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Utilizing a Data Warehouse to Analyze the Effects of Sales Type, Product Type, and Price on Net Profit in an F&B Outlet

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Abstract— The food and beverage (F&B) industry continues to expand amid increasing competition, making profitability analysis essential for effective decision-making. This study analyzes the effect of sales type, product type, and product price on net profit in an F&B outlet by utilizing a Data Warehouse to integrate and structure daily transaction data. The Extract, Transform, and Load (ETL) process ensure consistency and prepares the data for analysis, while multiple linear regression was used to evaluate the contribution of each variable. The results show that product price and sales type have a significant positive effect on net profit, indicating that higher prices and dine-in transactions generate greater profitability. Product type displays varied effects, with certain categories increasing net profit while others reduce it due to differences in demand patterns and cost structure. The regression model achieved an R^2 of 0.994, demonstrating strong explanatory power. Overall, the findings highlight the value of Data Warehouse based processing in improving financial analysis and supporting more accurate managerial decision-making in F&B outlet.

***Index Terms*— Data Warehouse; Sales Type; Product Type; Product Price; Net Profit**

I. INTRODUCTION

The food and beverage (F&B) sector is still expanding against a backdrop of severe competition [1]. Growth is stimulated by changing customer purchasing behavior, more businesses entering the market, and an expanding number of products on offer. Net income is also the primary indicator to evaluate how well existing business strategies or need to change them [2]. In the context of F&B outlet, the object of this research, analysis of sales type, product type, and price is crucial to determine the contribution of each aspect to net profit.

As daily transaction volumes at outlet increase, a system is needed that can manage operational data and transform it into useful business information for decision-making. In this regard, a Data Warehouse plays a crucial role. A Data Warehouse is a system that integrates data from various sources into a structured repository, supporting more effective business analysis and decision-making [3]. With a Data Warehouse, outlet management can monitor sales performance based on transaction mode, assess the contribution of each product type, and evaluate the impact of pricing policies on profits.

While numerous studies have been conducted on Data Warehousing and sales, most still discuss them separately. Data Warehousing research generally focuses on data integration and report generation but has not yet used the integration results to assess financial performance, such as net profit [3]–[5]. Furthermore, research on sales types is predominantly focused on digital sales [6], [7]. In contrast, research on product types and prices tends not to be linked to Data Warehouse utilisation or its impact on net profit [8], [9]. Therefore, research integrating analyses of sales types, product types, and prices within a Data Warehouse framework to evaluate their impact on net profit for F&B outlet remains limited.

Given that this topic has not been widely explored in previous research, this study aims to understand how sales types, product types, and prices affect net profit at a single F&B outlet. This study also evaluates how Data Warehouse utilisation can help process and present sales data in a structured manner, resulting in

clearer, more understandable analysis. Through this approach, the research is expected to provide business managers with deeper insights into the key factors influencing F&B outlet net profit.

II. LITERATURE STUDY

A. *THEORETICAL FRAMEWORK*

A Data Warehouse (DW) is an integrated data storage system that consolidates historical data from various sources and transforms it into meaningful information for business analysis [10]. Its presence permits business data regarding operations and transactions to gain more consistency, structure, and readiness when undertaking strategic assessments [3], which is aided by the Extract, Transform, and Load (ETL) method that guarantees data is cleansed and set up for analytical reporting [4]. In the F&B context, sales type refers to the transaction mode, such as dine-in, takeaway, or online ordering, and multichannel strategies have been shown to increase customer convenience, expand market reach, and improve revenue performance [6], [7], [12]. Product type categorising involves organising items based on shared features, which enables businesses to manage their products effectively, fine-tune their marketing approaches, and streamline the buying process for customers [8], [9]. Simultaneously, the pricing strategy has a direct impact on how much money is made per sales and the profit margin; raising prices can lead to higher earnings if the level of customer demand stays the same [13]. Net profit, which represents the earnings left over once all expenses, both those related to operations and those not, are subtracted [14], [15], is shaped by the mix of products offered, how prices are set. The methods used to sell, the type of sales, the product category, and the product's cost are key factors in judging how profitable food and drink businesses are.

