*Quantitative Economics and Management Studies (QEMS)* *ISSN: 2722-6247 (online)*
*Vol. 5 No. 3 (2024)*
https://doi.org/10.35877/454RI.qems2623

# Strategic Implementation of Big Data Automation for Wastage Management Reporting Using Analytical Hierarchy Process in The Tobacco Industry

Ilham Guspuji Maulana* & Yos Sunitiyoso

*School of Business Management, Institut Teknologi Bandung, Indonesia*

**Abstract**

In today's data-driven era, big data automation is crucial, often referred to as "the new oil." Industries, particularly the fast-moving consumer goods (FMCG) sector like the tobacco industry, must undergo digital transformation to stay competitive. The integration of big data automation with reporting processes is significantly correlated, as it can automate repetitive reporting tasks, enhancing efficiency. This automation enables decision-makers to make faster and more accurate decisions.

This research focuses on assessing the capacity and factors involved in the collaboration between the operations department and the digital team to automate repetitive reporting processes by integrating big data from various sources such as SAP and Microsoft Forms. The study employs a combination of qualitative and quantitative methods, along with the Analytic Hierarchy Process (AHP), to identify optimal business solutions. Insights from this research prioritize big data automation and reporting projects to meet business needs. Results indicate among four alternative project groups, the Central Data Wastage project is the top priority with a score of 51.7%, followed by SMD Wastage at 25.2%, PMD Wastage at 14.7%, and FMD Wastage at 8.4%. Five stakeholders participated in this research, including a product manager, business user, business analyst, and two developers. These participants contributed to assessing criteria, sub-criteria, and alternative project groups. This research not only helps prioritize projects but also facilitates seamless digitalization within the operations team, fostering synergy with the digital team.

*Keywords:* AHP, Big Data Automation, Power BI, Data Visualization, Data and Analytics.

Received: 14 February 2024 Revised: 9 June 2024 Accepted: 25 June 2024

## 1. Introduction

The tobacco industry has long been a critical sector of the Fast-Moving Consumer Goods (FMCG) industry, characterized by complex supply chains, stringent regulations, and the constant need to adapt to shifting market dynamics. In recent years, the integration of technology has emerged as a game-changer for various industries, and the tobacco industry is no exception. One of the significant technological advancements driving change in this sector is the implementation of big data automation and Power BI tools. This background thesis explores the significance of utilizing these advanced technologies to optimize wastage management operations within the tobacco industry.

The tobacco industry, like many others, has recognized the potential benefits of technology in improving operations. Technology adoption has become a strategic imperative to gain a competitive edge, optimize resource allocation, and enhance decision-making processes. The deployment of technology tools such as big data automation and Power BI in the tobacco industry is pivotal to address various challenges and opportunities.

In the FMCG sector, which includes the tobacco industry, rapid decision-making, supply chain optimization, and consumer insights are paramount. Big data offers the potential to revolutionize these aspects by providing access to large volumes of structured and unstructured data, which can be harnessed to gain valuable insights. The tobacco

* Corresponding author.
*E-mail address*: ilham_maulana@sbm-itb.ac.id

industry's reliance on consumer preferences, regulatory compliance, and cost control further underscores the importance of big data.

Waste management is a critical aspect of operations within the tobacco industry. It impacts cost control, environmental sustainability, and regulatory compliance. Big data automation and Power BI tools offer the ability to streamline waste management by providing real-time insights into waste generation, disposal, and recycling. This, in turn, facilitates data-driven decision-making to minimize wastage, reduce costs, and improve overall operational efficiency.


**Figure 1.** Value of Tobacco Waste in IDR

The value of waste within ABC Company has been a notable aspect of its financial landscape, exhibiting significant figures over the past few years. In 2021, the waste value amounted to IDR 183 billion, followed by a decrease to IDR 106 billion in 2022 and further to IDR 79 billion in 2023. The diminishing trend in waste value can be directly attributed to a decline in production, as evidenced by a comparative analysis of the cost of goods sold (COGS) between 2021 and 2022, where the former surpassed the latter.

The implementation of big data automation and Power BI tools in the tobacco industry is pivotal for enhancing waste management operations, which is crucial for cost control, sustainability, and regulatory compliance. This transformation is driven by the industry's need for real-time insights, data-driven decision-making, and efficient resource allocation. By harnessing the power of technology, the tobacco industry can better adapt to evolving market conditions and maintain a competitive edge in the FMCG sector.

### *1.1. Company Profile*

PT ABC Company is one of the largest tobacco industry in the world. Established in 1900, the company has ascended the ranks to become a leading multinational entity in the global tobacco industry. With a dedicated workforce of more than 50,000 employees spread across the world, its presence and influence are truly global. The company is fully embracing the future with a strategic transformation to digitalization and a database-centered approach. This transition is aimed at improving operational efficiency, enabling data-driven decision making, and ensuring the company remains competitive in an increasingly digital world. The company has set ambitious targets for the future. By 2030, it aims to serve 55 million consumers with its non-combustible products. It is also set to reach a remarkable financial milestone with a projected revenue of 5.5 billion euros by 2025. These goals underscore its commitment to innovation, sustainability, and financial stability in the ever-evolving landscape of the tobacco industry.

### *1.2. Business Issue*

Waste management holds a pivotal role in the sustainable operations and financial well-being of our company. Beyond the responsibility of ethical and environmentally conscious practices, efficient waste management is essential for tracking the value of waste generated and making informed decisions that resonate with our broader business strategy. The ability to analyze and report on waste management data is not just a regulatory requirement but a strategic imperative that influences our organizational sustainability and bottom line.

