within the music industry. Among all contemporary music industries, the South Korean K-Pop industry has emerged as one of the most influential and rapidly expanding entertainment sectors worldwide. K-Pop has evolved beyond regional popularity to become a global cultural phenomenon supported by highly organized fan communities, innovative promotional strategies, and extensive digital engagement. Unlike conventional music markets, where songs typically follow a gradual pattern of rise and decline, K-Pop exhibits a unique chart behaviour characterized by repeated comebacks, promotional cycles, anniversary events, award performances, social media campaigns, and fandom-driven streaming activities. These events often result in songs re-entering music charts multiple times, creating distinctive popularity patterns that cannot be adequately explained through traditional streaming metrics alone.

Most existing music analytics focus primarily on indicators such as total streams, peak chart position, average popularity, or cumulative listening time. While these metrics provide valuable information regarding commercial success, they often fail to capture the dynamic nature of chart resurgence and comeback behaviour that defines the K-Pop ecosystem. Songs may temporarily disappear from charts before reappearing due to renewed fan engagement, promotional activities, or major public events. Such re-entry patterns provide valuable insights into audience loyalty, marketing effectiveness, and long-term content sustainability. However, these behavioural characteristics remain relatively underexplored in traditional analytical frameworks.

Another significant aspect of the K-Pop industry is the influence of dedicated fandom communities. Unlike passive listeners, K-Pop fans actively participate in coordinated streaming campaigns, digital voting, promotional activities, and social media engagement to support their favourite artists. These collective actions often generate sudden increases in streaming activity, resulting in rapid chart recovery and sustained popularity over multiple promotional cycles. Understanding these fandom-driven dynamics is increasingly important for entertainment companies seeking to optimize release schedules, promotional investments, and long-term artist development strategies.

To address these challenges, this research presents a comprehensive K-Pop Chart Re-Entry and Comeback Momentum Analytics Dashboard that combines interactive data visualization with business intelligence techniques to analyze historical South Korea Top 50 playlist data. The proposed system extends conventional music analytics by introducing multiple analytical perspectives, including chart re-entry frequency, comeback momentum measurement, fandom intensity estimation, release strategy evaluation, and content-based performance analysis. These analytical modules collectively provide a deeper understanding of chart behaviour and audience engagement beyond simple popularity rankings.

The system has been developed using Python and modern data analytics libraries, including Pandas for data preprocessing and transformation, Plotly for interactive visualizations, and Streamlit for developing a responsive web-based dashboard. The dataset undergoes systematic preprocessing to ensure data

consistency before generating various performance indicators. Interactive filters allow users to analyze songs, artists, release types, popularity scores, and chart trends dynamically, enabling both high-level business insights and detailed exploratory analysis. The dashboard integrates multiple visualization techniques such as line charts, bar charts, scatter plots, heatmaps, distribution plots, leaderboards, and timeline analysis to support comprehensive interpretation of music chart dynamics.

The proposed dashboard is designed not only as an analytical tool but also as a decision-support platform for record labels, music producers, entertainment agencies, and marketing professionals. By identifying recurring chart patterns, measuring comeback effectiveness, and estimating fandom engagement, the system enables stakeholders to evaluate promotional strategies, optimize release planning, and understand long-term audience behaviour. Furthermore, the dashboard provides executive-level recommendations derived from the analytical findings, making the platform valuable for both technical analysts and business decision-makers.

The primary contribution of this research lies in integrating multiple dimensions of K-Pop chart analysis within a single interactive dashboard. Unlike conventional music analytics that emphasize only popularity metrics, the proposed framework investigates chart re-entry behaviour, comeback momentum, chart sustainability, release characteristics, and fandom-driven engagement simultaneously. This multidimensional approach enables a more comprehensive understanding of music performance while demonstrating the effectiveness of interactive business intelligence tools for entertainment analytics. The developed system illustrates how data visualization and exploratory analysis can transform large-scale music datasets into actionable insights, supporting evidence-based decision-making in one of the world's fastest-growing entertainment industries.

II. LITERATURE REVIEW

The rapid evolution of digital music streaming platforms has generated vast amounts of user interaction data, enabling researchers and entertainment companies to explore music consumption patterns through data analytics and

business intelligence techniques. Previous studies have primarily focused on understanding listener preferences, song popularity prediction, recommendation systems, and streaming behaviour using machine learning and statistical analysis. Platforms such as Spotify have become valuable sources of publicly available music metadata, facilitating research on audio features, popularity trends, playlist analysis, and artist performance.

Several researchers have employed exploratory data analysis (EDA) and visualization techniques to study music streaming datasets. These studies commonly examine relationships between song popularity, artist characteristics, release year, genre, audio features, and listener engagement. Interactive dashboards developed using tools such as Tableau, Power BI, and Plotly have further improved the accessibility of music analytics by enabling stakeholders to explore complex datasets through intuitive visual representations. Such dashboards assist record labels, marketing professionals, and artists in identifying emerging trends and optimizing promotional strategies.

Recent advancements in business intelligence have significantly expanded the application of interactive dashboards across multiple industries, including finance, healthcare, retail, education, and entertainment. Business intelligence platforms integrate data preprocessing, visualization, and decision-support capabilities into unified systems that facilitate real-time analysis of large datasets. Interactive dashboards have become increasingly important because they enable users to filter information dynamically, compare multiple performance indicators, and generate actionable insights without requiring extensive technical expertise. Within the music industry, these dashboards have been successfully applied to streaming statistics, playlist performance, audience demographics, and artist engagement analysis.

Although several studies have investigated popularity prediction and recommendation systems using machine learning algorithms, relatively limited research has focused on chart re-entry behaviour and comeback momentum, particularly within the context of the South Korean K-Pop industry. Unlike many international music markets, K-Pop operates through structured promotional cycles involving album releases, music show performances, fan events, social media campaigns, and organized streaming initiatives.

These activities frequently result in songs reappearing on music charts after temporary declines, creating unique chart dynamics that cannot be fully explained through conventional popularity metrics alone.

