

Implementation of Business Intelligence for Product Optimization to Enhance Profitability Through the Utilization of Synergies Among the Product Departments of the Look Company for the Period 2019-2022

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Abstract

This research discusses the implementation of Business Intelligence (BI) to enhance the profitability of The Look Company through the synergy of product departments. In the era of big data, a company's ability to process and analyse data becomes a crucial factor in achieving competitive advantage. This research aims to present data information from The Look Company's Product Departments in the form of visualizations, graphs, and diagrams that can be used as indicators for decision-making. It also aims to identify products that are not generating significant profitability for the company in order to optimize production costs and to identify products that experience frequent cancellations and returns. This analysis and recommendations are intended to assist The Look Company in its decision-making process through the implementation of a comprehensive and detailed Business Intelligence study. Additionally, this research outlines the steps of data collection and processing methods using tools such as Google Colab, Postgree, and Tableau to generate visualizations, graphs, and diagrams that provide indicators and recommendations for decision-making within The Look Company. The research results indicate that the BI data visualization dashboard plays a crucial role in determining business strategies and providing rapid and accurate decision-making recommendations.

1. Introduction

In the era of Industry 4.0, data-driven policies are essential. Data is crucial for decision-making, especially with the use of big data and analytics. Rapid technological advancements are reshaping society and businesses. Indonesia has seen substantial growth in Information and Communication Technology (ICT) usage, with a significant increase in internet and mobile phone adoption.

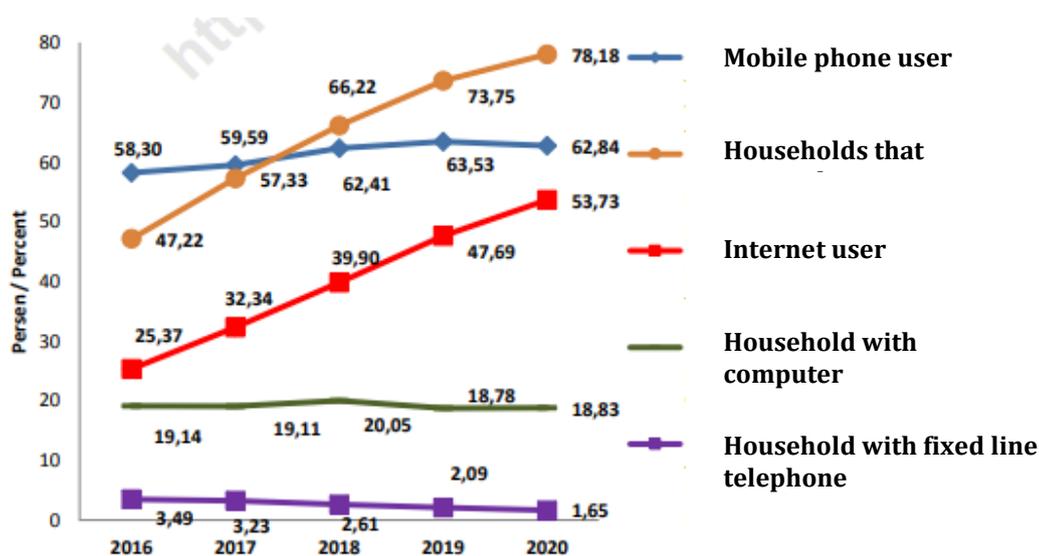


Fig. 1 The development of information and communication technology (ICT) in Indonesia

Source: BPS-Statistics Indonesia, National Socio-Economic Survey 2020

However, the fast flow of information poses challenges, requiring quick adaptation in business strategies and decision-making. Failure to adapt to technological disruption has led to many companies going bankrupt. Utilizing data effectively can enhance performance and profitability. Indonesia's demographic bonus presents both opportunities and challenges. Ruangguru, an education platform, is committed to preparing youth for the digital age. To improve human resources, Ruangguru offers competency-based training. Business Intelligence (BI) plays a vital role in data-driven decision-making. BI technology collects, analyse, and presents business information, benefiting various departments such as HR, Finance, Sales, and Marketing. It empowers organizations with actionable insights. Researchers aim to optimize The Look Company's performance through BI and data analysis. This research contributes to addressing global challenges and assisting companies in data-driven decision-making in the Industry 4.0 era.