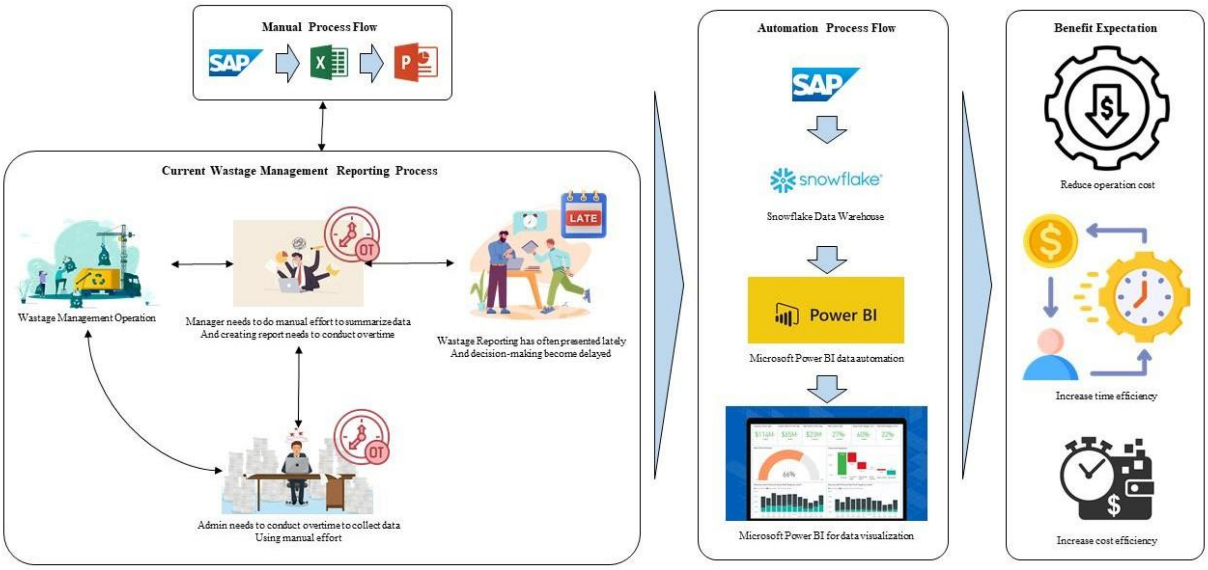


**Figure 2.** Rich Picture Diagram

However, a significant challenge looms over our waste management processes – they are predominantly manual, from the initial data scraping stage to the final data visualization. This manual approach places a considerable burden on our employees, demanding an extensive investment of time and effort. The exhaustive nature of this process not only leads to increased workload for employees but also requires substantial managerial involvement. This manual reporting cycle has created a scenario where employees are compelled to work overtime for 4 - 16 hours every week, illustrating the strain imposed by the current system on our workforce.

Compounding the issue, the protracted timeline of manual data collection means that reports regarding waste management are often delayed. The extended duration from data collection to final reporting translates into a delay in decision-making processes, impeding our ability to respond swiftly to changing circumstances and make timely, data-driven decisions. This delay in reporting not only affects the efficiency of our operations but also hampers our agility in adapting to market dynamics and implementing strategic initiatives promptly.

To address these challenges and usher in a new era of efficiency, the company has established an Information Digital Technology (IDT) department. This department is tasked with automating the business reporting process for waste management, presenting a solution to the current manual inefficiencies. The automation of this reporting process not only aims to reduce the labor-intensive efforts of our business users but also holds the promise of cutting costs and increasing overall operational efficiency.