Another distinctive characteristic of the K-Pop industry is the influence of highly organized fandom communities. Previous research has demonstrated that fan engagement extends beyond passive music consumption to include coordinated streaming campaigns, digital voting, online promotions, and community-driven support activities. These collective actions often generate sudden increases in streaming volume and chart performance, producing measurable comeback effects that differ significantly from organic listening behaviour observed in many Western music markets. However, existing analytical frameworks rarely quantify these behavioural patterns through dedicated metrics such as comeback intensity, rank recovery efficiency, chart retention, or fandom engagement proxies. Furthermore, existing music analytics dashboards generally emphasize descriptive statistics such as total streams, average popularity, artist rankings, or playlist distribution. While these indicators provide useful business information, they do not sufficiently explain long-term chart sustainability or repeated popularity cycles. There remains a significant opportunity to develop interactive analytical systems capable of integrating multiple dimensions of chart behaviour including re-entry detection, comeback momentum, retention analysis, content characteristics, and fandom-driven engagement within a single decision-support platform. To address these research gaps, the present study proposes an interactive K-Pop Chart Re-Entry and Comeback Momentum Analytics Dashboard that combines data preprocessing, exploratory data analysis, feature engineering, and business intelligence visualization techniques. Unlike conventional dashboards that primarily summarize historical statistics, the proposed system introduces analytical metrics specifically designed to evaluate comeback performance, chart recovery, momentum sustainability, release strategy effectiveness, and fandom intensity. By integrating these dimensions into an interactive Streamlit-based platform, the study provides entertainment companies and analysts with a comprehensive framework for understanding long-term chart behaviour and supporting data-driven strategic decision-making within the K-Pop industry.

Table 2.1 Comparison of Existing Studies

Study Focus	Existing Research	Limitation	Proposed Work
Music Popularity Analysis	Streaming counts, popularity prediction	Limited focus on chart resurgence	Analyzes repeated chart re-entry and comeback behaviour
Interactive Dashboards	General visualization dashboards	Primarily descriptive analytics	Interactive executive dashboard with decision-support features
Recommendation Systems	Personalized music recommendation	Focus on listener preference only	Focus on business intelligence and chart dynamics
K-Pop Analytics	Fan behaviour and streaming trends	Limited analytical metrics	Introduces fandom intensity, momentum score, and retention analysis
Business Intelligence	Sales and engagement monitoring	Lack of comeback-specific analysis	Comprehensive analytics platform for strategic music insights

Research Gaps:

Based on the reviewed literature, the following research gaps were identified:

- Existing music analytics predominantly emphasize streaming statistics and popularity rankings rather than long-term chart behaviour.
- Limited research investigates chart re-entry frequency and comeback momentum within the K-Pop ecosystem.
- Few analytical frameworks estimate fandom-driven engagement through measurable chart-based indicators.
- Interactive dashboards specifically designed for entertainment business intelligence remain relatively underexplored.
- Current systems rarely integrate multiple analytical dimensions including re-entry analysis, momentum measurement, content strategy, and executive recommendations within a unified platform.

The proposed dashboard addresses these limitations by providing a comprehensive analytical framework tailored to the unique characteristics of South Korea's K-Pop music industry.

III. PROBLEM STATEMENT

The rapid growth of digital music streaming platforms has enabled record labels and entertainment companies to access vast amounts of chart performance data. However, conventional music analytics primarily emphasize metrics such as streaming counts, peak chart positions, and overall popularity, providing only a limited understanding of long-term audience engagement. These traditional approaches fail to capture the dynamic behaviour of

songs that repeatedly re-enter music charts after temporary declines, a phenomenon that is particularly common within the South Korean K-Pop industry.

Unlike many global music markets, K-Pop follows a structured promotional ecosystem driven by album releases, comeback campaigns, live performances, award ceremonies, anniversaries, and highly organized fan communities. These events frequently generate sudden increases in streaming activity, causing songs to regain popularity and reappear on music charts. Despite the strategic importance of these comeback cycles, existing analytical frameworks rarely measure chart re-entry frequency, comeback momentum, rank recovery, or fandom-driven engagement through dedicated analytical metrics.

Furthermore, entertainment companies require interactive business intelligence platforms that transform complex chart data into meaningful insights for strategic planning. Existing dashboards often provide descriptive statistics but lack comprehensive analytical modules capable of evaluating long-term chart sustainability, release strategy effectiveness, and audience behaviour in an integrated manner.

Therefore, there is a need for a comprehensive analytics system capable of detecting chart re-entry patterns, measuring comeback momentum, estimating fandom intensity, and providing actionable business recommendations through an interactive visualization platform. This research addresses these challenges by developing a Streamlit-based analytics dashboard that combines data preprocessing, exploratory analysis, feature engineering, and interactive business intelligence techniques to support evidence-based decision-making within the K-Pop music industry.

IV. OBJECTIVES

The primary objective of this research is to develop an interactive analytics dashboard that enables comprehensive analysis of chart re-entry behaviour, comeback momentum, and fandom engagement within South Korea's Top 50 music charts. The proposed system aims to transform historical playlist data into meaningful business intelligence that supports strategic decision-making for entertainment companies.

The specific objectives of this research are:

1. To preprocess and validate historical South Korea Top 50 playlist data for accurate analytical evaluation.
2. To identify songs that experience multiple chart re-entries and analyze the frequency and timing of their comeback cycles.
3. To develop analytical metrics for measuring comeback momentum, including popularity growth, rank recovery, retention period, and momentum sustainability.
4. To estimate fandom-driven engagement using chart-based indicators such as re-entry frequency, popularity trends, recovery speed, and chart persistence.
5. To evaluate the influence of content-related characteristics, including album type, album size, song duration, and explicit content, on comeback performance.
6. To design and implement an interactive Streamlit dashboard featuring dynamic filters, visual analytics, leaderboards, and executive recommendations for comprehensive music industry analysis.
7. To provide actionable business insights that assist record labels and entertainment organizations in optimizing release strategies, promotional campaigns, and long-term artist development.

Expected Outcome:

The proposed system is expected to provide a comprehensive decision-support platform capable of analyzing long-term K-Pop chart dynamics through interactive visualizations and analytical metrics. By integrating chart re-entry detection, comeback momentum analysis, fandom intensity estimation, and content-based performance evaluation, the dashboard

aims to assist stakeholders in understanding audience behaviour and making data-driven strategic decisions. The developed platform is also expected to demonstrate the effectiveness of interactive business intelligence tools in transforming large-scale music streaming data into meaningful insights for the entertainment industry.

V. DATASET DESCRIPTION

The dataset used in this research consists of historical South Korea Top 50 Spotify playlist records provided for analytical purposes by Atlantic Recording Corporation. It contains daily playlist snapshots that capture song rankings, artist information, popularity scores, album characteristics, and content-related attributes. Each record represents the position of a song in the Top 50 playlist for a particular date, enabling longitudinal analysis of chart performance over time.

Unlike traditional music datasets that primarily focus on audio features or cumulative streaming counts, this dataset emphasizes playlist ranking dynamics, making it particularly suitable for studying chart re-entry behaviour, comeback momentum, and long-term audience engagement. The availability of daily playlist observations allows repeated chart appearances and popularity fluctuations to be tracked across multiple promotional cycles. Before analysis, the dataset underwent preprocessing to ensure consistency and reliability. This included validating daily playlist records, handling missing values, converting data types, normalizing song and artist identifiers, and generating additional analytical features required for momentum and fandom analysis. These preprocessing steps ensured that the dataset was suitable for interactive visualization and business intelligence applications. The dataset serves as the primary source for calculating chart re-entry frequency, momentum scores, retention periods, popularity trends, fandom intensity proxies, and content-based performance metrics presented throughout this research.