2. Literature Review

Marketing is the cornerstone, encompassing the creation, offering, and exchange of products to meet consumer needs and foster enduring relationships. Marketing management adds precision to this by emphasizing meticulous planning and execution of marketing activities (Panjaitan, 2018; Kotler & Keller, 2016). Business Intelligence (BI) stands as a pivotal methodology, empowering decision-making through comprehensive data management, analysis, and knowledge extraction. This approach enhances performance and competitive advantage (Elin, 2019; Rudiawan, 2021).

Optimization is indispensable, focusing on maximizing objectives within predefined constraints across diverse domains (Rostami et al., 2016). Profitability takes center stage, gauged through financial ratios like net profit margin and return on investment (Gitman & Zutter, 2019). Products, be they tangible goods or intangible services, are central to marketing strategies, representing a company's value proposition (Kotler & Keller, 2016). In the digital realm, Digital Product Analytics emerges, facilitating data-driven improvements through user behavior and product performance analysis (Fong, 2018). An analytics framework guides us by structuring data gathering, processing, and interpretation (Chaffey & Ellis-Chadwick, 2019).

Key Performance Indicators (KPIs) become crucial metrics for measuring organizational performance and progress toward strategic objectives (Chaffey & Ellis-Chadwick, 2019). Within marketing, Product Funnel Metrics offer vital insights into product or service progression through marketing or sales funnel stages, informing strategy refinement and enhancing conversions (Chaffey & Ellis-Chadwick, 2019). In the realm of technology, Python, a versatile programming language, serves data analysis, while SQL manages relational databases (Henschen, 2016; Redman, 2019). The establishment of a Data Warehouse acts as a centralized repository, underpinning data analysis and reporting (Inmon, 2005). The Extract, Transform, Load (ETL) process is pivotal, collecting, transforming, and loading data from diverse sources into a central destination, typically a data warehouse (Kimball & Ross, 2013). Data Visualization emerges as a critical element, enhancing the comprehension of complex datasets and supporting data-driven decision-making (Few, 2012).

Lastly, Tableau simplifies data analysis, enabling interactive, shareable reports, and dashboards for unlocking insights from data (Sarkar, 2016). This review forms the foundation of our research on marketing, BI, and data analysis.

3. Research Methodology

The research methodology employed in this study is a descriptive exploratory design that combines both descriptive and qualitative data. Its aim is to deepen understanding, generate new ideas, formulate detailed problems, and develop hypotheses without conducting hypothesis testing. The research focuses on the implementation of Business Intelligence for optimizing products to enhance profitability through departmental synergy at The Look Company within the period of 2019-2022. The unit of analysis is the organization, and the data were collected during the Independent Study Program at Ruangguru from February to July 2022, under the Ministry of Education and Culture, Republic of Indonesia. The study utilizes both qualitative and quantitative data, primarily collected as secondary data through documentation and recordings provided by The Look Company during the Independent Study Program. Data collection methods include a literature review and secondary data collection during the program. The research employs tools such as Google Colab, PostgreSQL, and Tableau for Business Intelligence to identify sales trends and optimize products through The Look Company's product department. The data processing steps encompass Business Understanding, Data Understanding, ETL (Extraction, Transformation, Load), Modeling, Dashboard Visualization, and Reporting. User Acceptance Testing (UAT) was conducted to validate the functionality of the BI Dashboard using black-box testing methodologies. The results of the UAT, as presented in Table 1, confirm the successful functionality of the BI Dashboard across various scenarios.