*1.2.1. Fishbone Analysis*

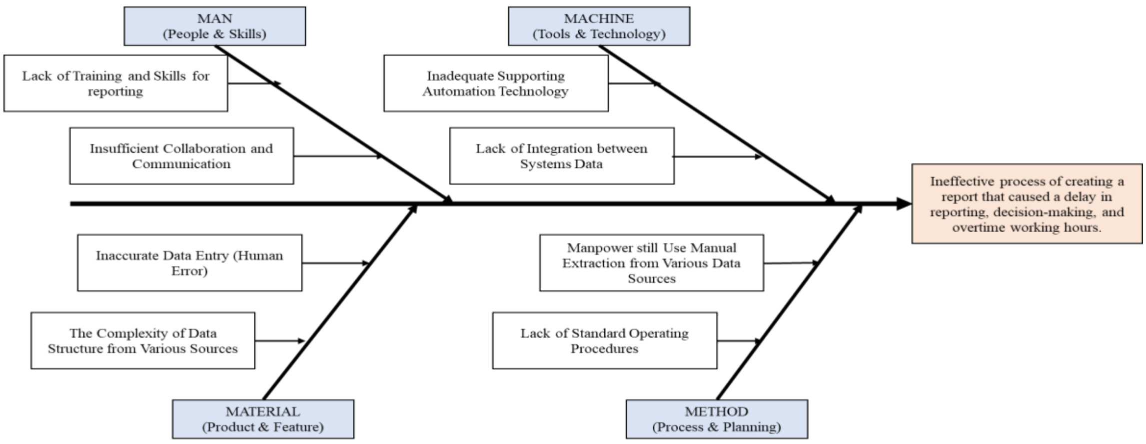


**Figure 3.** Fishbone Diagram

*1.2.2. Problem Tree Analysis*

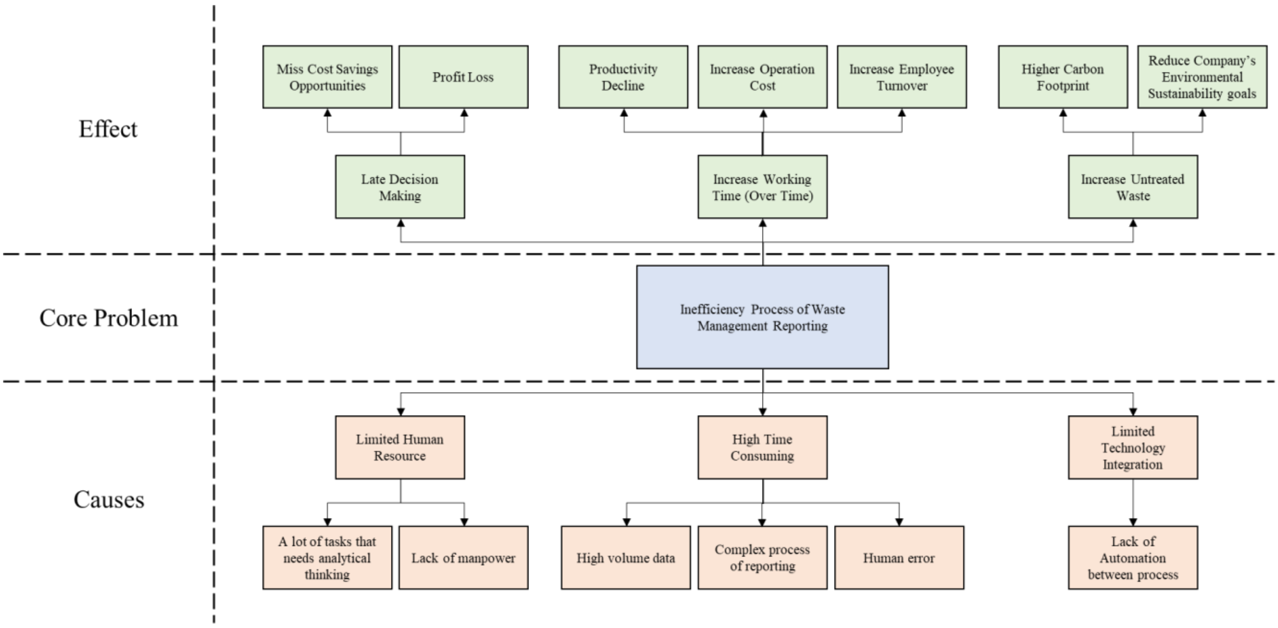


**Figure 4.** Fishbone Diagram

*1.3. Research Questions*

The primary objective of this research is to enhance the effectiveness and efficiency of the waste management reporting process within the organization. Ultimately, the goal is to create a reporting system that empowers our team to make more informed decisions regarding waste management while simultaneously fostering a healthier work-life balance and reducing operational costs. To be more specific there are several research questions to achieve the objectives:

a) How to conduct an analysis to decide which project should be prioritized to solve reporting problems in wastage management for tobacco industry?

b) What criteria and sub-criteria should decision-makers consider to decide the reporting and big data automation project prioritization?

To what extent does the implementation of automation and data analytics in waste management reporting using AHP to align with the broader goal of digital transformation in the company, and how does it contribute to more informed decision-making?

## 2. Literature Review

*2.1. Literature Review*

*2.1.1. Wastage Management*

Waste management has become an increasingly important issue in recent decades as populations grow, consumption rises, and the environmental impacts of waste become more apparent. Proper waste management is crucial for protecting public health, supporting environmental sustainability, and utilizing valuable resources efficiently. Studies characterize the high volumes and unique composition of tobacco industry wastes. Cigarette manufacturing generates paper, plastic, metal, tobacco dust, and general refuse wastes(Han et al., 2020). Tobacco leaf processing and cigarette production also yield large volumes of wastewater containing nicotine, solids, and other contaminants (Yolanda & Heriyanti, 2024). Additional wastes are produced from pesticides, fertilizers, and energy use in tobacco growing (Novotny et al., 2015). Various innovations aim to minimize tobacco industry waste and impacts. Investments in closed-loop water systems and on-site wastewater treatment can reduce discharges (Yolanda and Heriyanti, 2024). Novel bio-filters show promise for treating gaseous wastes (Han et al., 2020). Recycling programs for manufacturing waste like paper and plastic are increasing(Wallbank et al., 2017). Composting and land application controls can improve tobacco agricultural waste practices.

*2.1.2. Big data and Automation for Reporting*

Big data analytics and automation have potential applications in helping address the substantial waste generated by the tobacco industry. This review examines literature on leveraging these emerging technologies to improve tobacco waste characterization, reduction, and management. Studies have used big data techniques to better analyze tobacco waste volumes and sources. One study in 2018 applied statistical modeling to a tobacco factory's waste data, identifying trends in wastewater pollution parameters (Sadh et al., 2018). These studies demonstrate big data's utility for synthesizing waste information. Research also applies business intelligence tools for waste management insights. One study in 2019 built a dashboard using Power BI, allowing interactive drill-down by region, supplier, and other dimensions (Sinambela et al., 2024). Another study in 2022 used Tableau to correlate C02, moisture, and temperature data to predict optimal tobacco curing times, reducing losses (Boopathy et al., 2022).

*2.1.3. Analytic Hierarchy Process (AHP)*

First developed by Saaty (1980), AHP provides a framework to organize complex decisions with multiple criteria, enabling comparative judgements and systematic prioritization of alternatives. The process involves decomposing the decision into a hierarchy of criteria, sub-criteria, and alternatives. Comparative judgements are made through pairwise comparisons of elements at each level to derive ratio scale priorities. Numerical and consistency checks reduce subjectivity. By synthesizing judgements across all levels, composite weights and rankings of alternatives are obtained. AHP has seen wide application across fields including engineering, healthcare, and sustainability research. AHP offers several benefits for waste management technology selection. The hierarchical structure allows breaking down a complex decision into smaller comparisons (Kumar et al., 2015). It incorporates diverse criteria, both qualitative and quantitative. AHP's participatory approach enables input from varied stakeholders, improving acceptability of outcomes (Toufaili et al., 2023). The method provides a quantitative basis for prioritization and consensus building. It is relatively simple to implement.