5.1 Dataset Summary

Attribute	Description
Dataset Name	South Korea Top 50 Spotify Playlist Dataset
Domain	Music Streaming Analytics
Source	Atlantic Recording Corporation
Geographic Region	South Korea

Data Type	Daily Playlist Snapshots
Number of Records	27,800
Number of Features	10
Time Granularity	Daily
Target Application	Chart Behaviour & Business Intelligence

5.2 Dataset Attributes

Attribute	Data Type	Description
date	Date	Date of the playlist snapshot
position	Integer	Song ranking in the Top 50 playlist
song	String	Song title
artist	String	Artist or group name
popularity	Integer	Spotify popularity score
duration_ms	Integer	Song duration in milliseconds
album_type	Categorical	Indicates whether the release is a Single or Album
total_tracks	Integer	Number of tracks available in the album
is_explicit	Boolean	Indicates whether explicit content is present
album_cover_url	String	URL of the album artwork

5.3 Data Preprocessing

To ensure high-quality analytical results, the dataset underwent several preprocessing operations prior to visualization and analysis. The preprocessing workflow included:

- Validation of daily Top 50 playlist records to ensure data completeness.
- Conversion of date values into a standard datetime format for chronological analysis.
- Normalization of song and artist names to improve consistency during grouping operations.
- Conversion of song duration from milliseconds to minutes for better interpretability.
- Validation of popularity scores and ranking information.
- Removal of invalid or incomplete records where necessary.
- Creation of additional derived features such as chart re-entry events, comeback episodes, momentum scores, retention duration, recovery speed, and fandom intensity indicators.

These preprocessing steps improved data consistency and enabled accurate computation of advanced analytical metrics throughout the dashboard.

5.4 Dataset Characteristics

The dataset exhibits several characteristics that make it well suited for music analytics and business intelligence applications:

- Daily observations enable longitudinal tracking of chart behaviour.
- Multiple appearances of songs allow identification of chart re-entry patterns.
- Popularity scores support quantitative momentum analysis.
- Album-related information facilitates release strategy evaluation.
- Explicit content indicators enable comparative content analysis.
- Historical rankings provide insights into chart recovery, retention, and comeback sustainability.
- Artist-level information supports fandom engagement analysis and performance comparison.

Overall, the dataset provides a comprehensive representation of South Korea's Top 50 music chart, enabling detailed exploration of chart dynamics, audience engagement, and promotional effectiveness within the K-Pop industry.

VI. METHODOLOGY

The proposed K-Pop Chart Re-Entry and Comeback Momentum Analytics Dashboard follows a systematic data analytics workflow that transforms raw historical playlist data into interactive business intelligence. The methodology consists of six major stages: data acquisition, data preprocessing, feature engineering, analytical modelling, interactive visualization, and business insight generation. Each stage contributes to improving data quality, extracting meaningful performance indicators, and supporting evidence-based decision-making.

The overall workflow of the proposed system is illustrated in Figure 6.1.



6.1 Data Collection

The study utilizes historical South Korea Top 50 Spotify playlist data provided by Atlantic Recording Corporation. Each observation corresponds to a daily playlist snapshot containing song rankings, artist information, popularity scores, album characteristics, and content-related attributes.

The dataset was selected because its daily time-series structure enables the identification of repeated chart appearances, comeback cycles, popularity fluctuations, and audience engagement over an extended period. These characteristics make it well suited for analyzing the unique behaviour of K-Pop charts.

6.2 Data Preprocessing

Raw playlist data often contains inconsistencies that can affect analytical accuracy. Therefore, a preprocessing pipeline was applied before performing any statistical or visual analysis.

The preprocessing stage included the following operations:

- Validation of daily Top 50 playlist records.
- Conversion of date values into datetime format.
- Standardization of song and artist identifiers.
- Conversion of song duration from milliseconds to minutes.
- Verification of popularity scores.
- Identification and handling of incomplete records.
- Preparation of categorical variables for visualization.

These preprocessing operations ensured consistency throughout the analytical workflow and improved the reliability of the generated insights.

6.3 Feature Engineering

To capture chart behaviour beyond conventional popularity metrics, several analytical features were derived from the original dataset.

The engineered features include:

- Chart Re-Entry Frequency: Number of times a song reappears after leaving the Top 50.
- Re-Entry Gap: Number of days between chart exit and subsequent re-entry.
- Momentum Score: Measures comeback strength using changes in popularity and ranking.
- Rank Recovery Speed: Indicates how rapidly a song regains higher chart positions.
- Retention Duration: Number of consecutive days a song remains on the chart after re-entry.
- Fandom Intensity Proxy: Composite indicator derived from re-entry frequency, momentum, and chart persistence.
- Album-Level Metrics: Evaluation of album type, album size, and release strategy.

These engineered variables formed the basis for the analytical modules implemented within the dashboard.

6.4 Exploratory Data Analysis

Exploratory Data Analysis (EDA) was conducted to understand the overall characteristics of the dataset

and identify meaningful behavioural patterns before advanced analysis.

The EDA process focused on:

- Distribution of popularity scores.
- Daily chart composition.
- Artist frequency.
- Album type distribution.
- Explicit versus clean content.
- Song duration analysis.
- Temporal popularity trends.

The findings obtained during this phase guided the design of the dashboard and helped determine the most informative visualizations.

6.5 Analytical Framework

The analytical framework was designed around five major intelligence modules, each addressing a specific business objective.

Market Overview: Provides a comprehensive summary of chart behaviour through key performance indicators and trend visualizations.

Re-Entry Intelligence: Detects songs that leave and subsequently reappear in the chart while measuring re-entry frequency and temporal gaps.

Comeback Momentum: Evaluates the strength of chart resurgence using popularity variation, ranking improvement, recovery speed, and retention duration.

Fandom Intelligence: Estimates fan-driven engagement using behavioural indicators derived from chart persistence and comeback performance.

Content Intelligence: Examines the influence of release characteristics such as album type, total tracks, explicit content, and song duration on chart success. Together, these modules provide a multidimensional understanding of K-Pop chart dynamics.

6.6 Dashboard Development

An interactive web application was developed using Streamlit, enabling users to explore analytical results through dynamic filters and visualizations.

The dashboard provides:

- Interactive date-range selection.
- Song and artist filtering.
- Album type selection.

- Re-entry threshold filtering.
- Dynamic KPI cards.
- Interactive Plotly visualizations.
- Executive recommendation module.
- Downloadable analytical insights.

