Development of a Web-Based Analytics Platform for Competitive Analysis of Direct Mail Marketing in US Financial Institutions

A project work submitted to the University Tun Abdul Razak in partial fulfilment of the requirements for the award of

Bachelor of Information Technology
(Data Science)

by

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This is to certify that this project work entitled

DEVELOPMENT OF A WEB-BASED ANALYTICS PLATFORM FOR COMPETITIVE ANALYSIS OF DIRECT MAIL MARKETING IN US FINANCIAL INSTITUTIONS

is a bonafide record of the project work done

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at UNIRAZAK, Kuala Lumpur, Malaysia during the year 2025 in partial fulfilment of the requirements for the award of the degree of

Bachelor of Information Technology (Data Science)

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Senior Lecturer, Programme Director
Presented and submitted to the university on **00 Month 0000.**

DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged.

Date: **00 Month 0000**

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ABSTRACT

This project involves creating a web-based analytics platform for US financial institutions to perform comparative analysis of direct mail marketing effectiveness. US environmental institutions such as Bank of America, Citibank and American Express to name a few, depend heavily upon direct mail to acquire and retain customers. Currently there is no way for financial institutions to perform comparative analysis on direct mail marketing spend data across competitors at the institution level. My proposed solution is to build an accessible platform for all US financial institutions, that is centrally organized, based upon an easily defined scope, that will allow the user to specify a date range, surface monthly marketing trend data for specified time periods, to allow for report downloads. The data will be collected and stored in MySQL Workbench, organized by bank, year, month, estimated marketing spend. Data programming and processing will be done using pandas, NumPy and Matplotlib Python libraries. The web-based platform will be developed as a Streamlit application which will focus on interactive visualizations, secured access for users and downloadable CSV reports. With this platform, users will be able to find important insights that help them spot the biggest spenders, shifts in mail volume, and year-over-year performance. In addition, main goals for the system will be to be capable of providing updates in real-time, and to be designed for the most optimal user-experience for marketing analysts and decision-makers. By providing actionable insights and an overview of the competitive landscape in terms of direct mail strategies, this project will provide for greater transparency and efficiency in association with direct mail strategies and facilitate better financial marketing decision making. The product is a functional web-based dashboard fulfilling a real-world need in the US financial industry for marketing intelligence. This project illustrates how data science, database management, and web development can be combined to solve a relevant business issue, all while maintaining an academic and practical significance in the information technology or analytics space.

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LIST OF ABBREVIATIONS

FI: Financial Institutions

DM: Direct Mail

US: United States

LIST OF SYMBOLS

CHAPTER I

INTRODUCTION

1.1 BACKGROUND OF STUDY

Over the last couple of years data-driven decision-making has developed into a standard practice for strategic decisions-making across sectors, especially in financial services. Financial institutions rely on past performance data, which helps them make better decisions regarding consumer behavior, competitively understand the organization better, and help better future multimedia marketing decisions that drive ROI (Davenport & Harris, 2007). Digital channels have caused tremendous change in marketing practices, however direct mail is still a strong force in customer acquisition, especially because the banking industry is heavily regulated (Forrester, 2021). Banks are still closely monitoring their direct mail to understand ROI performance with large portions of their overall marketing budgets still being spent in direct mail. The potential for personalization with direct mail is considerable which helps mean bank institutions such as Bank of America and Citibank continue to review their envelopes, thematically and offer quality before deployment. Even when factoring in variations by placement, research has shown the average direct mail open rate is 80–90 percent, while the average email open rate is 20–30 percent (Media Logic, 2022). Furthermore, direct mail shows an average ROI of 112% which is more than any other marketing channel (DMA, 2020).