*2.1.4. Pairwise Comparison*

Pairwise comparison constitutes a structured analytical technique for multi-criteria decision making by comparing possible alternatives in sets of two (Goepel, 2018). As Saaty (2002) first defined, it helps break down a complex quantitative or qualitative evaluation problem into simple comparisons to derive the relative priority, rank, or weight of options on a ratio scale (Saaty, 2002). This is achieved by developing a comparison matrix to rate each option against every other for the selected criteria (Ishizaka & Labib, 2011). These paired comparisons are then synthesized to calculate the priority vector which can be aggregated across criteria levels as per the analytical hierarchy process (Bulut & Duru, 2018). Pairwise analysis brings consistency, reproducibility, and objectivity to complex multi-dimensional decisions across domains like engineering, healthcare, strategy, and more (Velasquez & Hester, 2013).

*2.2. Research Design*

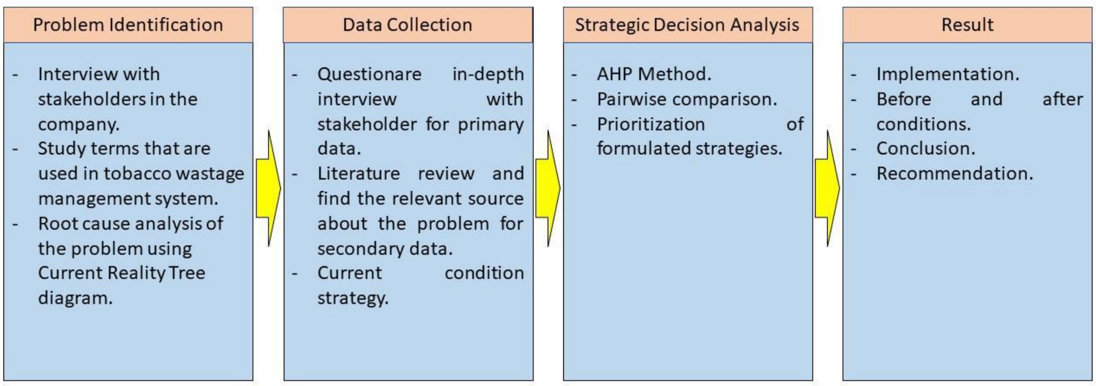


**Figure 5.** Research Flow Diagram

The research design of this study unfolds through a systematic process aimed at addressing the identified problem within the company. Commencing with problem identification, stakeholders were interviewed to glean insights into the challenges faced. An exploration of industry-specific terms related to tobacco wastage management ensued, followed by the application of a Current Reality Tree diagram to meticulously uncover the root causes of the issues at hand. This phase laid the groundwork for a comprehensive understanding of the problem's root cause.

Data collection, a pivotal aspect of the research design, integrates both quantitative and qualitative methods. The study harnesses data from questionnaires and in-depth interviews, tapping into the perspectives of stakeholders. Internal company data, coupled with a thorough literature review, contributes to a holistic dataset, capturing the current conditions and strategies that underpin the identified problem.

Strategic Decision Analysis forms the core of the research design, utilizing the Analytical Hierarchy Process (AHP) method to sift through potential solutions. The Pairwise Comparison method is employed to weigh and prioritize the available options, ensuring a nuanced and informed decision-making process.

Upon deriving results from the strategic decision analysis, the subsequent phase involves implementing the selected solution. A comprehensive before-and-after analysis is conducted to assess the effectiveness of the implemented decision. This paves the way for a conclusive summary, providing a basis for drawing insightful conclusions and offering recommendations for future actions. In essence, the research design seamlessly integrates problem identification, multifaceted data collection, strategic decision analysis, and a conclusive phase, culminating in a robust and systematic approach to addressing the identified problem in the company.

### *2.3. Conceptual Framework*

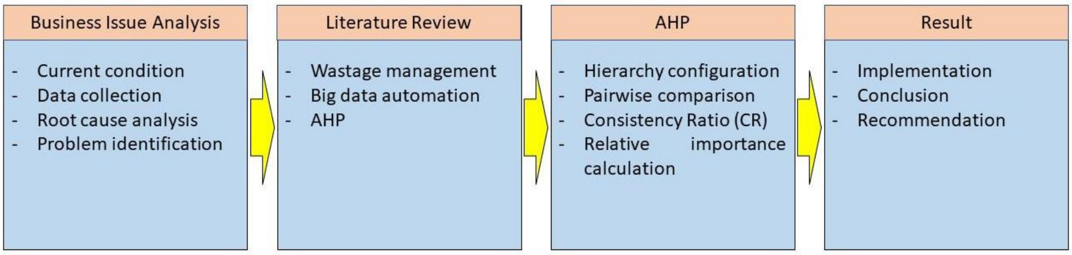


**Figure 6.** Conceptual Framework

## 3. Methods

### *3.1. Data Collection*

After determining the research design, the author needs data to help answer the research questions and achieve the objectives. This involves a process called data collection, which is used to gather the required information. The author collects primary data through methods such as interviews, surveys, and direct observation.

**Table 1.** Data Collection Method

| Data Type | Method | Category | Role Involved | Objective |
|---|---|---|---|---|
| Primary Data | Interview | Qualitative | Business User, Product Manager | Problem identification |
| | Survey | Qualitative | Business User, Product Manager, Developers, Data Analyst | Criteria, sub-criteria determination, and pairwise comparison |

### *3.2. Qualitative Methodology*

In this research, the author conduct interview with five stakeholders to identify the problem using Fishbone Analysis and Problem Tree Analysis. Also to establish criteria and sub-criteria for the AHP Model. The outcome of this process are the root cause problem, criteria, and sub-criteria.