The interface was designed to support both technical analysts and business stakeholders by presenting complex analytical information in an intuitive and visually accessible format.

6.7 Business Intelligence Generation

The final stage converts analytical findings into actionable recommendations.

Insights generated by the dashboard assist stakeholders in:

- Identifying artists with sustained comeback performance.
- Evaluating promotional effectiveness.
- Understanding fandom-driven chart behaviour.
- Comparing release strategies.
- Supporting strategic planning for future music releases.

The dashboard therefore functions not only as a visualization platform but also as a decision-support system for entertainment analytics.

VII. DASHBOARD IMPLEMENTATION

The proposed K-Pop Chart Re-Entry and Comeback Momentum Analytics Dashboard was developed using Streamlit, providing an interactive and user-friendly interface for exploring historical chart performance. The dashboard integrates multiple analytical modules into a unified platform, enabling users to investigate music trends, artist performance, fandom influence, and comeback dynamics through interactive visualizations.

The dashboard follows a modular architecture where each analytical component is implemented as an independent module, improving code organization, scalability, and maintainability. Data preprocessing is performed once during application initialization using Streamlit's caching mechanism, ensuring efficient loading and smooth interaction even when handling thousands of chart records.

The overall design adopts a modern dark-themed interface inspired by executive business intelligence dashboards. Interactive KPI cards, dynamic filters, and responsive Plotly visualizations provide an engaging user experience while maintaining professional presentation standards.

7.1 Dashboard Architecture

The dashboard consists of four major layers:

- Data Layer – Loads and preprocesses the historical K-Pop dataset.
- Processing Layer – Performs feature engineering, aggregations, and analytical calculations.
- Visualization Layer – Generates interactive Plotly charts and statistical summaries.
- Presentation Layer – Displays the results using Streamlit with custom CSS styling.

This layered architecture separates business logic from visualization, making the application easier to maintain and extend.

7.2 Interactive User Interface

The user interface was designed to provide an executive-level analytics experience while remaining intuitive for general users.

The dashboard includes:

- Professional dark theme
- Interactive KPI cards
- Responsive sidebar filters
- Animated metrics
- Responsive Plotly charts
- Modular navigation tabs
- Executive header section
- Business intelligence styled layout

Users can dynamically filter the dataset using:

- Date Range
- Artist
- Song
- Album Type
- Explicit Content

All visualizations update automatically according to the selected filters, enabling real-time exploratory analysis.

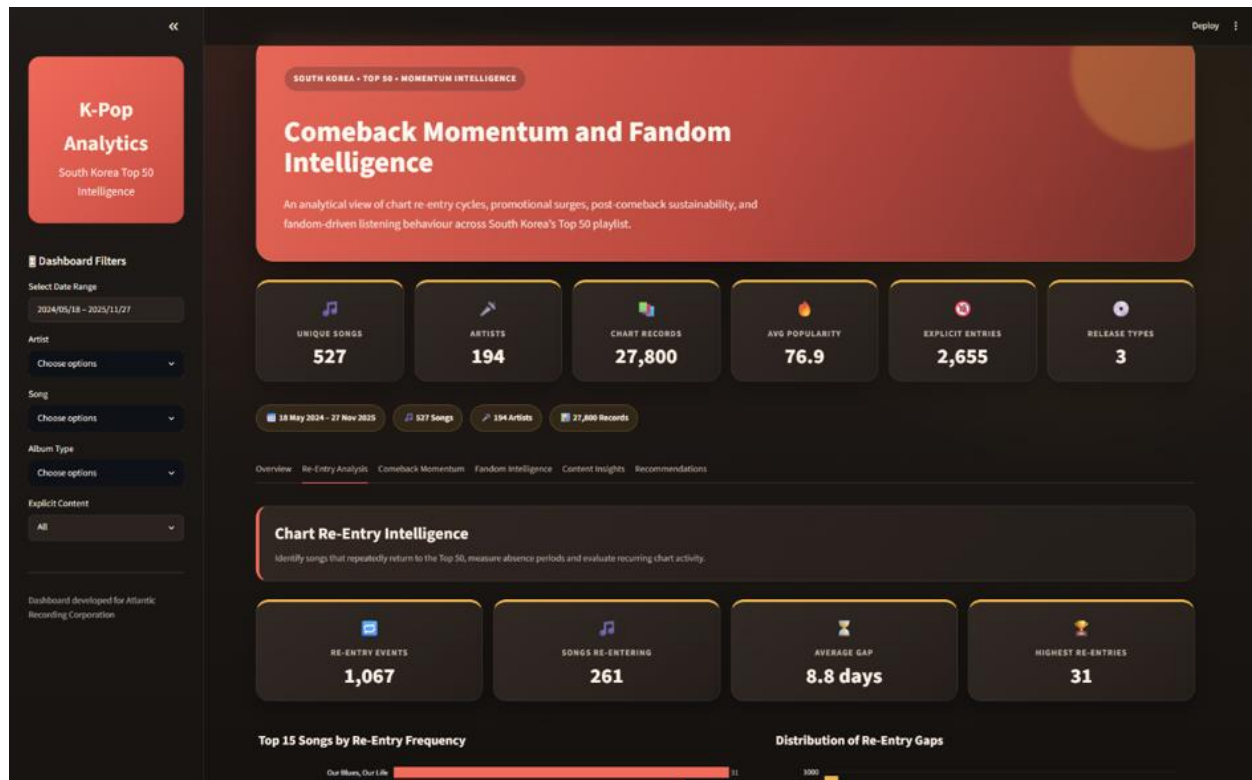


Figure 7.1: Dashboard Home Interface

7.3 Dashboard Modules

The dashboard is organized into six analytical modules.

7.3.1 Market Overview

This module provides a high-level summary of the dataset through key performance indicators and trend visualizations.

Features include:

- Total Songs
- Total Artists
- Chart Records
- Average Popularity
- Explicit Entries
- Release Types
- Popularity Trend
- Top Artists
- Album Distribution

7.3.2 Re-Entry Intelligence

This module focuses on identifying songs that return to the charts after temporary absence.

Visualizations include:

- Top Re-entering Songs
- Re-entry Frequency

- Gap Distribution
- Timeline Analysis
- Re-entry Scatter Analysis

These analyses help identify songs with long-term audience engagement.

7.3.3 Comeback Momentum

The Comeback Momentum module evaluates how successfully songs recover after re-entering the charts. The module contains:

- Momentum Score Distribution
- Rank Recovery Analysis
- Momentum Timeline
- Retention vs Momentum
- Album Type Comparison

This section helps assess promotional effectiveness and comeback sustainability.

7.3.4 Fandom Intelligence

The fandom module investigates the influence of fan communities on chart performance.