B. *Research Hypothesis*

Based on the theoretical foundation and previous studies, the research hypotheses are formulated as follows:

a) H1: Sales type has a positive effect on the net profit of F&B outlet.
b) H2: Product type has a significant effect on the net profit of F&B outlet.
c) H3: Product price has a positive effect on the net profit of F&B outlet.
d) H4: Sales type, product type, and price simultaneously have a significant effect on the net profit of F&B outlet.

C. *Previous Research*

Although previous studies have examined Data Warehousing and ETL processes to improve data integration and reporting [3], [4], [5], these works do not extend their analyses to evaluate financial performance indicators such as net profit. Studies on sales type also tend to focus on online platforms and multichannel e-commerce environments [6], [7], which makes them less applicable to the operational characteristics of F&B outlet that rely on dine-in and takeaway transactions. Research related to product type and pricing strategies likewise treats these variables independently [8], [9], without integrating them into a single analytical model. Consequently, previous investigations have not concurrently assessed sales category, merchandise category, and merchandise cost utilising a Data Warehouse structure to ascertain their collective influence on total earnings, thus highlighting a distinct area of investigation explored in the current research.

III. METHODOLOGIES

A. *Research Type and Approach*

This research is quantitative in its explanatory approach, using multiple linear regression to establish associations between the variables and objectively consider independent variable effects on net profit. Research data obtained from transaction data on daily F&B outlet sales from October 1, 2024 to September 30, 2025. A total of 6.920 transaction records and stored in a Data Warehouse (DW) system for the sake of consistency of information and ease of analysis [11].

B. *Research Stages*

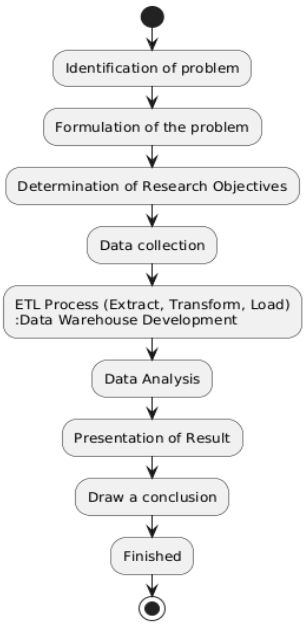

Fig 1. Research Stages

This study followed a structured research process comprising problem identification, objective formulation, data collection, ETL processing, Data Warehouse construction, data analysis, and conclusion drawing. Transaction data were extracted, cleansed, transformed, and loaded into a Data Warehouse to support regression analysis. The analytical stage included descriptive statistics, classical assumption testing, and hypothesis testing through multiple linear regression. The final stage summarised key empirical findings and interpreted whether sales type, product type, and price significantly influence net profit, highlighting insights valuable for data analysis and business decision-making.

C. Data Collection Sources and Techniques

The data for the study were collected from a daily transaction report F&B outlet sales types (dine-in and takeaway), product types (add-ons, coffee, matcha, dessert and main course), selling price, unit sold and margins. This data was then subjected to ETL in order to construct a Data Warehouse which contains data [16].

D. ETL Process and Data Warehouse Development

The development of Data Warehouse is done by ETL (Extract, Transform and Load) process to make sure that the transactions data are fully and reliably integrated. The ETL used contains below:

1. Extract (Data Extraction) step. Transaction data is provided in the form of daily screenshots from outlet: Excel reports that detail sales date, sales type, product type, price per unit, number of units sold and margin.

2. Transform (Data Transformation). It then performs normalisation of collected data and does the necessary tuning based on analysis requirements such as date, type of product, type of sales, selling price, number sold, sales value, COGS, and profit. The COGS reported in this study is derived from average cost data during the observation period. The dependent (net profit) is calculated as sales − COGS, serving as the net profit proxy (estimated revenue or gross margin) of the F&B outlet.

3. Load (Data Loading). Transformed data is subsequently inserted into the Data Warehouse in accordance with a star schema model with Fact_Sales, Dim_Product, Dim_Mode, and Dim_Date tables. This model facilitates multidimensional analysis of the impact of independent variables on net profit.