**Table 2.** List of Respondents

| No. | Initial | Role | Department |
|---|---|---|---|
| 1 | EN | Business User | Operation |
| 2 | FE | Product Manager | Information Digital Technology |
| **3** | IG | Data Analyst | Information Digital Technology |
| **4** | VA | Developers | Information Digital Technology |
| **5** | TK | Developers | Information Digital Technology |

*3.3. Quantitative Methodology*

After determining the criteria, sub-criteria, and alternatives with stakeholders, the author proceeded with the Analytic Hierarchy Process (AHP) to generate quantitative data and results. This process involves several key steps:

a. First, a survey is conducted to score all the criteria, sub-criteria, and alternatives, with input from all stakeholders. The scoring typically uses a scale from 1 to 9, where 1 signifies equal importance and 9 indicates extreme importance of one element over another.

b. Next, the author calculates the weights and analyzes the results using pairwise comparisons. This step ensures that the relative importance of each element is accurately represented.

Finally, the author ranks all the criteria, sub-criteria, and alternatives based on the results. This ranking helps prioritize the projects that need to be undertaken, ensuring that resources are allocated effectively and strategically.

## 4. Result and Discussions

*4.1. Analytical Hierarchy Process (AHP)*

*4.1.1. The AHP Structure*

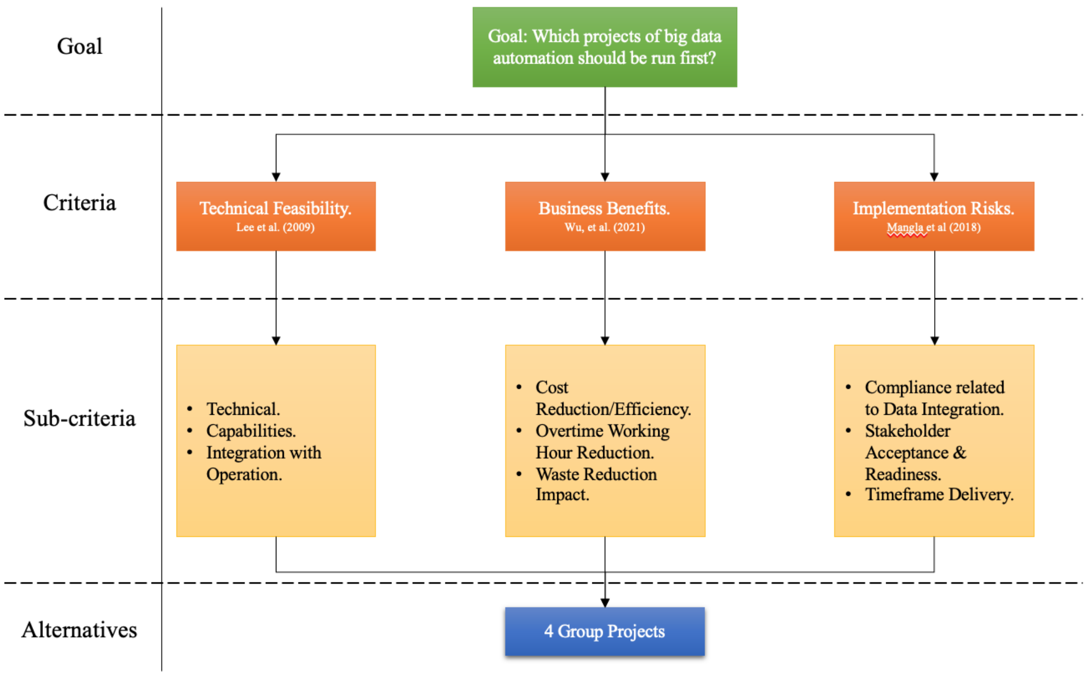


**Figure 7.** AHP Structure

Visualized as a tree structure, the AHP framework encompasses four essential components: goal, criteria, sub-criteria, and alternatives, as delineated in Figure 7. At the core of this framework are three fundamental criteria: Technical Feasibility, Business Benefit, and Implementation Risks.

- Technical Feasibility assesses the complexity of a project's technical aspects, including the depth of expertise required and organizational intricacies.
- Business Benefit evaluates the project's potential contribution to cost reduction, operational efficiency improvement, and other benefits to the company.
- Implementation Risks focus on compliance with regulations, adherence to delivery timelines, and overall impact considerations.

**Table 3.** Breakdown of Group Project Alternatives

| No. | Group Dept. | Project | Detail Project |
|---|---|---|---|
| 1 | Primary Manufacturing Department (PMD) | Automation Data flow using EDP (Snowflake) & Microsoft Form source | Build data automation flow from EDP and Microsoft Form to make it easier to use. |
| 2 | | Roll Your Own (RYO) Product Dashboard Visualization. | Create Central Data Wastage Dashboard for Roll Your Own (RYO) Product Waste for seamless reporting. |
| 3 | | PMD Waste Actual & After MC Dashboard Visualization | Create PMD Waste Before MC and After MC Dashboard Visualization |
| 4 | Secondary Manufacturing Department (SMD) | Automation Data flow using EDP (Snowflake). | Build data automation flow from EDP to make it easier to use. |
| 5 | | Roll Your Own (RYO) Tobacco Waste Dashboard Visualization | Create Central Data Wastage Dashboard for Roll Your Own (RYO) Tobacco Waste for seamless reporting. |
| 6 | | Roll Your Own (RYO) Wrapping Material Waste Dashboard Visualization | Create Central Data Wastage Dashboard for Roll Your Own (RYO) Wrapping Material Waste for seamless reporting. |
| 7 | Finish Material Department (FMD) | Automation Data flow using EDP (Snowflake) & Microsoft Form | Build data automation flow from EDP & Microsoft Form to make it easier to use. |
| 8 | | FMD TOW Wastage Dashboard Visualization | Create Central Data Wastage Dashboard for Tobacco Waste (TW) for seamless reporting. |
| 9 | Central Data Wastage | Glide Path Dashboard Visualization | To track overall waste value and percentage by the time granularity. |
| 10 | | Action Plan Dashboard Visualization | To track and report action plan in each plant |
| 11 | | Central Data Wastage Wrapping Material Waste (WMS) Dashboard Visualization | Create Central Data Wastage Dashboard for Wrapping Material Waste (WMS) for seamless reporting. |
| 12 | | Central Data Wastage Tobacco Waste (TW) Dashboard Visualization | Create Central Data Wastage Dashboard for Tobacco Waste (TW) for seamless reporting. |