Included analyses are:

- Top Fandom Songs
- Artist Popularity

- Bubble Chart

- Fan Engagement Distribution

These visualizations demonstrate how strong fan support contributes to sustained chart success.

7.3.5 Content Insights

This module examines how musical content characteristics affect chart performance.

Visualizations include:

- Song Duration Analysis
- Album Size Comparison
- Explicit Content Analysis
- Album Type Performance

The module assists in understanding content-related factors influencing popularity.

7.3.6 Executive Recommendations

The final module summarizes analytical findings into business recommendations.

Recommendations include:

- Promotional Strategy
- Release Planning
- Artist Performance Evaluation
- Fandom Engagement Strategy
- Comeback Optimization

This section converts analytical insights into actionable business decisions.

7.4 Interactive Features

The dashboard provides several interactive capabilities to improve analytical exploration.

Key features include:

- Real-time filtering
- Dynamic KPI updates
- Interactive hover tooltips
- Zooming and panning
- Responsive charts
- Cross-filtered visualizations
- Modular dashboard navigation
- Optimized loading through Streamlit caching

These features enable users to investigate different analytical perspectives without requiring technical expertise.

7.5 Technology Stack

Component	Technology Used
Programming Language	Python
Dashboard Framework	Streamlit
Data Processing	Pandas
Visualization	Plotly
Styling	HTML + CSS
Dataset Format	CSV
IDE	Visual Studio Code
Version Control	Git & GitHub

7.6 Dashboard Screenshots

This section presents the implemented dashboard interfaces.

