

# Implementation of the Weighted Product Method for Bank Credit Restructuring Applications

**Bagas Julian U, and Isnin Faried**

Department of Informatics

IKPIA Perbanas

Jakarta, Indonesia

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## ABSTRACT

*The impact of the Covid-19 pandemic is felt by the company, which is a decline in business revenue. The scan also has an impact in terms of the ability to repay bank credit and has a risk of credit clogging. The XYZ Bank as a lender has an obligation to implement the established policy of National Economic Stimulus. Nowadays, credit restructuring services exist, but many of the service processes are still carried out semi-automatically, partly by the system and the other part by humans and using paper-based data. The method used to solve such problems is the Decision Support System using the Weighted Product method. (WP). Research conclusions on the implementation of the Weighted Product (WP) method show good results and can perform criteria calculations (in numerical form) for all criteria. This method can be implemented by combining server-side scripting in PHP and client-sided scripting using Javascript. The overall results can be concluded the application created to meet the needs of the research problem that is making the automation of the priority process of submission of credit restructuring in Bank XYZ. There is a minimum result that is the algorithm used affecting the increase in the load of memory and processor performance.*

**Key Words:** Credit Restructuring, Decision Support System, System Semi-Automatic, Weighted Product Method.

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## 1. INTRODUCTION

The impact of the Covid-19 pandemic is felt by entrepreneurs, which is a decline in business revenue. The scan also has an impact in terms of the ability to repay bank credit and has a risk of credit clogging. Preventive measures occurred when large amounts of credit were blocked and the government established a countercyclical policy as an attempt to stimulate the national economy. This policy is established as the Regulations of the Financial Services Authority of the Republic of Indonesia Number 11/POJK.03 of 2020.

The XYZ Bank as a lender has an obligation to implement the established policy of National Economic Stimulus. Nowadays, credit restructuring services already exist, but many of the service processes are still semi-automatic, some of which are carried out by the system and some are done by humans and use paper-based data.

Based on previous research, one method applied to the Decision Support System is Weighted Product (WP). Some literature that discusses the application of the methods one of which is Nuraeni and Purnama that the assessment of indicators or parameters using the WP method gives more detailed results so that the giving of the target recipients of People's Enterprise Credit is more accurate target [1]. Other researchers stated that the WP method could help home surgical aid recipient decision-making with criteria that the researchers had defined [2]. WP method gives good results in determining rankings for outsourcing staff performance at Bank Rakyat Indonesia [3]. Sugiarto, etc. also informed that WP Method provides accurate and accurate selection calculation results to determine employees who receive bonuses [4]. Application of WP method can produce target credit recipients for retirement based on 5 criteria and weights set in the Bandung Post Office [5]- In ranking the WP method gives good results for simple calculations and is easy to apply in cases where the element of subjectivity is still high [6].

## 2. LITERATURE SURVEY

### 2.1. Credit Restructuring

According to the Regulations of the Financial Services Authority of the Republic of Indonesia No. 11/POJK.03/2020 Chapter III Article 5 para. 2 states that credit restructuring or financing may be carried out against credit or funding granted before or after the debtor is affected by the spread of coronavirus disease 2019 (COVID2019) including debtors of micro, small and medium-sized enterprises.. [7-9]

Credit restructuring is an attempt to improve credit activities against debtors who have potential difficulties meeting their credit repayment obligations. [7-9] This activity is in the form of government policy. The requirements to be met are:

1. The debtor has difficulty paying the substance and/or credit interest, and
2. The debtor has good business prospects and is assessed to be able to meet obligations after credit restructuring.

The type of credit restructuring carried out by the bank, among other things, through:

1. reduction of credit interest rates;
2. extension of the credit term;
3. reduction in credit interest rate delays;
4. decrease in credit substantive delay;
5. addition of credit facilities; and/or
6. conversion of credit into Temporary Capital Participation.

### 2.2. Weighted Product (WP) Method

The Weighted Product method is applied using the overlapping technique presented by Kusumadewi, etc. in [1]. The stages of problem solving using the WP method are depicted below [10].

1. Determining the criteria to be classified as a reference
2. Calculating the weight value ( "W" )
3. Calculation of the vector values ( "S" )
4. Calculate vector values ( "V" )
5. Determine data rankings

Calculate the weight value of W using the following equation 1.

$$W_j = \frac{w_j}{\sum w_j} \quad (1)$$

$W_j$  : Index weight to j

$\sum w_j$  : Total  $W_j$

Calculate the value of the vector S using the following 2 equation.

$$s_i = \prod_{j=1}^n x_{ij}^{w_{ij}} \quad (2)$$

s : Alternative preferences are analogous to vector S

x : criteria value

w : criteria weight

i : alternative

j : criteria

n : number of criteria

Calculate vector V values using the following 3 equation.

$$v_i = \frac{\prod_{j=1}^n x_{ij}^{w_{ij}}}{\prod_{j=1}^n (x_{ij}^*)^{w_{ij}}} \quad (3)$$

### 3. PROBLEM DEFINITION

The credit restructuring submission service is still a long time in XYZ bank because it is still done manually in particular the priority determination of customer service with the criteria and values set. The research is aimed at solving the problem by developing a system that uses the Weighted Product method to prioritize to reduce the time of the credit restructuring process.

