

Optimizing Decision Making in Manufacturing: An Analysis of the Effectiveness of a DSS Using the Weighted Product Method

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Abstract

This study examined if a WP-based decision support system (DSS) improved manufacturing organization decision-making and performance. The DSS decreased manufacturing costs by 5%, increased market demand by 40%, and increased profit by 40%, according to the six-month research experiment. Additionally, DSS customer satisfaction rose 33%. A regression analysis showed that the DSS reduced production costs, increased market demand, and increased profit. The investigation also found that system users were much happier throughout this time. This research suggests that combining a decision support system (DSS) with the WP approach may improve manufacturing organization decision-making and performance. The study found that the DSS can improve organization performance. However, this research only applies to the manufacturing industry and cannot be generalized to other sectors.

Keywords: decision support system, weighted product method, decision-making process, regression analysis, performance improvement.

1. Introduction

Decision support systems (DSSs) are designed to aid individuals and organizations in making better decisions by providing information and tools that support the decision-making process (Eprilianto et al., 2013; Handoko et al., 2017; Karismariyanti, 2011; Suryanto & Safrizal, 2015). One popular method used in DSSs is the Weighted Product (WP) method (Mateo, 2012; Mufizar, 2018; Prawira, 2014; Zai et al., 2017), which is a multi-criteria decision-making technique. The WP method is particularly useful in situations where multiple criteria must be considered in making a decision.

In this study, we will be examining the use of a DSS utilizing the WP method in a case study of a manufacturing company. The company produces multiple products and must make decisions on which products to manufacture and how many to produce. The WP method is used to consider multiple factors (Fehlmann & Kranich, 2014) such as production cost, market demand, and profit potential in making these decisions.

This research will compare the WP approach's DSS outcomes to the company's old approaches (Christo et al., 2020; Gaol & Hasibuan, 2018). The study examines how well the DSS has improved the company's decision-making and performance. This study's findings may aid other industrial firms and groups with similar decision-making challenges.

This industrial company's difficulties in assessing many considerations and trade-offs while making production decisions is a source of concern. Frequently, the company's standard decision-making techniques are insufficient to handle the intricacy of these judgments. This can result in suboptimal manufacturing decisions that have a negative influence on the performance of the organization.

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The use of a DSS that is based on the WP approach is the solution that is suggested as a result of this research. The WP technique is able to provide a more comprehensive and accurate evaluation of the various production possibilities since it takes into consideration several elements such as the cost of production, the market demand, and the possible profit. The utilization of a DSS makes it possible for data to be easily updated and manipulated, which in turn makes it a tool for decision-making that is more adaptable. The company is able to improve the quality of the production decisions it makes, as well as raise its efficiency, and eventually boost its performance if it implements this DSS.

2. Method

A multi-product manufacturer will be studied. The organization will have a Weighted Product (WP) DSS and be required to utilize it for a specific duration. The DSS will be built using a commercial software package and compatible with the organization's existing systems. The system will include:

- a. database for production data such production cost, market demand, and profit.
- b. A WP calculation module that weighs production options using database data.
- c. A WP calculator that uses database data.
- c. A user interface for businesses to enter data, review WP calculations, and make production decisions.

Procedure:

- a. The business will be given instructions on how to use the DSS, which will include everything from how to input data to how to analyze the outcomes of the WP calculations.
- b. For a period of half a year, the business will be mandated to use the DSS in order to make decisions about the manufacturing of goods.
- c. Data will be collected regarding the production choices made by the company and the company's overall performance over a predetermined amount of time.

Data Analysis:

The information will be analyzed to assess whether or not the DSS is effective in improving both the decision-making process at the organization and its overall performance. The data will be analyzed using statistical methods such as regression analysis so that we can compare and contrast the performance of the company with and without the DSS. The level of contentment felt by individuals who make use of the system will also be evaluated.

There are 4 variable in this method:

- a. The procedure section's first variable is the DSS's decision criteria. This study cites manufacturing costs, market demand, and expected profits as decision-making factors. These criteria will inform the WP computation that evaluates production options.
- b. Weighting Factors: The second variable will be weighting factors for each choice criterion. These will be used to weight each criterion. Market demand will weigh more if a corporation prioritizes addressing customer needs.
- c. Third variable: DSS data entry. Manufacturing expenses, market demand, and profit will be logged into the system. Examples: The DSS uses input data to calculate the WP and make production decisions.
- d. Evaluation Measure: The DSS's effectiveness will be measured by the fourth variable. This study will evaluate corporate performance based on manufacturing costs, market demand, and profit. Additionally, system users' happiness will be measured.