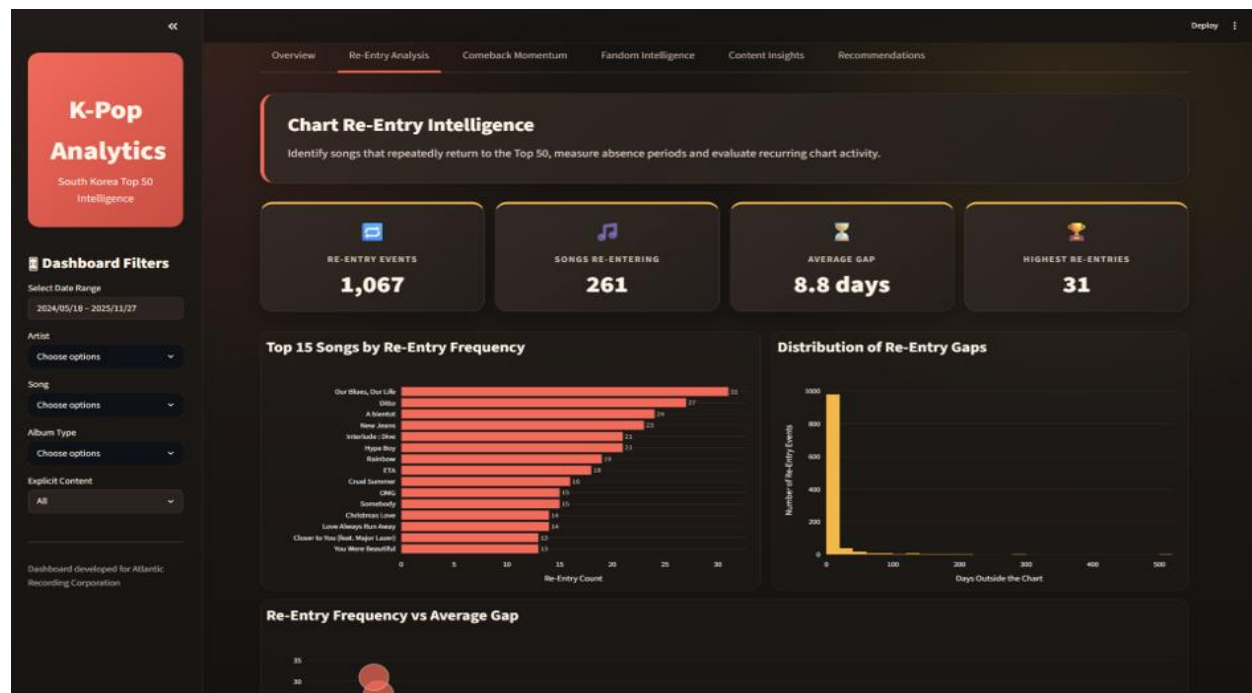


Figure 7.2: Re-Entry Intelligence Module

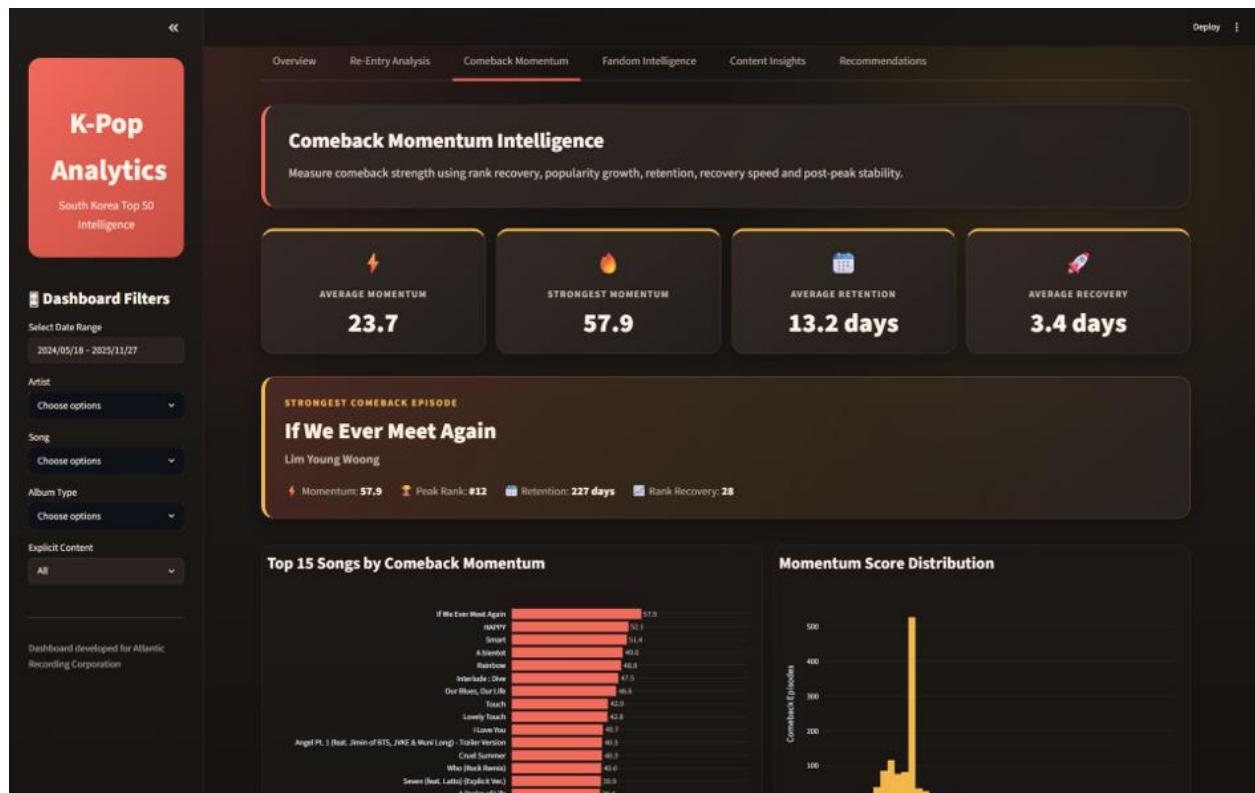


Figure 7.3: Comeback Momentum Module

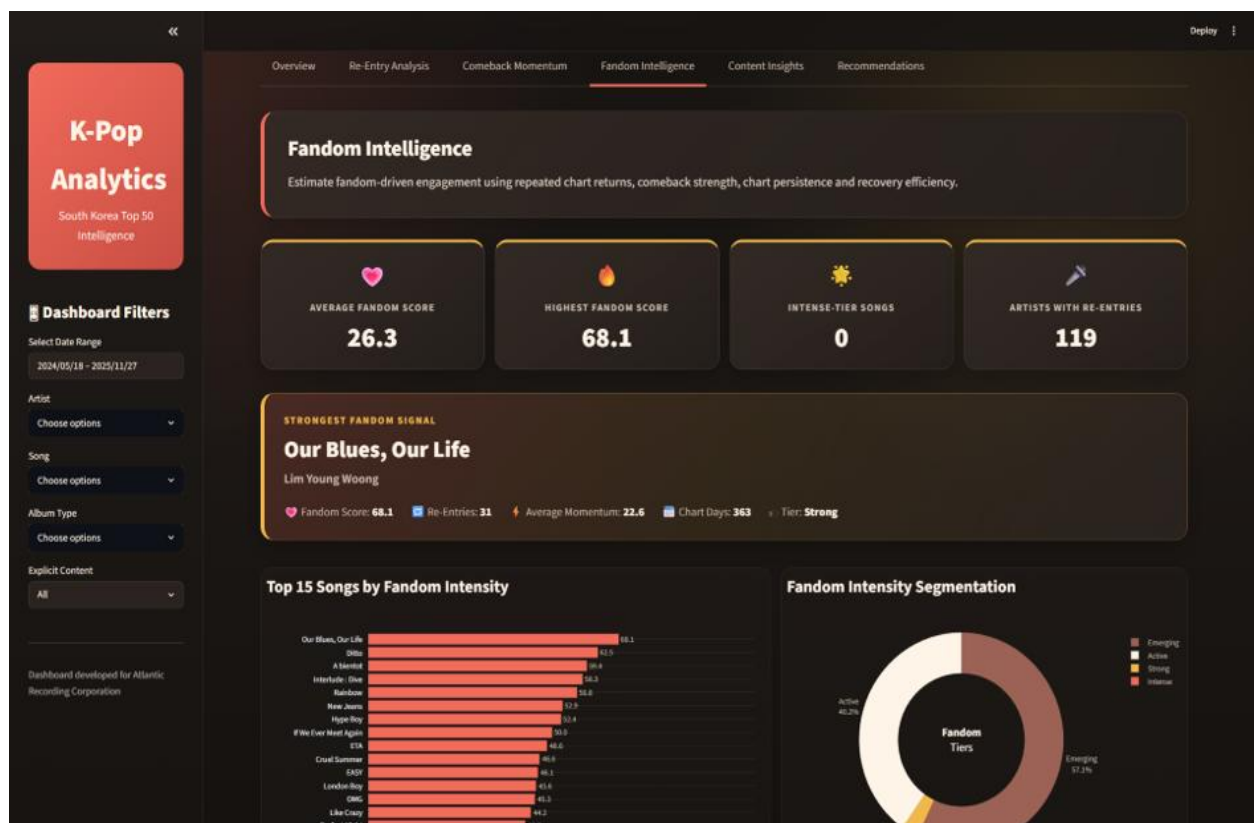


Figure 7.4: Fandom Intelligence Module

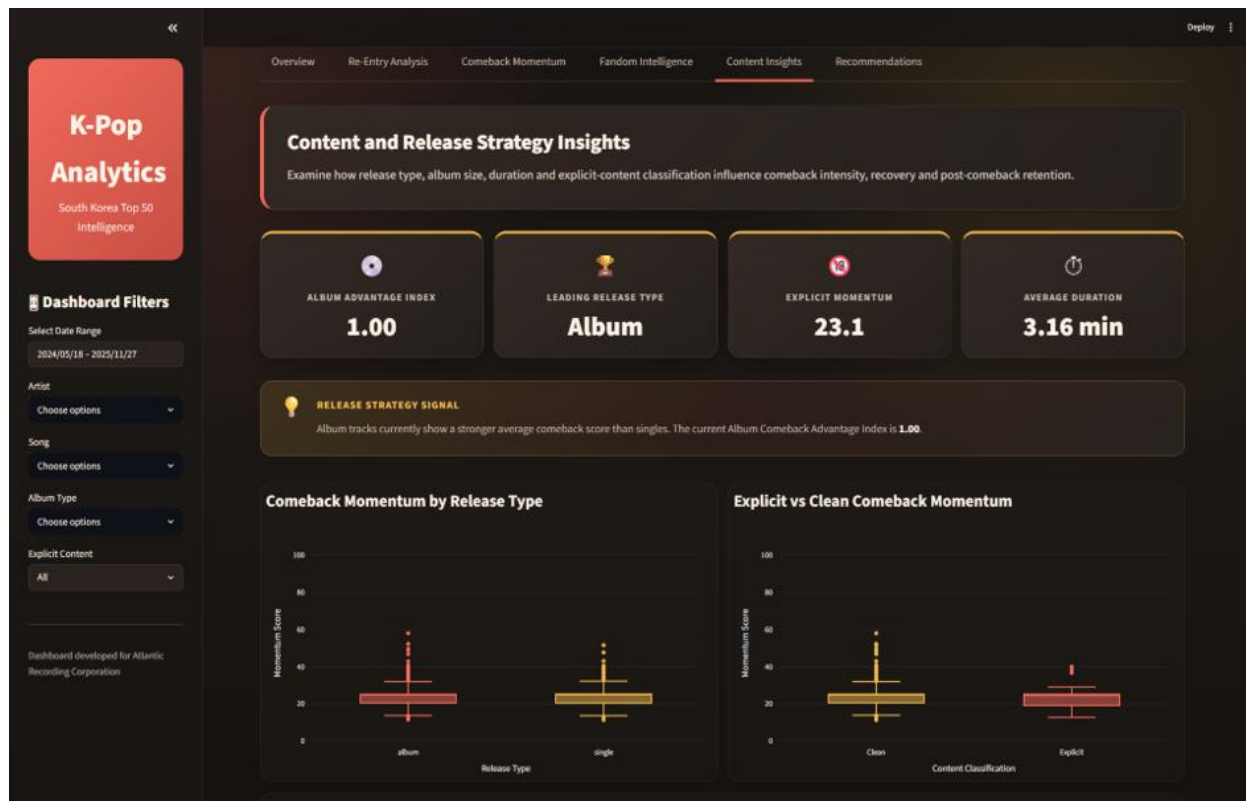


Figure 7.5: Content Insights Module

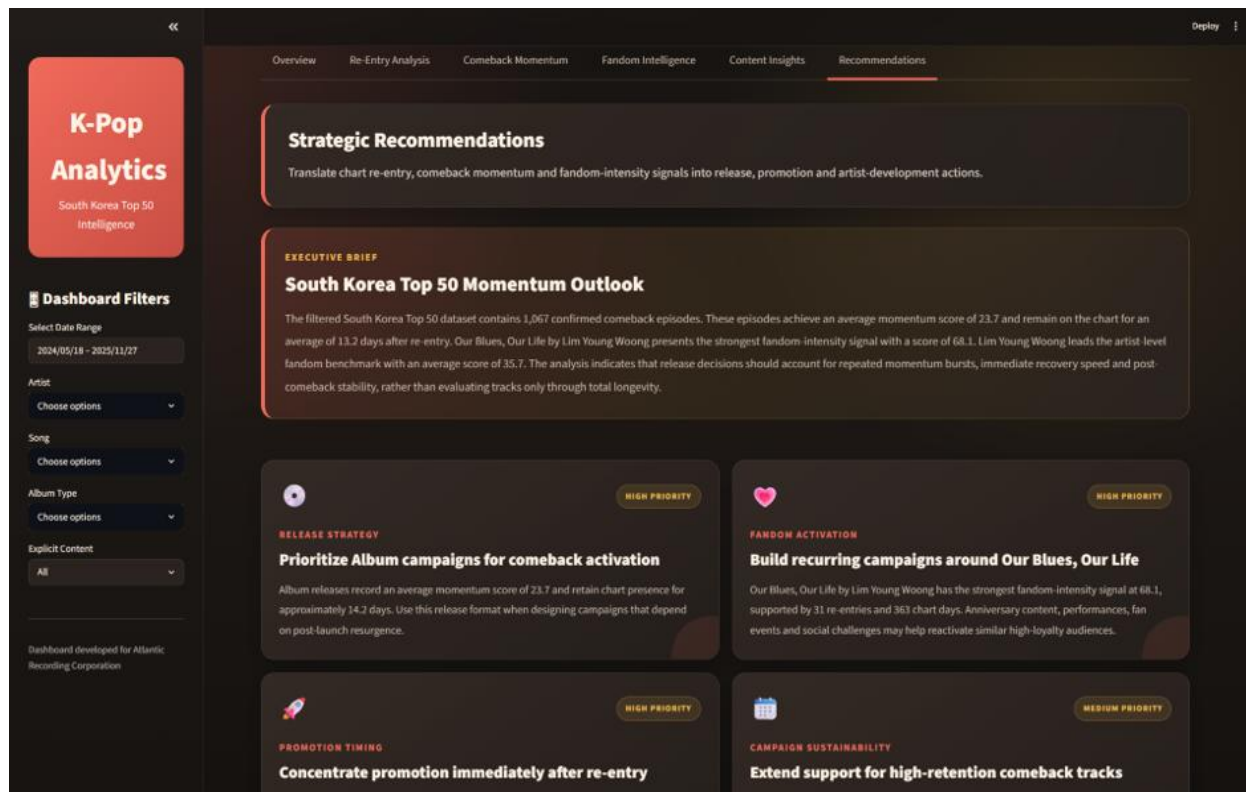


Figure 7.6: Recommendation Module

VIII. RESULTS & DISCUSSION

The proposed analytics dashboard successfully transformed historical South Korea Top 50 playlist data into meaningful business intelligence through interactive visualization and analytical feature extraction. The results demonstrate that chart performance in the K-Pop industry is influenced by multiple interconnected factors, including repeated chart re-entry, comeback momentum, fandom-driven engagement, and release characteristics. By integrating these dimensions into a unified analytical framework, the dashboard provides insights that extend beyond conventional popularity metrics and support strategic decision-making within the music industry.

The following sections discuss the key findings obtained from the analysis.

8.1 Market Overview Analysis

The overall market analysis revealed that chart performance remained dynamic throughout the observation period, with continuous changes in rankings reflecting the highly competitive nature of the South Korean music industry. While popularity scores exhibited moderate fluctuations over time, certain artists consistently maintained strong chart presence across multiple playlist snapshots.

The analysis also indicated that single releases represented a considerable proportion of chart entries, highlighting the industry's preference for frequent promotional releases and comeback strategies. Additionally, explicit-content songs constituted only a small fraction of the overall dataset, suggesting that clean content continues to dominate mainstream K-Pop playlists.