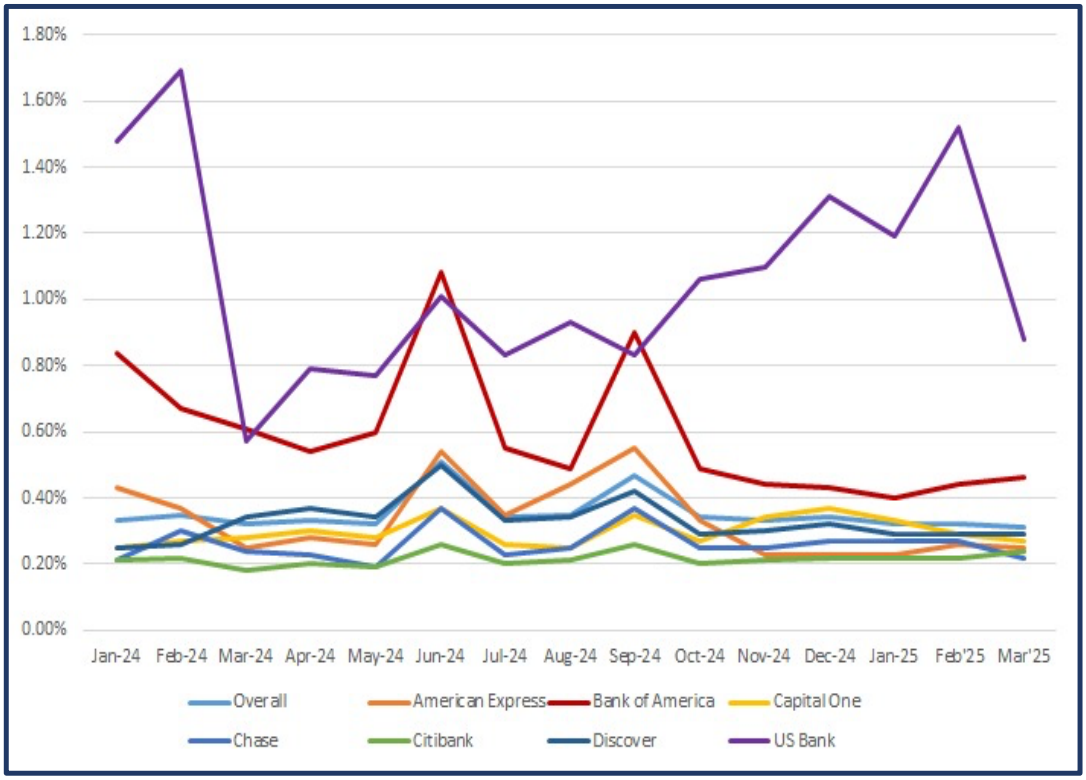
1.2 PROBLEM STATEMENT

In today's financial world, organizations like Bank of America, Citibank, and American Express continue to utilize direct mail as an important channel for customer

acquisition and retention. Regardless of the growth in digital media, direct mail has not dropped in priority since it is tactile and has a higher user-engagement rate. For example, direct mail open rates can be 80%–90%, compared to a high average financial email open rate of 31% (BAI, 2024; eMarketer, 2024). In addition, the ROI for a direct mail campaign can be 112% - again higher than other mediums (BAI, 2024). Nevertheless, a significant challenge exists like banks and credit unions typically do not have a real-time, comparative understanding of their direct mail marketing performance compared to competitors. Without benchmarking data, it will hinder decision making - especially with budget allocations, program optimizations, and marketing positioning. In fact, internal tracking initiatives may exist. However, collectively as an industry there is no standardized and centralized method to aggregate and analyze direct mail campaign data across institutions (The Financial Brand, 2020). This presents obstacles in terms of inefficiencies as well as missed opportunities to leverage trends in the market in the space of financial industries.

Figure 1.2: DM Response Rates (%) by FI, January 2024 - March 2025

Source: Mintel/Credit Card, Behavior

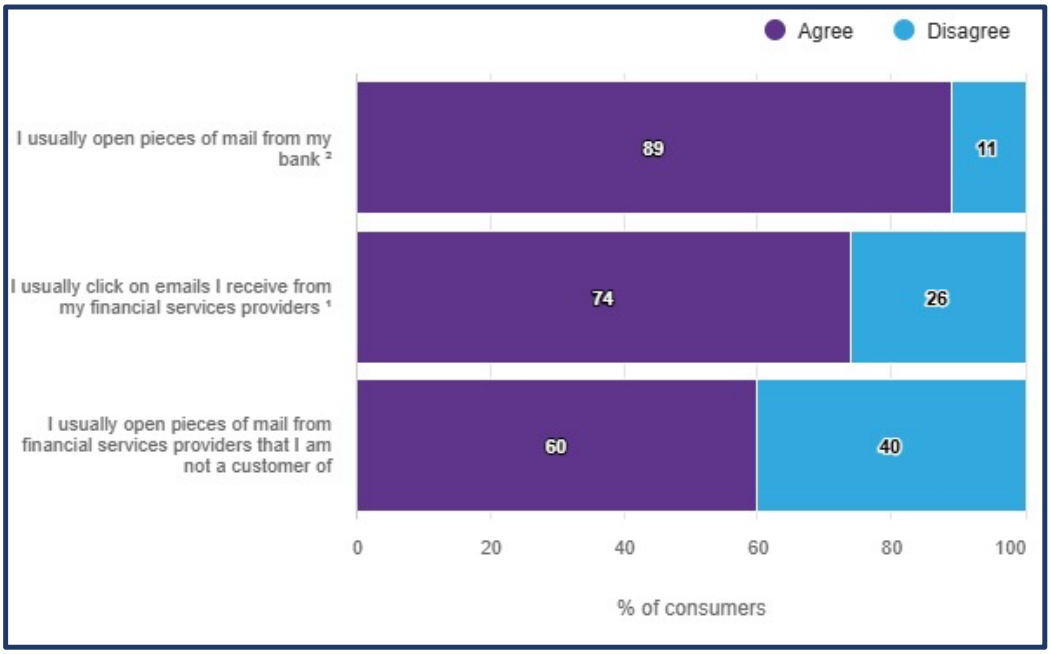


1.3 RESEARCH AIM

Financial institutions need a web-based analytics platform development for conducting direct mail marketing campaign analysis. The current data-abundant situation causes organizations to face difficulties extracting valuable insights because their data remains scattered and they have limited insight into their competitors marketing approaches. The study fulfills the requirement of building an effortless platform enabling financial organizations to add defined time periods then inspect direct mail marketing trends among significant banking institutions and discover meaningful findings. The proposed platform helps marketing analysts find essential market patterns as well as improve their campaign strategies and enhances data-based decision processes.

Figure 1.3: US Consumer Responses to DM vs. Email Communications from Financial Providers, 2024

Source: Kantar Profiles/Mintel, January 2024



1.4 RESEARCH OBJECTIVE

The research creates a web-based analytics solution focused on improving marketing decisions through strategic planning in financial institutions. This platform achieves the following:

1) The system organizes direct mail marketing information derived from major US banks into a structure that enables simple data queries and analysis.

2) The system which uses Python coupled with MySQL examines marketing expense trends and mail volume data to establish associations between marketing approaches.