E. Research Variables

This study uses two variables: dependent and independent variables. Net profit is the dependent variable (Y), while sales type (X_1), product type (X_2), and price (X_3) are independent variables that influence it.

1. Dependent Variable (Y)
   Net profit, as the dependent variable, is used to measure the profit per transaction [15].

2. Independent Variable (X)

- X_1 (Sales Type): Includes dine-in and takeaway transaction methods to assess differences in sales characteristics and their impact on net profit.
- X_2 (Product Type): Includes add-on groups, coffee, matcha, desserts, and main courses.
- X_3 (Product Price): Indicates the product's selling price, which influences purchasing decisions and revenue generation [15].

F. Data Analysis Techniques

Data were analyzed to investigate the impact of sales type, product type and price on net profit at F&B outlet. The analysis consisted of descriptive, classical assumptions tests, and multiple linear regression with OLS. If heteroscedasticity existed, the robust standard error test (HC3) was applied to check the significance of the coefficient. Additionally, the hypotheses were tested by t-test, F-test, and R^2 (coefficient of determination).

1. Descriptive Analysis

Sum, mean, standard deviation, minimum and maximum were computed of price variables and net profit proxies. Categorical variables (product type and sales type) were given numerical codes in regression sessions, and described as counts in the exploratory data overview.

2. Classical Assumption Test

Classical assumptions are tested to confirm that the regression model meets statistical requirement for valid analysis [17]. A normality test measures the distribution of residuals, a multicollinearity test evaluates for collinearity between independent variables and homoscedasticity tests identify heteroskedasticity in the residuals. Moreover, the autocorrelation test shows that there is no residual correlation among observations themselves.

3. Multiple Linear Regression Analysis

Multiple linear regression analysis was employed to test simultaneously and partially of the influence of sales type (X_1), product type (X_2) and price (X_3) on net profit (Y) [18]. The regression model applied is presented as:

$$Y = \beta 0 + \beta 1\ X1 + \beta 2\ X2 + \beta 3\ X3 + \varepsilon$$

Where:
Y = Net Profit
β_0 = Constant
β_1, β_2, β_3 = Regression Coefficients
X_1 = Sales Type
X_2 = Product Type
X_3 = Price
ε = Error Factor

We used the Ordinary Least Squares (OLS) method to estimate the parameters. But heteroscedasticity may make the standard error of regular OLS wrong, which makes the t-test and F-test less accurate [19]. Therefore, if heteroscedasticity is detected, the analysis is supplemented with robust standard errors.

4. Robust Standard Error (HC3)

Suppose the heteroscedasticity test indicates that the residual variance is not constant. In that case, the OLS estimates are supplemented with robust standard errors. The variant used in this study is HC3 because, according to [20], it produces more stable and accurate standard errors than HC0–HC2. Therefore, the coefficient values are still estimated using OLS, while the coefficient significance is based on the robust standard errors from HC3.

5. Hypothesis Testing and Coefficient of Determination

Hypothesis testing is applied to test whether independent variables either partially or simultaneously have effect on net income. b) T-test This test is to see the effect of each individual variable. On the other hand, the joint effect of all independent variables is examined using an F-test to determine whether they simultaneously influence net profit [21]. $p<0.05$ expressing its significance. R^2: R^2 explains the variance of net income in relation to the regression model. An R^2 value closer to 1 would indicate that the sales type, product type, and price are better in explaining variations in net profit on studied F&B outlet.

IV. Result and Discussion

A. *Descriptive Statistics*

TABLE 1. DESCRIPTIVE STATISTIC OF RESEARCH VARIABLES

Statistics	Product Type	Sales Type	Price (Rp)	Net Profit (Rp)
Count	6.920	6.920	6.920	6.920
Mean	3,42	1,78	35.509,83	21.815,02
Std. Dev.	1,09	0,42	10.398,68	7.243,07
Minimum	1	1	5.000	3.750
Maximum	5	2	75.000	52.500

As seen in Table 1, the average value of 3.42 for the Product Type argument means that most of transactions are coming from moderate and high influential-product categories, respectively. The huge standard deviation of 1.09 means there is a considerable variation among product categories. For the Sales Type variable, a value of 1.78 for Mean indicates that the second sales method like dine-in is more often used. The low standard deviation of 0.42 shows that sales tactics are fairly consistent.