These findings demonstrate that chart performance is influenced not only by song popularity but also by release strategies and audience engagement patterns.

8.2 Chart Re-Entry Behaviour

One of the primary objectives of this study was to identify songs that repeatedly re-entered the Top 50 playlist after temporary absences. The analysis successfully detected multiple chart re-entry events, confirming that chart success within the K-Pop industry is not strictly linear.

Several songs demonstrated repeated re-entry behaviour, indicating sustained audience interest and

effective promotional activities beyond their initial release period. The calculated re-entry gaps showed that while many songs returned within relatively short intervals, others successfully regained chart positions after considerably longer periods, reflecting the influence of comeback promotions, live performances, and fan-driven streaming campaigns.

These observations emphasize that chart re-entry frequency serves as an effective indicator of long-term commercial sustainability rather than short-term popularity alone.

8.3 Comeback Momentum Analysis

The Comeback Momentum analysis evaluated the effectiveness of songs in recovering chart positions following re-entry. The results indicate that songs exhibiting stronger momentum scores generally achieved faster rank recovery and remained on the chart for longer durations after their comeback.

The momentum analysis further revealed that not all chart re-entries resulted in sustained success. While some songs experienced immediate popularity recovery, others displayed only temporary improvements before declining again. This distinction highlights the importance of measuring both comeback intensity and post-comeback retention when evaluating promotional effectiveness.