*4.1.2. Pairwise Comparison on Criteria and Sub-criteria*

During the initial phase of the survey, respondents engage in pairwise comparisons to assess the criteria crucial for prioritizing the group of projects. These criteria include Technical Feasibility, Business Benefit, and Implementation Risk. Each criterion is meticulously evaluated to determine its relative importance in guiding project prioritization. Throughout the survey process, a total of five respondents actively participate by filling out the questionnaire, providing valuable insights into the decision-making process. Their collective input aids in achieving a comprehensive understanding of the project landscape and facilitates informed prioritization strategies

The survey results are summarized in Table 4, offering a clear view of the project prioritization based on pairwise comparisons. According to the survey data, Business Benefit emerges as the top concern, with a significant 73.6% priority score for big data automation projects. This underscores the importance of tangible business advantages in decision-making. Implementation Risk follows closely with an 18.4% score, highlighting the need to assess and manage potential risks during project execution. Meanwhile, Technical Feasibility ranks lowest in priority, with only 8.1% score, suggesting confidence in the organization's ability to meet technical requirements.

These findings indicate that project prioritization is primarily driven by Business Benefit, reflecting management's focus on outcomes that directly impact the company's profitability. Addressing Implementation Risk as the second priority underscores the importance of risk management in project execution. Finally, Technical Feasibility is considered less critical, indicating trust in the organization's technological capabilities. This understanding of project priorities provides valuable insights for effective project planning and execution, aligning efforts with desired business outcomes.

**Table 4.** Pairwise Comparison Result on Criteria

| | Criteria | Priority | Rank | Consistency Rate (CR) |
|---|---|---|---|---|
| 1 | Technical Feasibility | 8.1% | 3 | 0.8% |
| 2 | Business Benefit | 73.6% | 1 | |
| 3 | Implementation Risk | 18.4% | 2 | |

In the second stage of the survey, participants were tasked with filling out pairwise comparison questionnaires for sub-criteria. Specifically, for the Technical Feasibility criterion, there are three sub-criteria: Technical, Capabilities, and Integration with Operation. According to the results in Table 5, Capabilities received the highest score at 67.7%, followed by Integration with Operation at 19.4%, and Technical at 13.5%.

This indicates that, in terms of technical aspects, the capability of the workforce takes top priority. This emphasizes the importance of having a skilled development team led by a competent Product Manager to ensure smooth project execution. Additionally, it highlights the necessity for the business team to possess adequate knowledge in the wastage field, enabling effective collaboration between the development and business teams. Ultimately, this ensures that the development team can accurately gather requirements from the business team and deliver the project on time and within scope.

Within the Business Benefit criterion, three sub-criteria are identified: Cost Reduction, Overtime Working Hour Reduction, and Waste Reduction Impact. The analysis reveals that Cost Reduction holds the highest priority, with a substantial score of 62.5%, followed by Waste Reduction Impact at 26.7%, and Overtime Working Hour Reduction at 10.8%.

This prioritization strategy indicates that the focus lies on the potential impact of cost reduction on the business's bottom line. Projects are sorted based on their capacity to deliver significant cost savings. Waste Reduction Impact addresses the critical aspect of eliminating waste and its environmental implications. Projects are evaluated based on their effectiveness in minimizing waste generated during production processes. Lastly, Overtime Working Hour Reduction underscores the importance of maintaining a healthy work-life balance for employees. This criterion considers projects that streamline reporting processes, reducing the need for extended work hours. By prioritizing these sub-criteria, the company aims to optimize business benefits, minimize environmental impact, and enhance employee well-being, thereby fostering sustainable growth and efficiency in its operations.

The Implementation Risk criterion is divided into three sub-criteria: Compliance Related to Data Integration, Stakeholder Acceptance & Readiness, and Timeframe Delivery. The analysis reveals that Compliance Related to Data Integration holds the highest priority, with a significant score of 71.5%. This indicates the project's strong emphasis on adhering to data integration regulations within the company, ensuring the safety and security of data and integration processes.

Stakeholder Acceptance & Readiness follows as the second concern, with a score of 16.5%. This underscores the importance of building and running the project based on user acceptance, ensuring that users understand and can effectively utilize the platform. Lastly, Timeframe Delivery ranks lowest in priority, with a score of 12.1%. Despite its lower priority, this criterion remains crucial, as it dictates the timeline for project completion and implementation. Considering these concerns, both the development and business teams must carefully assess the time required for the project to go live and become operational. By addressing these sub-criteria, the company aims to mitigate implementation risks effectively, ensuring smooth project execution and successful deployment.