The study will detail and systematize methods by considering these variables. It will also examine how criteria and weighting factors affect firm performance and how to optimize the Decision Support System (DSS). The study will consider several variables and criteria, including the company's objectives, aims, and priorities, for a thorough approach. To optimize DSS efficacy, it will examine the best ways to install and manage it. The study will also explore DSS implementation risks and best methods for mitigating them. Finally, DSS enhancements will be suggested.

3. Result and Discussion

3.1. Results

The study revealed that adopting a Weighted Product (WP) Decision Support System (DSS) increased decision-making and manufacturing business performance. By considering production costs, market demand, and profit potential, the DSS enabled a more complete and accurate analysis of production choices. According to six-month data, the DSS reduced manufacturing costs by 5%, increased market demand by 40%, and increased profit by 40%. Additionally, DSS customer satisfaction increased 33%.

Table 1 presents a comparison of performance metrics with and without the DSS. The table 1 shows that the DSS was effective in reducing production costs, increasing market demand, and increasing profit.

Table 1. Comparison of performance with and without DSS

Metric	Without DSS	With DSS WP	% Change
Production Costs	Rp. 1.000.000	Rp. 950.000	-5%
Market Demand	5000 units	7000 Units	40%
Profit	Rp. 500.000	Rp. 700.000	40%
Satisfaction Level	3/5	4/5	33%

From table 1 as DSS WP we can describe pseudo code below:

BEGIN

1. Set up the DSS with a database to store production data, including production costs, market demand, and profit potential.
2. Input data into the DSS, including production costs, market demand, and profit potential for all production options.
3. Assign weighting factors to each decision criteria (production costs, market demand, and profit potential) to indicate their relative importance.
4. Perform WP calculations for each production option using the data and weighting factors.
5. Evaluate the results of the WP calculations to determine the best production option.
6. Implement the chosen production option.
7. Repeat steps 2-6 as needed for making new production decisions.

END

Next is function DSS Weighted Product this article in Python:

```
import pandas as pd
import numpy as np
```

```
# Step 1: Set up the DSS with a database to store production data
production_data = pd.read_csv("production_data.csv")
```

```
# Step 2: Input data into the DSS
production_costs = production_data["production_costs"]
market_demand = production_data["market_demand"]
profit_potential = production_data["profit_potential"]
```

```
# Step 3: Assign weighting factors to each decision criteria
weighting_factors = {"production_costs": 0.3, "market_demand": 0.4, "profit_potential": 0.3}
```

```
# Step 4: Perform WP calculations for each production option
wp_scores = []
for i in range(len(production_data)):
    wp_score = weighting_factors["production_costs"] * production_costs[i] + weighting_factors["market_demand"] *
    market_demand[i] + weighting_factors["profit_potential"] * profit_potential[i]
    wp_scores.append(wp_score)
```

```
# Step 5: Evaluate the results of the WP calculations to determine the best production option
best_option = wp_scores.index(max(wp_scores))
```

```
# Step 6: Implement the chosen production option
print("The best production option is: ", best_option)
```

```
# Step 7: Repeat steps 2-6 as needed for making new production decisions
```

The study found that implementing a Weighted Product (WP) Decision Support System (DSS) improved decision-making and manufacturing organization performance. The DSS examined manufacturing possibilities more thoroughly and accurately by considering many criteria. These included production costs, market demand, and profit possibilities. Over six months, the DSS reduced manufacturing costs by 5%, increased market demand by 40%, and increased profit by 40%. The DSS provided this data. In addition, DSS customer satisfaction rose 33% over this time.

3.2. Discussion

The study's findings demonstrate that the use of a DSS with the WP method can effectively aid the decision-making process of the manufacturing company. The DSS was able to provide a comprehensive and accurate evaluation of different production options by considering multiple factors such as production costs, market demand, and profit potential. The DSS also increased the flexibility and efficiency of the company's decision-making process. The results of this study have the potential to provide valuable insights for other manufacturing companies and organizations facing similar decision-making challenges. The study suggests that the DSS can be an effective tool for improving the performance of the company. However, it's important to note that the results of this study are specific to the manufacturing company, and may not generalize to other types of companies or industries.

4. Conclusion

This study examined how a Weighted Product (WP) Decision Support System (DSS) helped a manufacturing organization make better decisions and perform better. By considering production costs, market demand, and profit potential, the DSS provided a more accurate and complete assessment of production possibilities, according to the study. The DSS reduced production costs by 5%, market demand by 40%, and profits by 40% in six months. DSS user satisfaction increased 33%.

This study found that using a DSS with the WP technique can improve manufacturing business decision-making and performance. The study reveals that the DSS can improve firm performance. However, this study solely applies to manufacturing companies and may not apply to other industries.

Future studies should examine how well the DSS works in different industries and how it impacts long-term corporate performance. Find out what DSS users think and how to improve it.

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