Overall, the momentum metrics provide a more comprehensive understanding of comeback performance than peak chart position alone.

8.4 Fandom Engagement Analysis

The fandom intensity analysis demonstrated the significant role of dedicated fan communities in sustaining chart performance. Songs associated with stronger fandom activity frequently exhibited repeated chart re-entry, faster recovery rates, and improved chart persistence.

The derived Fandom Intensity Proxy Score effectively distinguished songs that maintained long-term popularity through consistent audience engagement from those experiencing only short-lived popularity spikes. These findings support the widely recognized characteristic of the K-Pop industry, where organized fan participation contributes substantially to commercial success. Consequently, fandom-driven engagement should be considered an important analytical dimension when evaluating artist performance and promotional outcomes.

8.5 Content Characteristics Analysis

The content-based analysis examined whether release characteristics influence chart performance and comeback success. Comparisons between singles and album tracks indicated noticeable differences in chart behaviour, suggesting that release format may affect promotional effectiveness. Similarly, album size, song duration, and explicit-content classification exhibited varying relationships with chart persistence and comeback momentum. Although these attributes alone cannot determine commercial success, they provide valuable contextual information for understanding how release strategies influence audience response.

The analysis therefore highlights the importance of considering both musical content and promotional factors when evaluating chart performance.

8.6 Business Implications

The analytical findings generated through the dashboard provide valuable insights for entertainment companies, record labels, and artist management agencies.

The results suggest that organizations should:

- Monitor chart re-entry behaviour as an indicator of sustained audience engagement.
- Evaluate comeback momentum alongside traditional popularity metrics.
- Strengthen fan engagement initiatives to improve long-term chart persistence.
- Optimize release schedules using historical comeback patterns.
- Incorporate interactive business intelligence into strategic decision-making processes.

By leveraging these insights, stakeholders can design more effective promotional campaigns, improve release planning, and better understand long-term audience behaviour.

8.7 Overall Discussion

The proposed dashboard demonstrates that interactive business intelligence can significantly enhance music industry analytics by combining historical chart data with advanced exploratory analysis. Unlike conventional reporting systems that primarily summarize popularity statistics, the developed platform investigates chart re-entry dynamics, comeback sustainability, fandom engagement, and content characteristics within a single analytical framework.

The findings indicate that repeated chart re-entry, strong comeback momentum, and sustained fan engagement are key contributors to long-term chart success in the K-Pop industry. Furthermore, the interactive nature of the dashboard enables users to explore these relationships dynamically through filtering and visualization, making the system valuable for both analytical exploration and executive decision support.

Overall, the proposed framework successfully addresses the research objectives by transforming raw playlist data into actionable insights that can support evidence-based strategies within the modern digital music ecosystem.

Table 8.1 Summary of Major Findings

Analysis Area	Key Observation	Business Significance
Market Overview	Stable popularity with periodic fluctuations	Reflects continuous audience engagement and competitive chart dynamics
Chart Re-Entry	Multiple songs repeatedly returned to the charts	Indicates sustained popularity beyond the initial release period
Comeback Momentum	Stronger momentum resulted in faster recovery and improved retention	Helps evaluate promotional effectiveness and comeback success
Fandom Engagement	Higher fandom intensity was associated with greater chart persistence	Demonstrates the importance of organized fan communities in K-Pop
Content Analysis	Release characteristics influenced chart behaviour but did not solely determine success	Supports optimization of release strategies and promotional planning
Business Intelligence	Interactive analytics improved interpretation of historical chart behaviour	Assists entertainment companies in evidence-based decision-making

IX. CONCLUSION

The rapid evolution of digital music streaming platforms has created new opportunities for applying data analytics and business intelligence within the entertainment industry. This research presented an interactive K-Pop Chart Re-Entry and Comeback Momentum Analytics Dashboard designed to analyze historical South Korea Top 50 playlist data and generate meaningful insights into chart behaviour, comeback performance, fandom engagement, and release strategies.

The proposed system successfully integrated data preprocessing, feature engineering, exploratory data analysis, and interactive visualization into a unified Streamlit-based dashboard. Multiple analytical modules including Market Overview, Re-Entry Intelligence, Comeback Momentum, Fandom Intelligence, Content Insights, and Executive Recommendations enabled comprehensive exploration of music chart dynamics through an intuitive and interactive interface.

The study demonstrated that chart performance within the K-Pop industry extends beyond conventional popularity metrics. Songs frequently experience repeated chart re-entry due to promotional campaigns, comeback activities, and sustained fan engagement. The introduction of analytical indicators such as re-entry frequency, momentum score, recovery speed, retention duration, and the Fandom Intensity Proxy Score provided a more comprehensive understanding of long-term chart sustainability and commercial success.

Furthermore, the dashboard effectively transformed historical playlist records into actionable business intelligence that can support entertainment companies, record labels, and artist management agencies in designing evidence-based promotional strategies. The interactive filtering capabilities and executive-level visualizations improve the accessibility of complex analytical information while enabling users to investigate chart behaviour from multiple perspectives.

Overall, the proposed dashboard successfully achieved the objectives of this research by providing a scalable, interactive, and user-friendly platform for analyzing K-Pop chart dynamics. The study demonstrates the practical value of combining data analytics, business intelligence, and interactive visualization techniques

to support strategic decision-making within the rapidly evolving digital music industry.

X. FUTURE SCOPE

Although the proposed dashboard provides comprehensive analytical capabilities for historical chart analysis, several opportunities exist for extending its functionality and improving its practical applicability.

Future enhancements may include the integration of real-time music streaming data through official APIs, enabling continuous monitoring of chart performance and automated dashboard updates. Machine learning models could also be incorporated to predict future chart rankings, estimate comeback success, and forecast long-term popularity trends based on historical performance patterns.

The analytical framework may be expanded to include additional streaming platforms such as Apple Music, Melon, Genie, YouTube Music, and Billboard charts, providing a broader perspective on global music performance. Similarly, integrating social media engagement data from platforms such as X (formerly Twitter), Instagram, TikTok, and YouTube could improve the estimation of fandom activity and promotional effectiveness.

Advanced sentiment analysis techniques may also be employed to examine audience reactions toward comeback announcements, album releases, and promotional campaigns. Furthermore, network analysis could be used to investigate collaborations between artists, producers, and entertainment agencies, providing additional insights into industry dynamics.

From a technical perspective, future versions of the dashboard could incorporate user authentication, customizable reports, PDF export functionality, automated business recommendations, and cloud-based deployment with scalable database support. These enhancements would transform the current analytical dashboard into a comprehensive decision-support platform suitable for large-scale commercial applications.

Overall, the proposed framework provides a strong foundation for future research in music analytics and demonstrates considerable potential for supporting data-driven decision-making across the global entertainment industry.

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