Variable Price on the average price of the product is Rp35,509 with a range of prices from (Rp5.000 to Rp75.000). The high standard deviation (Rp10.398) indicates differences in price exist between categories. Meanwhile, the average of Net Profit variable is Rp 21,815 and has a distinct minimum and maximum values. The high standard deviation of Rp7,243 reflects wide diversity in the level of profit among transactions.

TABLE 2. FREQUENCY DISTRIBUTION AND PERCENTAGE OF THE SALES TYPE VARIABLE

Sales Type	Frequency	Percentage(%)
1	1547	22.36%
2	5373	77.64%

As seen in Table 2, the distribution of the Sales Type variable is largest at 77.64%, coming from the second sales category (dine-in). Conversely, the first category (takeaway) only accounts for around 22.36% of all transactions.

TABLE 3. FREQUENCY DISTRIBUTION AND PERCENTAGE OF THE PRODUCT TYPE VARIABLE

Product Type	Frequency	Percentage(%)
1	412	5.95%
2	543	7.85%
3	3167	45.77%
4	1326	19.16%
5	1472	21.27%

As seen in Table 3, the variable product type demonstrates relative diversity of the distribution. Among the product categories, product category 3 (Matcha) has been selected for maximum time around 45.77% by the consumers of Product. Categories 5 and 4, with up to 21.27% (Main Course) and 19.16% (Dessert). Category 1 (Add On) and category 2 (Coffee), on the other hand contribute very little to total sales.

B. Classical Assumption Tests

The diagnostic tests in this study are normality test, multicollinearity test, heteroskedasticity test, and autocorrelation test.

1. Normality Test

The normality test was tested using the Jarque–Bera test in this analysis. The test results are:

TABLE 4. NORMALITY TEST RESULT

Statistic	*p-value*
1342.3758	0.000

According to the Jarque–Bera test in Table 4, the model's residuals have a test statistic of 1342.3758 with p-value = 0.000. It means we reject the null hypothesis of normally distributed residuals. The Q–Q Plot additionally supports the above evidence.

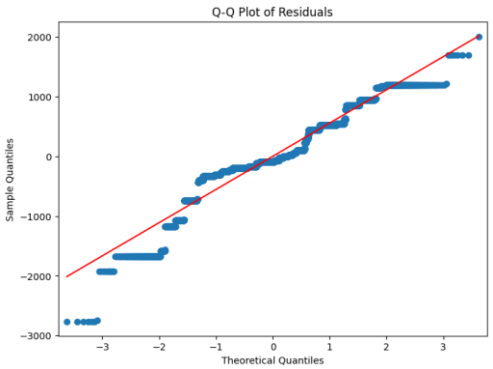

Fig 2. Q–Q Plot of Regression Residuals

Figure 2 shows the Q–Q Plot of the residuals generated from the multiple linear regression model. in performing regression analysis we use HC3 robust standard errors, which don't need normality of residuals for t-tests and F-test.

2. Multicollinearity

The Multicollinearity test was tested using the VIF (Variance Inflation Factor). The result presented in Table 5:

TABLE 5. MULTICOLLINEARITY TEST RESULTS WITH VARIANCE INFLATION FACTOR (VIF)

Variable	VIF
Price	21.712
Sales_Type_2	4.195
Product_Type_2	2.173
Product_Type_3	12.126
Product_Type_4	5.317
Product_Type_5	7.289

As seen in Table 5, several variables had quite high values. Particularly Price (21.71) and Product Type 3 (12.12) exhibited a high VIF. Other variables, Product Type 4 and Product Type 5, are in the moderate range (around 5–7), which is still acceptable. On the other hand, Sales Type 2 and Product Type 2 have low VIF values, so they do not pose a multicollinearity problem. Overall, despite several variables with high VIFs, the model remains usable.