Table 1 *Black-box testing*

No	Test Scenario	Expected Outcome	Status
1	Value to Business	<ul style="list-style-type: none"> - Ability to create insightful ideas and analysis - Provide analyses directly benefiting the company - Create applicable future analyses - Generate analyses with a positive impact on the business 	(1)
2	Data Understanding and Preparation	<ul style="list-style-type: none"> - Prepare and manipulate provided data - Transform and encode data as per the case 	
3	Data Analytics	<ul style="list-style-type: none"> - Apply EDA, correlation, and visualize it - Appropriate use of tools as recommended - Reference scientific journals/books supporting hypotheses/analyses - Create models in line with the case - Apply one or more evaluation metrics as per the case 	
4	Visualization	<ul style="list-style-type: none"> - Create various visualizations/charts - Create visualizations that answer analysis goals - Proper placement of filters/legends 	

4. Data Analysis and Result

In this research, the software requirements and the entire process for developing a Business Intelligence Dashboard for The Look company. The study begins with the utilization of CSV-format datasets, followed by Business Understanding and Data Understanding to gain a deeper insight into the business and data transformation. Subsequently, the research progresses into the ETL phase using Google Colab and PostgreSQL for data quality enhancement. The ETL results are then modelled, facilitating in-depth data pattern analysis before entering the Dashboard Visualization Creation phase utilizing Tableau.

The software utilized throughout this Business Intelligence Dashboard development process includes Microsoft Excel, Python (Google Colab), SQL (PostgreSQL), and Tableau Desktop & Tableau Public. In the initial phase of Business Understanding, the primary objective is to identify unprofitable products, thereby optimizing production costs. The Look, an E-commerce clothing platform, operates in the digital realm and manages multiple distribution centers to handle order processing and delivery efficiently.

The ETL (Extract, Transform, Load) phase takes center stage, employing Postgre SQL and Google Colab Python for the necessary processes. This phase includes critical tasks like the identification of missing values, ensuring data integrity and accuracy. Missing values were identified in the 'product name' column of the 'inventory items' table. While examining the available data, the researcher also discovered missing values in the 'product brand' and 'product name' columns of the 'inventory items' table.

```

19
20 select * from inventory_items where product_name is null
21

```

product_id	created_at	sold_at	cost	product_category	product_name	product_brand
2586	2021-05-16 04:55:46+00:00	2021-05-22 23:27:46+00:00	18.9719999749...	Intimates	[null]	Jo...
2586	2020-01-11 07:51:00+00:00	[null]	18.9719999749...	Intimates	[null]	Jo...
2586	2022-04-24 01:48:00+00:00	[null]	18.9719999749...	Intimates	[null]	Jo...
2586	2021-01-17 08:48:00+00:00	[null]	18.9719999749...	Intimates	[null]	Jo...
2586	2021-03-27 00:14:54+00:00	2021-04-20 00:54:54+00:00	18.9719999749...	Intimates	[null]	Jo...
2586	2021-11-24 01:30:00+00:00	[null]	18.9719999749...	Intimates	[null]	Jo...
2586	2020-10-27 00:54:00+00:00	[null]	18.9719999749...	Intimates	[null]	Jo...
2586	2022-03-22 01:22:47+00:00	2022-03-22 12:57:47+00:00	18.9719999749...	Intimates	[null]	Jo...
2586	2020-12-26 02:52:00+00:00	[null]	18.9719999749...	Intimates	[null]	Jo...
2586	2021-10-24 12:18:00+00:00	[null]	18.9719999749...	Intimates	[null]	Jo...
4455	2021-05-21 06:31:51+00:00	2021-06-21 23:38:51+00:00	67.3354526482...	Outerwear & Coats	[null]	Tru...
4455	2021-02-02 03:03:00+00:00	[null]	67.3354526482...	Outerwear & Coats	[null]	Tru...
4455	2022-02-09 14:55:00+00:00	[null]	67.3354526482...	Outerwear & Coats	[null]	Tru...
4455	2022-04-03 15:18:00+00:00	[null]	67.3354526482...	Outerwear & Coats	[null]	Tru...