3) Streamlit technology powers an interactive web-based dashboard within the platform that enables users to input time periods for comparing marketing trend evolutions. The system allows users to gain deeper understanding of marketing performance metrics together with dynamic monitoring abilities for better performance tracking.

4) The system allows users to obtain downloadable reports that enable extended analysis and strategic planning.

5) Real-time graphics rendering within the platform helps users visualize data trends better through updated visualizations for instant quick decision-making based on the data. Real-time data presentation through this system improves strategic planning because the data easily transforms into understandable formats.

6) The platform enables user data and report exportation through the download function facilitating both offline assessment and business process combination integration.

1.5 RESEARCH QUESTION

A data-driven platform which analyzes direct mail marketing trends is the subject of this research project while the listed questions serve as its investigative demands:

1) How can financial institutions leverage a comparative analysis of direct mail marketing trends to enhance their marketing strategies and gain a competitive edge?

2) What are the key patterns on monthly spending and mail volume among major US banks, and how do these trends inform marketing effectiveness?

3) In what possible ways enable a web-based dashboard to optimize the accessibility, visualization, and interpretation of direct mail data for marketing analysts in financial institutions?

4) What type of tools and technologies are most suitable for developing an intuitive, data-driven platform that facilitates seamless analysis and decision-making in direct mail marketing?

1.6 PROJECT MILESTONES

Table 1.6: Project Milestones and Process Division

Milestone No.	Date Range	Milestone Description
M1	**01 May (Thurs) – 03 May (Sat)**	**Requirement Study Analysis** • Identify user need, define project scope and identify real problem to solve. **Functional Requirements** • Outline platform features likes data input, trend visualization and CSV report. **Technical and Non-Functional Spec**

		• Define tools like MYSQL, Python, Streamlit, performance security and usability. **Project Kickoff & Planning** • Finalize proposal • Outline report structure • Create Gantt chart & milestones • Review possible data sources
M2	**07 May (Wed) – 09 May (Fri)**	**Database Design** • Design Entity-Relationship Diagram (ERD) • Build MYSQL schema • Build dashboard layout and data flow structure • Populate sample data for testing
M3	**10 May (Sat) – 14 May (Wed)**	**Data Collection & Preprocessing** • Conduct data collection and build database • Import raw datasets and build backend processing (Python) • Clean and structure data using Pandas • Explore structure
M4	**15 May (Thurs) – 17 May (Sat)**	**Trend Analysis Development** • Analyze direct mail spending & volume trends • Compute statistics • Display data visualizations
M5	**21 May (Wed) – 23 May (Fri)**	**Streamlit Dashboard** • Set up layout • Implement date filtering • Create initial trend visualizations • Add interactive features • Enable CSV report downloads
M6	**24 May (Sat) – 28 May (Wed)**	**Testing & Debugging** • Test date filtering, visuals, dashboard features and reports download

		• Validate outputs & downloads • Fix bugs
M7	**29 May (Thurs)** **–** **03 June (Tue)**	**Report Writing – Chapter V & VI** • Document analysis findings • Add visuals & interpretations • Draft conclusion **Appendix & Formatting** • Add screenshots, code, ERD, structure • Organize references **Supervisor Review & Amendments** • Present to supervisor • Apply feedback
M8	**4 June (Wed)**	**Submission & Presentation** • Submit final report • Deliver project presentation

1.7 CONCLUSION

In conclusion, the web-based analytics platform brings solutions to financial institutions which need real-time comparative marketing performance analysis of direct mail marketing trends. The platform aggregates data from US major banks to let marketing analysts conduct effortless analyses of expenditure patterns and mail quantities and campaign performance while utilizing Python and MySQL with Streamlit for producing real-time graphical data displays and user-friendly data search functions. The platform enhances direct mail marketing outcomes by making marketing data more accessible and easier to interpret while supporting better decisions and optimized campaigns and strategic planning thus giving financial institutions better market performance.

CHAPTER II

BACKGROUND OF STUDY

2.1 INTRODUCTION TO BACKGROUND STUDY

Direct mail stands as a vital marketing pathway in the adapting financial field since it generates superior response outcomes beyond digital marketing methods (BAI, 2024). The current set of marketing analytics systems does not supply sufficient targeted functions for real-time monitoring of direct mail activities in the financial sector. This study works to build a performance evaluation system for financial institutions that combines web-based interface and lightweight design to provide real-time performance metrics about their direct mail activities compared to competitors and spending details. Through operational intelligence solutions, the proposed system creates swift decision pathways that help financial marketers transform their strategies by using existing market patterns together with competitor reactions (Oracle, 2024). Financial institutions will gain marketing improvement together with stronger customer relationships and superior market positioning in the financial services sector (ThoughtSpot, 2024).