**Table 5.** Pairwise Comparison Result on Sub-criteria

| Criteria | Sub-Criteria | Local Priority | Global Priority | Consistency Ration (CR) | Rank |
|---|---|---|---|---|---|
| Technical Feasibility | Technical | 13.5% | 1.1% | 0.9% | 9 |
| | Capabilities | 67.1% | 5.4% | | 5 |
| | integration with Operation | 19.4% | 1.6% | | 8 |
| Business Benefit | Cost Reduction | 62.5% | 46.0% | | 1 |
| | Overtime Working Hour Reduction | 10.8% | 8.0% | | 4 |
| | Waste Reduction Impact | 26.7% | 19.7% | | 2 |
| Implementation Risk | Compliance Related to Data Integration | 71.5% | 13.1% | | 3 |
| | Stakeholder Acceptance & Readiness | 16.5% | 3.0% | | 6 |
| | Timeframe Delivery | 12.1% | 2.2% | | 7 |

Table 5 provides detailed information on the pairwise comparison results, offering a deeper understanding of the project prioritization process. In summary, there's a global weight that takes into account all sub-criteria prioritization. This global weight is calculated by multiplying the local weight of criteria from the first stage with the local weight of each sub-criteria from the second stage. The table displays the ranking of all sub-criteria, revealing that Cost Reduction from the Business Benefit criterion holds the top spot with a score of 46%. Following closely are Waste Reduction Impact and Compliance Related to Data Integration with scores of 26.7% and 13.1%, respectively.

*4.1.3. Pairwise Comparison on Alternatives*

At this stage of the process, the author has obtained the global weight for each sub-criteria, as displayed in Table 6. The next step involves multiplying this global weight by every available alternative. This crucial process allows for a comprehensive comparison of each alternative to determine project priorities. Stakeholders must carefully assess the four groups of projects identified from the survey: Central Data Wastage, PMD Wastage, SMD Wastage, and FMD Wastage, aiming to prioritize them effectively.

The result calculation entails aggregating weights by summing up the products of each alternative's weight and the global weight for each sub-criteria. This detailed calculation process ensures a thorough evaluation of the projects' relative merits and assists in decision-making. By systematically comparing alternatives based on their weighted scores across various sub-criteria, stakeholders gain valuable insights into the most beneficial projects for the company. This approach fosters informed decision-making and resource allocation, aligning project priorities with organizational objectives. Through this meticulous process, the company can focus its efforts and resources on projects that promise the greatest impact and contribute most effectively to its overarching goals. Detail of the calculation process is showed on Table 6.

The aggregate weighted result reveals that Central Data Wastage garners the highest score at 51.7%, followed by SMD Wastage at 25.2%, with PMD Wastage and FMD Wastage trailing behind at 14.7% and 8.4% respectively. Decision makers concur with the prioritization outcome, citing several reasons to support their judgment.

a. Central Data Wastage is assigned the top priority:

- Due to its pivotal role as a centralized hub for all departmental wastage monitoring. It offers a comprehensive overview, allowing management to effectively track wastage across departments.
- Moreover, the inclusion of a glide path dashboard facilitates easy tracking of wastage targets, enabling swift decision-making processes.

- Additionally, the project features an action plan dashboard, empowering management to delegate tasks and formulate action plans for wastage treatment. This proactive approach enhances accountability and ensures timely intervention in wastage management.
- Furthermore, Central Data Wastage provides a platform for collaboration and coordination among teams, fostering a cohesive approach to addressing wastage issues.

**Table 6.** Pairwise Comparison Result on Alternatives

| Criteria | Sub-Criteria | Glb Prio. | Alternatives | | | |
|---|---|---|---|---|---|---|
| | | | Central Data Wastage | PMD Wastage | SMD Wastage | FMD Wastage |
| Technical Feasibility | Technical | 1.10% | 58.60% | 12.40% | 22.50% | 6.50% |
| | Capabilities | 5.40% | 58.20% | 14.20% | 21.20% | 6.40% |
| | integration with Operation | 1.60% | 57.20% | 15.10% | 20.20% | 7.50% |
| Business Benefit | Cost Reduction | 46.00% | 54.90% | 12.70% | 24.60% | 7.80% |
| | Overtime Working Hour Reduction | 8.00% | 37.40% | 21.00% | 32.30% | 9.30% |
| | Waste Reduction Impact | 19.70% | 51.60% | 14.50% | 25.00% | 8.90% |
| Implementation Risk | Compliance Related to Data Integration | 13.10% | 42.70% | 19.50% | 27.20% | 10.50% |
| | Stakeholder Acceptance & Readiness | 3.00% | 56.20% | 13.20% | 22.10% | 8.50% |
| | Timeframe Delivery | 2.20% | 59.80% | 9.80% | 23.10% | 7.30% |
| Aggregate Weighted | | | 51.70% | 14.70% | 25.20% | 8.40% |
| Rank | | | 1 | 3 | 2 | 4 |

b. SMD Wastage is assigned the second priority due to several key factors:

- Firstly, there's a lot of waste in the SMD Department, so it needs close monitoring and good data management.
- Secondly, there are many steps involved in organizing and summarizing data to make it useful.
- Thirdly, fulfilling all the reporting requirements takes up a lot of time.
- Lastly, there are various types of wrapping materials used in SMD that need proper handling to reduce waste effectively. Prioritizing SMD Wastage shows a focus on dealing with the department's waste issues and making operations smoother.

c. PMD Wastage is ranked 3rd for several reasons:

- Firstly, its processes are simpler compared to the SMD Wastage department, resulting in a lower volume of waste.
- The waste generated here is predominantly organic, making it easier to treat or reintegrate into the process with minimal treatment required.
- Additionally, the data within this department is relatively straightforward to summarize, requiring less complex analysis compared to other departments. Despite its lower priority, addressing PMD Wastage remains essential to optimize resource utilization and minimize waste within the organization.

d. FMD Wastage is ranked as last priority:

- Firstly, it has the fewest processes among the departments, resulting in lower waste production. The processes mainly involve filter attachment, gluing, and packing, which contribute to a relatively small amount of waste generated.
- Additionally, the integration data process within this department is straightforward, making it manageable for the workforce.
- Despite its lower priority, addressing FMD Wastage remains important to ensure efficient resource utilization and minimize waste within the organization.