Fig. 4 Checking for missing values in the column

Source: PostgreSQL 2022

The Product Department introduces Clustering Modeling as an analytical tool to address existing issues, harnessing the capabilities of Google Colab Python for this purpose. Based on the results of the Silhouette Coefficient equation, five clusters have been identified. The type of data modeling used is Conceptual Data Modeling, which serves the purpose of presenting data at a higher user level. This model is beneficial for business and data stakeholders to organize, expand, and define business concepts and rules in the context of business architecture.

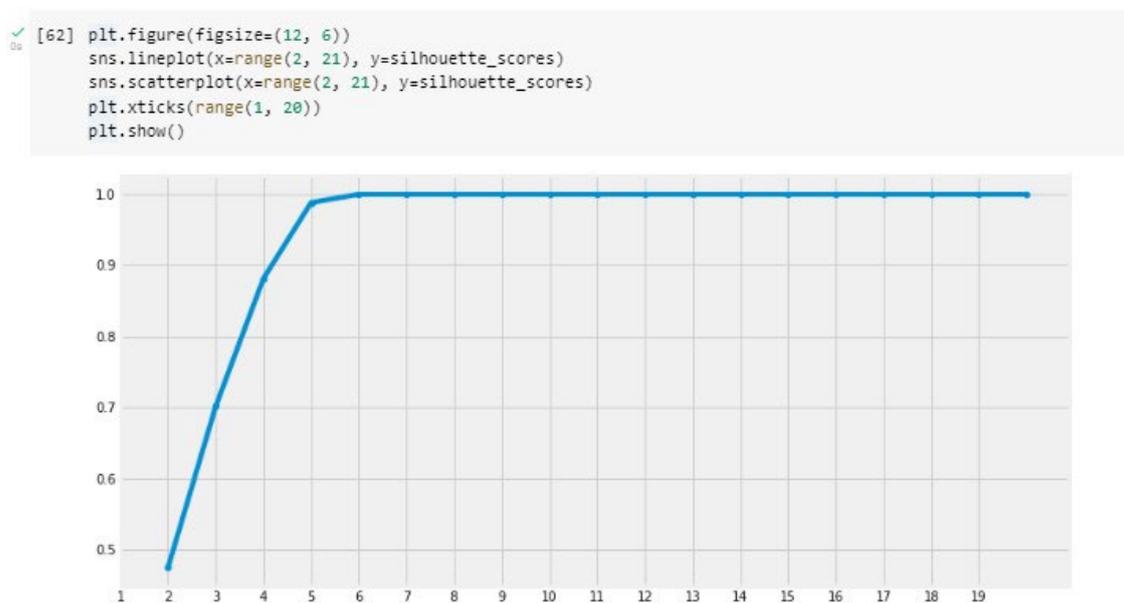


Fig. 5 K-means with Silhouette Coefficient through Python in Google Colab

Source: Google Colab 2022

The Dashboard Data Visualization Creation phase is where Tableau Desktop, a robust business intelligence tool, comes into play. It empowers the team to create a comprehensive dashboard that enables efficient data collection, analysis, processing, and visualization on a large scale.