Figure 2.1: 4 stats prove DM's marketing potential

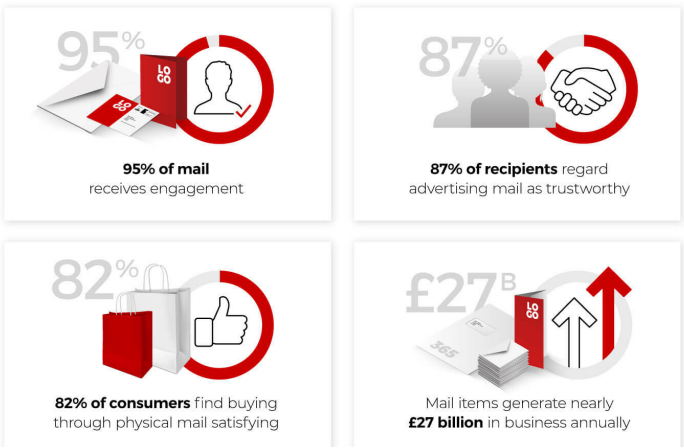
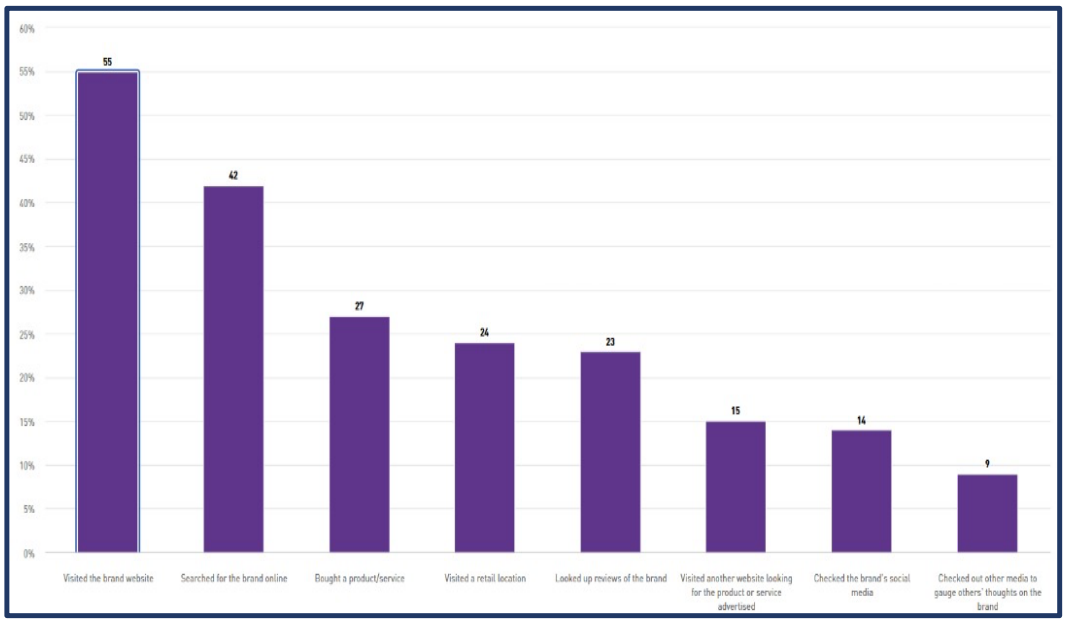


Figure 2.1: How users show how they engage in actions in DM usage that induce engagement opportunities, 2024.

Source: Specific Action Taken on Direct Mail



2.2 Review of Existing Systems

2.2.1 Mintel Comperemedia Direct

Figure 2.2.1: Comperemedia Direct

Mintel launched Comperemedia Direct in 1972 as its global market intelligence platform that provides enterprise data Analytics for acquisition strategies and pricing structures and targeted offers and product release projects across multiple marketing

channels including direct mail delivery. Through this platform users can display information as well as measure competitive performance while observing current market standings.

- **Strengths:** Users gain complete marketing information through this tool which helps them study competitor tactics.
- **Weaknesses:** The platform needs substantial implementation funds and employee training in order to exploit its entire functionality.
- **Operation:** Through this system users obtain access to extensive marketing material information and campaign records while creating filtering functions for specific data elements to develop strategy reports.

2.2.2 Tableau Marketing Analytics

Figure 2.2.2: **Tableau Pulse Marketing Web Analytics**

Tableau Software inaugurated its operation in 2003 through founders Christian Chabot and Pat Hanrahan and Chris Stolte to deliver Tableau Marketing Analytics to customers. Users of this platform integrate marketing data to obtain detailed views into their digital media expenses alongside social media reach and website traffic capabilities as well as the complete customer journey.

- **Strengths:** The platform provides users with keen data visualization features which help users make decisions based on data.
- **Weaknesses:** The software presents difficulties to customers who do not possess experience handling analytics tools.

- **Operation:** The system enables users to link multiple data sources to Tableau through its interface so they can build visualizations and distribute dashboards for marketing performance monitoring.

2.2.3 Dun & Bradstreet Marketing Analytics

Figure 2.2.3: **Dun & Bradstreet Marketing Analytic**

Since 1841 Dun & Bradstreet has developed marketing analytics solutions that enable businesses to search for prospects alongside prospect list quality enhancement alongside campaign performance tracking. The company develops tools that boost targeting precision and lead conversion efficacy because these elements serve as fundamental requirements for successful direct mail marketing success.

- **Strengths:** Dun & Bradstreet enables businesses to access broad business analytics and data for their marketing initiatives.
- **Weaknesses:** The company's main target market consists of B2B sectors which creates restrictions for B2C advertising campaigns.
- **Operation:** Users of Dun & Bradstreet data can use their information to conduct market segmentation as well as identify prospective clients along with analyzing their marketing campaign success.

2.2.4 Salesforce Marketing Cloud with Direct Mail Integration

Figure 2.2.4: Salesforce Marketing Cloud

The platform emerged as ExactTarget in 2000 before Salesforce purchased it in 2013 to form Salesforce Marketing Cloud. The platform helps users merge automated marketing sequences with direct mail allowing customers to receive sales promotion across multiple contact platforms.

- **Strengths:** The platform delivers one platform which manages multi-channel marketing campaigns designed for email and social media together with direct mail.
- **Weaknesses:** Technical expertise along with necessary resources may limit how readily users integrate and customize the system.
- **Operation:** Operation lets users build customer journeys which use direct mail points to deliver targeted and expedient messages across different contact methods.