*4.2. Implementation Plan*

| No. | Activities | 2024 | | | | 2025 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| 1 | Central Data Wastage Data Automation and Reporting | | | | | | | | |
| **2** | SMD Wastage Data Automation and Reporting | | | | | | | | |
| **3** | PMD Wastage Data Automation and Reporting | | | | | | | | |
| **4** | FMD Wastage Data Automation and Reporting | | | | | | | | |

## 5. Conclusions

In conclusion, the application of Analytical Hierarchy Process (AHP) and pairwise comparison has proven invaluable in addressing the complexities associated with data automation and reporting within business contexts. By employing a structured approach that incorporates criteria such as Technical Feasibility, Business Benefit, and Implementation Risk, alongside nine sub-criteria, including Technical, Capabilities, and Cost Reduction, the author adeptly prioritized projects into four distinct alternative groups. This methodological framework not only provided a systematic means of evaluating project priorities but also offered insights into the relative importance of various criteria and sub-criteria in decision-making processes.

Through this prioritization process, it became evident that Business Benefit emerged as the highest priority with score of 73.6%, followed closely by Implementation Risk 18.4% and Technical Feasibility 8.1%. Consequently, the project prioritization allocated Central Data Wastage as the top priority with score of 51.7%, underscoring its pivotal role in addressing wastage management effectively, and followed by SMD Wastage 25.2%, PMD Wastage 14.7%, and FMD Wastage 8.4%. This strategic alignment of project priorities with organizational objectives is crucial in ensuring the efficient allocation of resources and maximizing the impact of data automation initiatives.

The prioritization facilitated by AHP underscores the significance of big data automation and reporting in enhancing business operations and decision-making processes. By providing seamless monitoring capabilities and enabling swift decision-making strategies, stakeholders can navigate business challenges more effectively and capitalize on emerging opportunities. Moreover, the implementation of technology, particularly in the realm of big data automation, remains critical for companies seeking to stay ahead of the curve in today's rapidly evolving landscape. Through meticulous prioritization and strategic implementation, organizations can.

## References


Boopathy, S., Kumar, P. S., & Karaaslan, M. (2022). Predictive Analytics with Data Visualization. *Journal of Ubiquitous Computing and Communication Technologies*, *4*(2), 75–96. https://doi.org/10.36548/jucct.2022.2.003

Bulut, E., & Duru, O. (2018). Analytic Hierarchy Process (AHP) in Maritime Logistics: Theory, Application and Fuzzy Set Integration. In *International Series in Operations Research and Management Science* (Vol. 260, Issue January 2018). Springer International Publishing AG 2018. https://doi.org/10.1007/978-3-319-62338-2_3

Goepel, K. (2018). Implementation of an Online Software Tool for the Analytic Hierarchy Process (AHP-OS). *International Journal of the Analytic Hierarchy Process*, *10*(3), 469–487. https://doi.org/10.13033/IJAHP.V10I3.590

Han, Y., Wang, Y., Chai, F., Ma, J., & Li, L. (2020). Biofilters for the co-treatment of volatile organic compounds and odors in a domestic waste landfill site. *Journal of Cleaner Production*, *277*. https://doi.org/https://doi.org/10.1016/j.jclepro.2020.124012

Ishizaka, A., & Labib, A. (2011). Review of the main developments in the analytic hierarchy process. *Expert Systems with Applications*, *38*(11), 14336–14345. https://doi.org/10.1016/J.ESWA.2011.04.143

Kumar, R., Madhu, E., Dahiya, A., & Sinha, S. (2015). Analytical hierarchy process for assessing sustainability. *World Journal of Science, Technology and Sustainable Development*, *12*(4), 281–293. https://doi.org/10.1108/WJSTSD-05-2015-0027

Novotny, T. E., Bialous, S. A., Burt, L., Curtis, C., Luiza Da Costa, V., Usman Iqtidar, S., Liu, Y., Pujari, S., & Tursan D'espaignet, & E. (2015). The environmental and health impacts of tobacco agriculture, cigarette manufacture and consumption. *Bull World Health Organ*, *93*. https://doi.org/10.2471/BLT.15.152744

Saaty, T. L. (2002). Decision making with the Analytic Hierarchy Process. *Scientia Iranica*, *9*(3), 215–229. https://doi.org/10.1504/IJSSCI.2008.017590

Sadh, P. K., Kumar, S., Chawla, P., & Duhan, J. S. (2018). Fermentation: A boon for production of bioactive compounds by processing of food industries wastes (By-Products). *Molecules*, *23*(10). https://doi.org/10.3390/molecules23102560

Sinambela, A. D. D., Zahra, A., & Jaman, J. K. (2024). Using Power BI to Apply Business Intelligence to Product Sales. *Sistemasi: Jurnal Sistem Informasi*, *13*(2), 506–516. https://doi.org/10.32520/STMSI.V13I2.3036

Toufaili, A. El, Pozzetto, D., Padoano, E., Toneatti, L., & Fakhoury, G. (2023). Selection of a Suitable Waste to Energy Technology for Greater Beirut Area Using the Analytic Hierarchy Process. *International Journal of Environmental Science and Development*, *14*(6), 340–347. https://doi.org/10.18178/ijesd.2023.14.6.1453

Velasquez, M., & Hester, P. T. (2013). *An Analysis of Multi-Criteria Decision Making Methods*.

Wallbank, L. A., MacKenzie, R., & Beggs, P. J. (2017). Environmental impacts of tobacco product waste: International and Australian policy responses. *Ambio*, *46*(3), 361–370. https://doi.org/10.1007/s13280-016-0851-0

Yolanda, V. C., & Heriyanti, A. P. (2024). Wastewater Quality Characteristics Test in Domestic Wastewater Treatment Plant Dinas Lingkungan Hidup Kota Semarang. *Indonesian Journal of Earth and Human*, *1*, 44–52. https://journal.unnes.ac.id/journals/ijeh/article/download/2678/235/8694