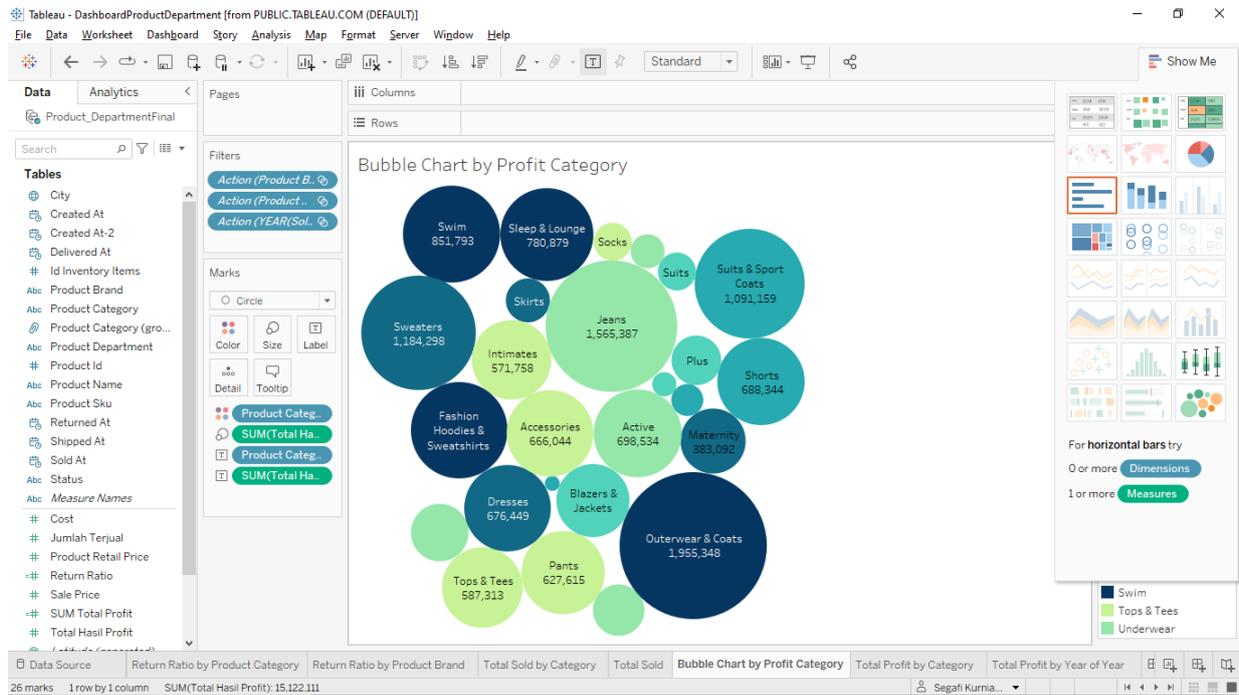


Fig. 6 Creating data visualization dashboard

Source: *Tableau Public 2022*

Once the dashboard is crafted, it undergoes the Reporting phase. Here, the dashboard is published to Tableau Public. This process involves connecting Tableau Desktop to Tableau Public and signing in with the Tableau Public account created on the website.