2.2.5 Adobe Campaign – Direct Mail

Figure 2.2.5: **Adobe Campaign**

Advertising Campaign works as a part of Adobe Experience Cloud to deliver marketing automation tools that help users manage and automate their direct mail operations. Marketers can use this system to define their audience groups while creating content and creating files for mail vendors that enhance campaign management across offline platforms.

- **Strengths:** Adobe Campaign supports marketers to administer and automate direct mail marketing initiatives as part of campaign strategies.
- **Weaknesses:** The implementation of this solution requires advanced setup while its deployment needs substantial financial resources.
- **Operation:** Beside proper management of user-generated content the system enables users to produce and control direct mail efforts through audience selection and content design and mail service provider management for delivery.

2.2.6 Oracle Eloqua Marketing Automation

Figure 2.2.6: Oracle Marketing Cloud

The marketing automation platform Eloqua was established in 1999 before Oracle purchased it in 2012 to use as a cloud-based Software-as-a-Service (SaaS) solution. Eloqua delivers solutions that assist B2B marketing departments and business organizations in managing their marketing initiatives and obtaining sales leads.

- **Strengths:** Eloqua provides its users with extensive capabilities to nurture leads and to manage their marketing campaigns and conduct analytics.
- **Weaknesses:** Eloqua demonstrates limited capabilities in B2C marketing due to its main focus on B2B operations.

- **Operation:** Through the operation users deploy marketing campaigns across various channels via their available tools for email marketing and lead scoring and customer segmentation functions.

2.3 ANALYSIS ABOUT EXISTING SYSTEMS

Firstly, what I can observe is that the users cannot modify the displayed time frames in Mintel Comperemedia Direct and Dun & Bradstreet Marketing Analytics while analyzing competitive data because these platforms lack interactive dashboards. Users need to spend significant funds for getting mail comparison data through the direct marketing platform Mintel and users should possess special expertise to utilize its features effectively.

Meanwhile, Tableau and Oracle Eloqua offer powerful data visualization and analytics capabilities. Tableau allows users to benefit from its user-friendly dashboards yet its rigid setup requirements emerge since the system lacks direct mail analysis expertise and independent data source integration. The reporting system in Oracle Eloqua does not support competitive benchmarking of financial service mail as efficiently as it automates B2B lead management activities.

The direct mail automation capabilities exist in the marketing systems from Salesforce Marketing Cloud and Adobe Campaign. Their system manages campaigns internally with no external functionality for analyzing direct mail methods of competitors. Implementation complexities along with resource requirements act as barriers for financial institutions trying to gain fast market trend data rather than automated customer pathway optimization.

The present market lacks solutions that provide lightweight web-based real-time competitor direct mail benchmarking exclusively for financial institutions to track volume and expenditure data. Consumer businesses currently work with systems that either warrant broad application boundaries or monitor internal processes instead of external operations yet remain expensive to implement and require complex analytics abilities beyond basic technological skills.

2.3.1 Further Clarifications and In-Depth Analysis

The changing financial services market makes direct mail more important because it delivers connected experiences which digital platforms currently cannot provide. Direct mail produces superior response rates than email according to research findings and financial institutions utilize this method to reach 1.16% respondents in their lending promotions thus creating significant conversion prospects (CUInsight, n.d.). The rising popularity of direct mail requires financial institutions to develop strong capabilities for monitoring and analyzing their direct mail marketing strategies. An online dashboard system grants financial organizations access to real-time marketing data which lets them monitor their campaigns while comparing performance against rivals (CUInsight, n.d.).

Using direct mail with digital strategies produces an improved marketing outcome in overall terms. A proper integration of physical mail and digital follow-ups achieves response rate improvements reaching up to 62% according to KPM Group. Financial institutions achieve competitive advantage through a unified competitive analysis platform which provides them with market data about trends and customer demands and competitor movements to refine services and maintain market leadership. Platform adoption leads to better customer retention and acquisition rates as well as product and service delivery innovation through proactive measures (KPM Group, n.d.).

2.4 CONCLUSION

In conclusion, the evaluation of existing systems shows financial institutions lack proper tools which monitor their direct mail marketing trends in real-time alongside competitor data. The existing marketing analysis tools and campaign management solutions include comprehensive features yet they overlook specific comparative evaluations of direct mail expenses and distribution data between competitors operating in the financial industry. Financial institutions face a gap in the market because the proposed web-based dashboard solves this problem through its specific and easy-to-use interface which enhances decision-making while showing competitive market trends alongside efficient marketing strategy development. Through its ability to fill this missing functionality the system will generate lasting value that improves marketing

operational efficiency and strengthens market position and enables data-driven growth in the evolving financial industry.

CHAPTER III

METHODOLOGY

3.1 INTRODUCTION

This chapter explains the methodology applied to construct the web analytics platform through which financial institutions may analyze and compare direct mail marketing trends. It describes the structured steps followed in collecting the data, developing the design of the system, and in implementing the same, as well as explaining the choice of technical tools and approaches. The methodology perfectly fits the objectives of the project, which focus on data-driven insights with an interactive touch and user-oriented design. The project follows a systematic approach that incorporates steps such as: data collection, processing, visualization, and platform development. Combining prototyping skills with serious data handling through MySQL and Python, and putting the finishing touch on the web deployment through Streamlit, will ensure that the methodology makes a fine compromise among efficiency, scalability, and requirements of financial analysts.