3. Heteroskedasticity Test

In this analysis the Breusch-Pagan test was used to identify variance inconsistencies in this study. The results from the test were Breusch-Pagan=2384.4490 and F-statistic= 605.7219 with both having P-value of 0.0000. Since p-value is less than 0.05, it suggests that the model has heteroskedasticity.

In heteroscedasticity conditions like this, using the robust standard error (HC3) is an appropriate measure to measure bias in standard error estimates. This adjustment allows the t-test and F-test results to remain valid and reliable, allowing the regression model to provide more accurate and stable estimates.

4. Autocorrelation Test

The Durbin–Watson is used to assess autocorrelation in the regression residuals, The statistic obtained is 1.899, which is close to the ideal value of two and is within the acceptable range of 1.5 – 2.5. This indicates that the residuals are independent and the model is free from autocorrelation.

C. Result of Multiple Linear Regression Analysis

TABLE 6. MULTIPLE LINEAR ANALYSIS RESULTS

Variabel	Coef	Std. Error	z	p-value	CI 95% Lower	CI 95% Upper
const	815.6963	20.309	40.164	0.000	775.891	855.501
Price	0.6688	0.001	480.227	0.000	0.666	0.672
Sales_Type_2	22.4162	11.321	1.980	0.048	0.227	44.605
Product_Type_2	31.4707	30.215	1.042	0.298	-27.749	90.691
Product_Type_3	352.2875	39.382	8.945	0.000	275.100	429.475
Product_Type_4	-6756.7416	42.678	-158.319	0.000	-6840.389	-6673.094
Product_Type_5	-7693.9598	47.111	-163.314	0.000	-7786.296	-7601.623

Table 6 presents the result of multiple linear analysis used to identify the influence of each independent variable on Net Profit.

1. F-Test (Simultaneous Significance Test)

Based on the regression results using HC3 robust standard error in Table 6, the Prob(F-statistic) was 0.00. Since this value is below the 0.05 significance threshold, the null hypothesis (H0) is rejected and the alternative hypothesis (H4) is accepted, indicating that all independent variables collectively exert a significant effect on Net Profit in food and beverage (F&B) outlet.

2. Coefficient of Determination (R^2 and Adjusted R^2)

According to the estimation results, the R-squared statistic is 0.994 and the Adjusted R-squared is also 0.994. This means that the variables Sales Type, Product Type and Price explain 99.4% of the variation in Net Profit by the model.

3. t-Test (Partial Significance Test)

This t-Test is performed by contrasting the p-value of each regression coefficient with the 5% level of significance.

As seen in Table 6, Price variable has a 0.6688 coefficient with p-value = 0.000 this implies that Price has a significant effect in Net Profit. The positive value of the coefficient indicates that a unit rise in Price results as 0.6688 units growth in Net Profit, keeping all other variables unchanged. We also have the variable Sales_Type_2 (dine-in) which has a coef : 22.4162 and p-value 0.048 we can say that dine-in transaction has significant effect on Net Profit. Unlike the former factors, Product_Type_2 has a p-value of 0.298 significantly higher than the cut-off value and hence would have no impact on Net Profit. Meanwhile, Product_Type_3, Product_Type_4 and Product_Type_5 are shown to have strong effects in both univariate and multivariate models (p-value = 0.000 for all). Product_Type_3 has a positive coefficient value of 352.2875, meaning that this set has the potential to lift net profit relative to the base category. In contrast, large negative coefficients are derived for Product_Type_4 and Product_Type_5 (-6756.7416, -7693.9598).

In summary, the t-test results show that Price, Sales_Type_2, and Product_Type_3–5 significantly influence Net Profit, while Product_Type_2 does not.

D. Comparison of Research Results with Theory

Price, sales type, and product type were all found to influence net profit in this study. The effect of price is consistent with the literature, which states that higher selling prices can increase margins and lead to greater profits when cost conditions remain stable [13]. The differences across product types also align with the idea that each type has its own cost structure and demand level, resulting in varying profit contributions [12].