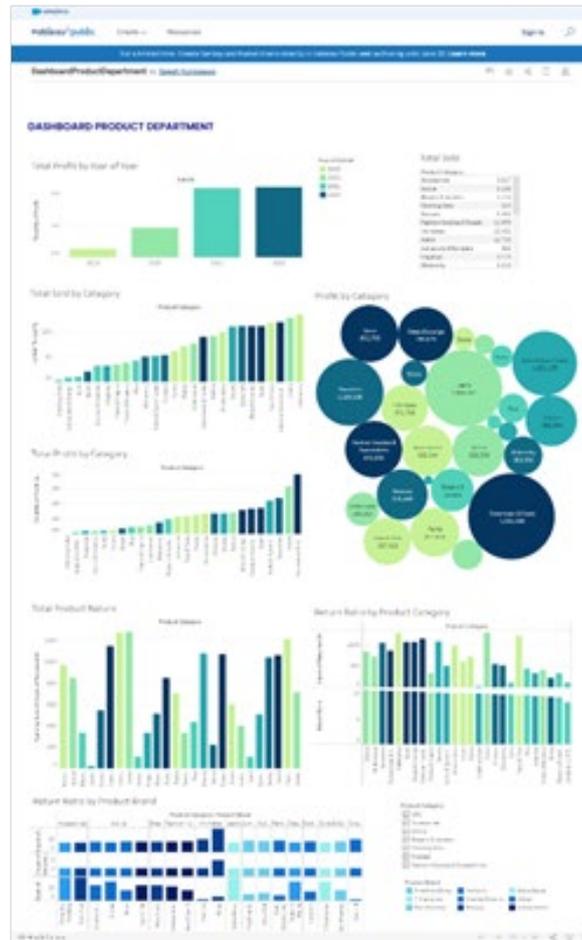


Fig. 7 Dashboard product department

Source: Tableau Public 2022

Finally, the User Acceptance Testing phase ensures the functionality and usability of the Business Intelligence dashboard. Black-box testing techniques are applied to validate its performance, and the results indicate that the dashboard functions as designed. The culmination of user acceptance testing confirms the readiness of the visualized dashboard, offering valuable insights that can significantly contribute to optimizing The Look company's overall performance and profitability. User Acceptance Testing the Business Intelligence dashboard is subjected to user acceptance testing using the black-box testing technique to validate its functionality. The results indicate that the dashboard functions as designed, passing all test scenarios. These scenarios encompass Value to Business, Data Understanding and Preparation, Data Analytics, and Visualization.

Table 2 Black box testing results

No	Test Scenario	Expected Outcome	Status
1	Value to Business	<ul style="list-style-type: none"> - Ability to create insightful ideas and analysis - Provide analyses directly benefiting the company - Create applicable future analyses - Generate analyses with a positive impact on the business 	Passed
2	Data Understanding and Preparation	<ul style="list-style-type: none"> - Prepare and manipulate provided data - Transform and encode data as per the case 	Passed
3	Data Analytics	<ul style="list-style-type: none"> - Apply EDA, correlation, and visualize it - Appropriate use of tools as recommended - Reference scientific journals/books supporting hypotheses/analyses 	Passed

No	Test Scenario	Expected Outcome	Status
4	Visualization	- Create models in line with the case - Apply one or more evaluation metrics as per the case - Create various visualizations/charts - Create visualizations that answer analysis goals - Proper placement of filters/legends	Passed

The successful completion of user acceptance testing confirms the readiness of the visualized dashboard, providing valuable insights for optimizing The Look company's performance and profitability.

5. Conclusion

In conclusion, the implementation of Business Intelligence, spanning from initial phases like Business Understanding and Data Understanding to Data Preparation, Modeling, Dashboard Creation, and Reporting, was effectively executed to enhance The Look company's profitability through collaboration with the Product Department. Key outcomes include the development of a Product Department Dashboard utilizing Business Intelligence technology, a deeper understanding of the company's business processes, and the identification of low-performing product categories that should be discontinued. Insights also emphasized the importance of product quality and packaging for customer trust. The Dashboard, covering data from January 2019 to December 2022, successfully underwent user acceptance testing. For future research, it is recommended to extend Business Intelligence implementations to diverse companies and scenarios, building upon these findings and addressing any limitations encountered.

In this research project, Business Intelligence was successfully implemented to create a Product Department Dashboard, leveraging data to support decision-making at The Look company. The study began with comprehensive Business Understanding and Data Understanding, providing deeper insights into business processes and data issues within the Product Department. Data Preparation transformed multiple tables into a dataset of 487,395 rows, followed by Modeling using the Silhouette Coefficient, revealing 5 clusters for high-level data presentation. The resulting interactive Dashboard, designed with Tableau, offered 7 visualizations for data analysis and was accessible online across devices. Insights from the Reporting Dashboard emphasized product quality and market segmentation. User acceptance testing validated the dashboard's success. The research also identified low-profit Product Categories for discontinuation and highlighted three categories with high return rates, recommending product quality improvements for enhanced customer trust, ultimately providing valuable insights for The Look's profitability optimization.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

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