3.2 RESEARCH METHODOLOGY

The research design for the project involves a design and development research approach, suitable for creating and assessing the functional artifact established here as the web-based analytics dashboard. This approach undertakes solving an actual-world problem, and it involves the iterative development, testing, and refining of the solution. Because the project focuses on providing a real problem faced by financial institutions in comparing and analyzing trends relating to direct-mail marketing, the design-based research framework indeed becomes relevant and useful. The research is a mixed-mode research design, employing both qualitative and quantitative strategies.

On the quantitative side, banks provide structured data on marketing expenditures and volumes, and these datasets are analyzed for trending, patterning, and comparison. On the qualitative side, stakeholder insights that can collected via interviews and surveys inform the functional design of the platform, ensuring it implements user expectations and industry standards. This combination makes the project data-oriented and user-centered, which something that is of great importance when building support tools for decision-making in financial analytics.

3.2.1 Agile Approach

For the real-time application of this design-oriented research, I have taken on the Agile software development technique. This method enables the iterative build, which is in harmony with the real-time nature of the dashboard and its features. If needed to perform the system through several phases such as database and data processing layer, visualization layer, and user interaction components I have use each iteration to gain feedback and thus to make a continuous polishing of the product. Such incremental way guarantees that the final solution is not only satisfying the user requirements effectively but also evolving smoothly (Clarkston Consulting, 2024).

The core of Agile, being collaboration, flexibility and speed, is just right for the technical and research purposes of the study. The Agile strategies foster regular communication and stakeholder participation at every stage, hereby guaranteeing that the end products are in line with the company's goals and the needs of the clients. This way of collaborative working raises the bar for the quality of the work output than if the work was done without such collaboration. Through this way, the product can be of high quality and based on time-adjustment as per feedback, thus more efficient and user-centric are the outcomes (Clarkston Consulting, 2024).

Relative to what is presented, Agile has a major role in risk management, allows for the early uncovering of probable issues, and continuous prioritization of tasks are two of the key benefits. As well as such structured flexibility improving response to change, particularly in data analytics projects where the needs and the insights continue to develop rapidly. In addition, Agile makes timely delivery of an implemented part the

priority, which also results in quicker creation of value, and the ones who are interested can attend the project's life cycle with visible progress and benefits (Clarkston Consulting 2024).

On the other hand, the conventional Software Development Life Cycle (SDLC) was thought of, but disqualified as it is linear. As there is always scope for adding extra features, or making enhancements to the dashboard, or even during the user testing stage, Agile is a better choice for this project. It aims at optimizing the working relationship of the developer and the users thus delivering the final output that satisfies the need perfectly.

For the achievement of this project, agile methodology has been chosen due to the following reasons:

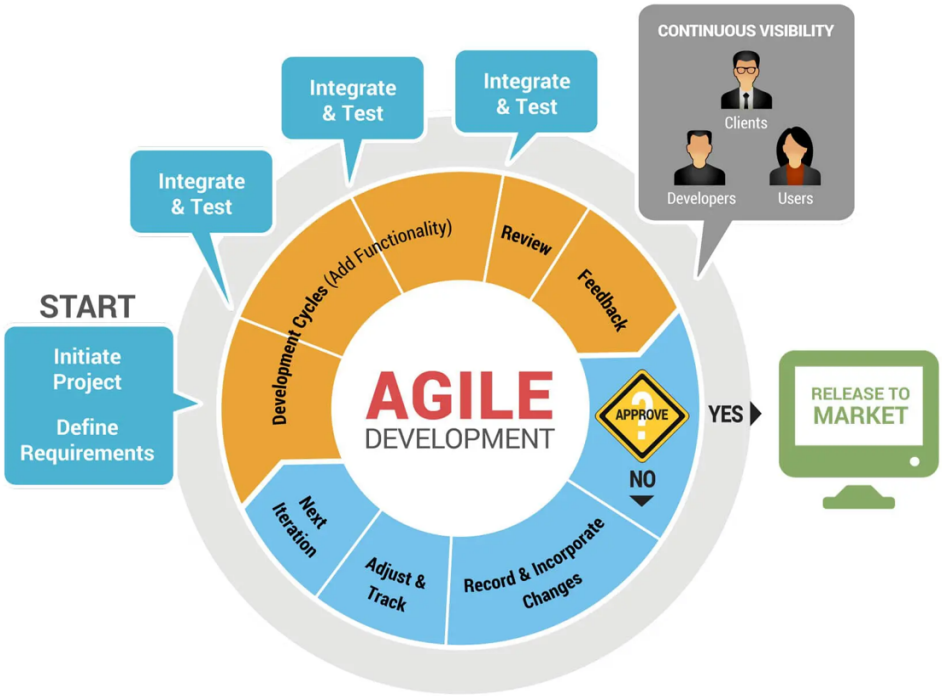
- Agile allows step-by-step developments of the web-based dashboard (Streamlit) with continuous enhancements.
- Agile facilitates the quick capture of the user's needs and the collection of data through the deployment of a paper prototype and the frequent feedback from potential users.
- Agile continuously increases the flexibility of the team to refactor the design in case of issues or the rejection of stakeholders concerning the work.
- Collaboration with the end-users, also known as financial analysts, can take place under the condition that the former is more comfortable with the Handson approach of the later.
- This also allows the application of the system where the data is being used to guide the user, the other way round, and the system is also interactive and user-friendly.
- The cycle of development being short, the period required for testing and deployment is shorter as well.

- This method is better suited for the realization of the customized features requested by the users, such as time periods that can be selected, downloading to CSV files, and the real-time tracking of trends.