The impact of sales type, where dine-in produces higher net profit than takeaway, is also consistent with studies in the F&B field. Customer purchasing patterns and transaction behaviour often differ between sales modes, and these differences naturally affect the value of each transaction [23]. Overall, the findings support the existing theory that pricing, product mix and sales methods all play an essential role in shaping the profitability of F&B outlet.

E. Direction and Magnitude of Variable Influence

The regression results show that each independent variable impacts net profit in a different direction. Price has a positive and significant effect ($\beta = 0.6688$; $p < 0.001$), meaning that an increase in selling price leads to higher net profit. Sales type also has a significant effect, with dine-in transactions ($\beta = 22.4162$; $p = 0.048$) generating higher net profit than takeout transactions.

Product type exhibits varying impacts. Product Type_2 is insignificant, while Product Type_3 contributes positively to net profit ($\beta = 352.2875$; $p < 0.001$). Conversely, Product Type_4 and Product Type_5 reduce net profit ($\beta = –6756.7416$ and $\beta = –7693.9598$; $p < 0.001$), indicating lower profitability due to differences in cost structure and demand levels. Overall, only price and sales type showed a positive effect, while the impact of product type depended on margin characteristics and inherent cost structures.

F. Hypothesis Status (H1–H4)

The hypothesis testing in this work used robust regression findings (OLS–HC3). The evaluation was predicated on the coefficient size, the directional effect of each variable, and the p-value, supplemented by a concurrent test using the F-statistic.

1. Status H1 : Sales type has a positive effect on the net profit of F&B outlet

The estimation results show that Sales Type_2 (dine-in) has a positive coefficient of 22.4162 with a p-value of 0.048, indicating a significant effect on net profit. Therefore, H1 is accepted, and dine-in transactions generate higher net profit than takeaway.

2. Status H2: Product type has a significant effect on the net profit of F&B outlet.

The results show that Product Type_2 is not significant ($p = 0.298$), while Product Type_3, Product Type_4, and Product Type_5 are significant ($p = 0.000$). Because most categories show significance, H2 is accepted, indicating that product types contribute to variations in net profit.

3. Status H3: Product price has a positive effect on the net profit of F&B outlet.

H3 stated that price had a positive effect on net profit. The coefficient of 0.6688 with a p-value of 0.000 confirms a significant positive effect on net profit, therefore H3 was accepted. In other words, increasing prices was proven to increase net profit when other variables were held constant.

4. Status H4: Sales type, product type, and price simultaneously have a significant effect on the net profit of F&B outlet.

H4 stated that sales type, product type, and price simultaneously had a significant effect on net profit. The Prob(F-statistic) value of 0.00 indicates that these three variables collectively have a significant effect on net profit. Therefore, H4 is accepted.

V. CONCLUSION

After seeing the results of the processed data, this study concludes that Sales Type, Product Type and Price can be identified as significant factors affecting the Net Profit of F&B outlet on every increase of Rp. 1 related to an increase in net profit of around 0.6688 ($p < 0.001$), Sales Type 2 (dine-in) provides a higher net profit than its comparison category ($\beta = 22.4162$; $p = 0.048$), and Product Type 3 (matcha) increases net profit by 352.2875 ($p < 0.001$) while 4 and 5 decrease net profit by -6756.7416 and -7693.9598 ($p < 0.001$), respectively. The goodness of fit of the regression model is also very high, 99.4% in reference to R-squared, which means that most of the variance in Net Profit is explained by those variables. These empirical results are consistent with the theory of pricing strategies which lead to margin increase and the direct impacts on profit, and that F&B products have different cost structure and demand along with impact to profit contributive. Also, differences between types of sales (dine-in and takeaway) are in line with literature that customer consumption patterns may not only vary by type but also induce differences in transaction value. Therefore, this study not only supports the linear regression in relation to independent and dependent variables but it also adds value to business theory within F&B to show that pricing strategy, product mix and sales approach are important influences over improved outlet profitability.

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