- Agile further compartmentalizes the execution of the task by involving the steps of: database (MySQL) → data processing (Python) → visualization (Streamlit).

Figure 3.2.1: Agile Development Process

Source: Agile Development Methodology



3.3 DATA COLLECTION TECHNIQUES

3.3.1 Interviews

Guarantee to ensure that the project that can be brought to life is customer-friendly, I have conducted interviews with marketing analysts, data analysts, and people from bank that I had previously known. These discussions were fruitful and as a result

I have obtained qualitative data that helped me see the importance of real-time comparative analysis features and dashboard rankings.

According to the author of the User Interviews blog, Not only is it very flexible and adaptable, but user interviews are also very powerful tools for uncovering new opportunities and generating ideas during the discovery phase, indispensable to both qualitative and quantitative evaluative methods, and concurrent listening continuous methods to cope with users or client needs and opinions that change over time. (User Interview, 2023).

3.3.2 Questionnaires

Another approach is the method of questionnaires which in fact is a great addition to personal interviews, as it allows for the collection of a wider range of responses from a larger number of respondents without having to ask all of them directly. Through sending electronic surveys to people from the financial industry, technically competent developers can find the most important features, liked or accepted visualizations, as well as functional data and information categories that the users require on the dashboard.

Furthermore, questionnaires make it easier for one to attain the user's satisfaction and experiences during the prototype test phase. The information that is collected can then be correlated with the areas identified for improvements so that the dashboard maintains a constant evolution to meet its user's needs (SuperSurvey, 2023).

3.3.3 Observations

Observational methods are also used during prototype tests to uncover user'activities on the web-based portal and likewise come up with the improvements. By watching users, who are walking through this system, where I can explore the issues of system's usability, deconstruct the users' behavior, as well as identify the areas that need improvement.

Moreover, this strategy instantly reveals the user experience limitations and the outstanding parts. In fact, the user's experience in carrying out the various tasks helps confirm that the platform is indeed enabling intuitive examination of data and identifying trends (Dovetail, 2024).

3.3.4 Third-Party Data Acquisition

To expand the exposure and consistency of the analytics platform, the project brings in outside data vendors who are specific to the direct mail marketing campaigns. This project discusses Comperemedia Direct as the vendor to be used for this reason, since they have data that is highly accurate and consistent. These outside vendors provide detailed relational databases on the volume of the campaign, format types, geographic distribution, and industry-specific benchmarking, among other important issues to be covered on how to conduct an analysis of the entire project (Deepsync, 2025).

Through this process of integrating external datasets into the database of the project, the dashboard can be provided with information from actual practice on a big scale which otherwise would require too much of an effort to be gathered in such a manner. Thus, it gets more reliable, becomes more actual and competitive, and the platform benefits from comparative benchmarking, also the dashboard can support the forecast of the trends, and the evaluation of the campaign's effectiveness (Deepsync, 2025).

3.4 PROTOTYPE OF SYSTEM DEVELOPMENT METHODOLOGY

When designing a system prototype, one of the crucial steps to take is to use an approach that is systematic and open but at the same time can easily change in line with the new requirements and at the same time, it encourages the continuous or ongoing progression. Agile was chosen as the suitable methodology because of its iterative nature, inclination for communication, and outright flexibility. The usage of Agile brings in help to the project by means of a steady stream of feedback, thus, staying close to the specification and with the user's impression of the product.

Table 3.4: Comparison of Methodology

Methodology	Description	Suitability to this project?
Waterfall	A linear and sequential approach where each phase is completed before the next phase begins.	Rigid and inflexible. It is not suitable for iterative improvements or continuous customer feedback.
Prototyping	Focus more on creating quick mockups or models that only serve to gather user feedback.	Useful for early design evaluation but lacks the structure needed for full-cycle delivery.
Agile	An iterative model that emphasizes collaboration, adaptive planning, and continuous delivery.	It is most suitable because it supports the evolving requirements process and continuous user feedback.

3.5 PROTOTYPE METHODOLOGY IMPLEMENTATION

Implementing Agile in all its effectiveness was done by the development process splitting into a series of structured sprints with each of them concentrating on particular deliverables software and their enhancements. It, in turn led to modular tracking, testing, and adaptation.

3.5.1 Sprint Planning and Execution

The project milestones which have been elaborated in Chapter 1 via Table 1.6 are the main outcomes and the time periods which are necessary for the conclusion of the project and to ensure that a structured and iterative development process was followed through, the Agile methodology was employed, which permitted the delivery of system components incrementally through several sprints. Each sprint was

meticulously synchronized with unique project milestones so that the process of the continuous tracking of the progress, the early testing, and the timely adjustments according to the feedback will become much easier.

The following table is an overview of the symmetry between Agile sprint cycles and the specified project milestones:

Table 3.5.1: Agile Sprint Mapping

Sprint	Duration	Agile Activities	Aligned Milestone
0	**29 Apr - 03 May**	• Backlog creation • Requirement analysis • Define technical stack (MySQL, Python, Streamlit) - Gantt chart + timeline setup	• Requirement Study & Planning • Proposal finalization, tool selection, functional spec, project scope
1	**07 May – 09 May**	• Design ERD & DB schema • Build initial Streamlit layout • Create MySQL database and populate test data	• Database Design • ERD, schema creation & frontend structure planning
2	**10 May - 14 May**	• Backend data collection & import • Panda's preprocessing • Handle missing/invalid data	• Data Collection & Preprocessing • Use Python to clean and structure direct mail datasets
3	**15 May - 17 May**	• Implement trend analysis logic • Statistical summaries • Visualizations (line charts, bar charts)	• Trend Analysis Development Spending trends, mail volume insights, visualization logic
4	**21 May - 23 May**	• Finalize Streamlit dashboard UI • Add filters, dropdowns, user controls	• Streamlit Dashboard • Full interface with interactivity and reporting

		• Implement CSV download button	
5	**24 May - 28 May**	• Test full app (filters, visuals, downloads) • Debug any UI or backend issues • Validate user scenarios	• Testing & Debugging • Fix usability/logic bugs, QA validation
6	**29 May - 03 June**	• Finalize Chapter V & VI • Include charts, analysis results • Add appendix, code screenshots • Format citations and references	• Report Writing & Supervisor Review • Results write-up, conclusion &formatting
7	**04 June**	• Submit final version • Conduct presentation with dashboard walkthrough	• Submission & Presentation • Final delivery of thesis and demo

3.6 PROGRAMMING LANGUAGE AND JUSTIFICATION

Below is a combination of technologies that have been selected based on their effectiveness for data processing, visualization and web usage to make this project a success:

Table 3.6: Programming Language Used

No	Technology	Role in Project	Justification
1	Python	Back-end logic, data analysis	A rich ecosystem of libraries like Pandas (for data manipulation), NumPy (for numerical computing) and Matplotlib (for data

			visualization) efficient for handling large data sets and performing complex analyses.
2	Streamlit	Web application framework	Python-based open source framework specifically designed to create interactive and responsive web dashboards.
3	MYSQL Workbench	Relational database management	Powerful and user-friendly tools for designing, managing, and querying relational databases.
4	CSV export	Reporting and data downloads	Allows users to download analyzed reports and upload raw data for processing.

3.7 CONCLUSION

In conclusion, this project was designed in a way that a data-focused web analytics platform for the financial sector could be developed and used to compare and analyze the direct mail marketing effect. Through the methodology of the Agile framework, the project could capitalize on the manifestation of incremental enhancements, the collaboration with stakeholders, and the adaptability to the feedback of the product's users. The rich information which the platform was imparted due to the interviews, questionnaires, observations, and the use of external data sources made it even more useful by creating value for the users. The step-by-step managing of the project tasks, which began with the creation of the database and ended with the deployment of the Streamlit dashboard, was so well-coordinated as to result in the timely delivery of the components with scalability, usability, and real-time insights.

CHAPTER IV

DATA COLLECTION AND TREND ANALYSIS

4.1 INTRODUCTION

4.2 DATA COLLECTION

4.2.2 Database Design with MySQL

4.3 DATA PREPROCESSING

4.3.2 Cleaning and Structuring

4.3.3 Handling Missing Values and Outliers

4.4 TREND ANALYSIS

4.2.2 Spending Trends

4.2.3 Mail Volume Trends

4.2.4 Comparative Statistics

4.3 CONCLUSION

CHAPTER V

SYSTEM DESIGN AND DEVELOPMENT

5.1 INTRODUCTION

5.2 SYSTEM ARCHITECTURE OVERVIEW

5.3 DATA FLOW AND SYSTEM LAYOUT

5.3.1 System Context Diagram

5.3.2 Data Flow Diagram (DFD Level 1)

5.3.3 System Activity Diagram

5.3.4 Deployment Diagram

5.4 STREAMLIT DASHBOARD COMPONENTS

5.4.1 Layout and Navigation

5.4.2 Feature Planning and Widget Design

5.5 USE CASES ANALYSIS

5.6 CLASS DIAGRAM

5.7 CONCLUSION

CHAPTER VI

SYSTEM IMPLEMENTATION

6.1 INTRODUCTION

Introduction related to system testing.

6.2 STREAMLIT DASHBOARD DEVELOPMENT

Explain related to your software development.

6.2.1 Layout and Navigation

6.2.2 Date Range Filtering

6.2.3 Visualization (Line Charts & Bar Graph)

6.2.4 Domain

Explain related to which domain you had chosen.

6.2.5 Web Server

Explain related to which web server that you had chosen. Using local host as an example.

6.2.6 Screenshots of Developed Application/Software

Explain your screen shots (interface).

6.3 INTERACTIVE FEATURES

6.3.1 CSV Reports Downloads

6.3.2 Secure Access and Data Visibility

6.4 CHOOSE ANY TYPE OF SYSTEM TESTINGS

Elaborate the chosen type of system testing.

6.4.1 Functional Testing

6.4.2 Example 1: Acceptance Testing

Explain related to acceptance testing.

6.4.3 Example 2: Functional Testing

Explain related to functional testing.

6.4.4 Example 3: Reliable Testing

Explain related to reliable testing.

6.5 INSTALLATION

Explain related to installation.

6.5.1 Sub Section 1

Explain related if you have additional sub section related to installation.

6.5.2 Sub Section 2

Explain related if you have additional sub section related to installation.

6.6 CONCLUSION

Conclusion for this chapter.

CHAPTER VII

CONCLUSION

7.1 INTRODUCTION

Introduction related to introduction to conclusion.

7.2 INSIGHTS FOR FINANCIAL INSTITUTIONS

7.3 PLATFORM USABILITY AND PERFORMANCE EVALUTION

7.4 LIMITATIONS

7.5 CONCLUSION

Explain related to conclusion

7.6 FUTURE WORK

Explain something related to your future work.

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APPENDIX B

PYTHON SNIPPET CODE