### 4. RESEARCH METHODOLOGY

The research uses primary data obtained from the research site of XYZ bank. The data source is from the Collection Strategy team with a little process of masking to keep the security and privacy of customers.

System development is made using web-based JavaScript, PHP programming language with Bootstrap v.5 framework. Data storage using Microsoft SQL Server Management Studio 18.

#### 4.1. Research Question

In order to answer the problem, the research question is defined:

1. can the weighted product method deliver better results with the specified parameter setting
2. can the application of the weighting product method be well implemented in web-based applications
3. can the implementation of the weighed product method give faster results for the priority determination process of the credit restructuring application?

#### 4.2. Research Framework

In order to answer the research question above, a framework for research thinking and the process of determining the priority scale of research is created. The framework of thought and the flow of the process is one of the oldest ideas of research on how the solution will be built into a part of the credit restructuring submission system.

The thinking framework is a research chart that will focus (white background) on the processing of submission data, priority processing using the Weighted Product (WP) method and the results obtained will be sorted downwards. The framework of thought described above can be seen in Figure 4.1 below.

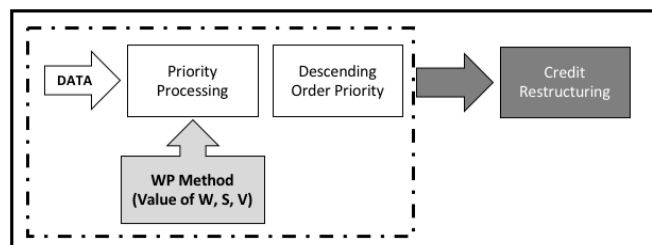


Figure 4.1 Research Framework

The process is a detailed process of the research framework. The process shows the implementation of the Weighted Product Method, which is the calculation of a value “W” which is continued with the calculations of the value “S” and the final calculation is “V”. After the value V is obtained from each customer data then the sequencing process is carried out with the reference value “V” in order to obtain data processing priority. This process is expected to speed up the process of submitting credit restructuring. The processes described above can be seen in Figure 4.2 below.

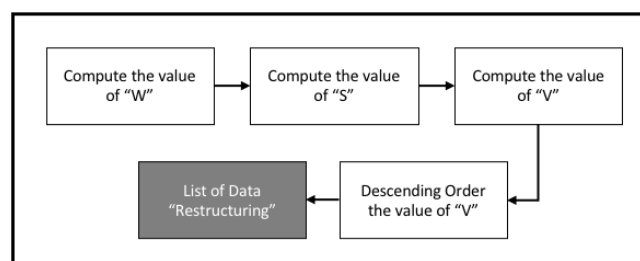


Figure 4.2 Priority Scale Determination Process Flow

**4.3. Criteria**

The criteria are the standard values used to determine the priority scale (based on data) and the parameters of the value of the restructuring submission. This means that if the submission has a value below the parameter then submission will be automatically rejected. The criteria used are obtained from the setting of the research site.

**Table 5.1 Criteria and Parameter**

Criteria	Weight (Total =10)	Category
Outstanding	3	Benefit
DPD	3	Cost
Tenor	1	Cost
Interest	3	Benefit

Outstanding (balance) is the amount that the debtor has paid or owed from the balance of the loan after paying the minimum amount of the payment obligation. Day Past Due (DPD) represents the number of calendar days passed since the due date of the last payment. Tenor is the period of credit or payment granted to the debtor with the agreed time to perform the repayment of the loan. Interest rate is the rate of interest that is set when a bank lends to a customer. Weigh is the weight value given to each criterion with a total of 10 weights. This weigher is done by the Collection Strategy department at the XYZ bank. The category consists of 2 Benefits and Costs. For criteria with the category Benefit then the value you have will be multiplied by 1 while the category Cost then the amount you have multiplies by -1. [12]

**5. RESULT and DISCUSSION**

The stage of implementation of the research is carried out following the benchmarks described in section 2.2 above.

**5.1. Compute the value of “W”**

Based on the criteria set with the following settings:

- Criteria 1 (C1) – Outstanding = 3 (point) – Benefit
- Criteria 2 (C2) – DPD = 3 (point) – Cost
- Criteria 3 (C3) – Tenor = 1 (point) – Cost
- Criteria 4 (C4) – Interest = 3 (point) – Benefit

The result of the calculation using equation 1 is obtained as seen in table 5.1.

**Table 5.1 Value of W**

Weight	Compute with Equation 1	Result
W1	$3 / (3+3+1+3) = 0.30$	$0.30 \times 1 = \mathbf{0.30}$
W2	$3 / (3+3+1+3) = 0.30$	$0.30 \times (-1) = \mathbf{- 0.30}$
W3	$1 / (3+3+1+3) = 0.10$	$0.10 \times (-1) = \mathbf{- 0.10}$
W4	$3 / (3+3+1+3) = 0.30$	$0.30 \times 1 = \mathbf{0.30}$

**5.2. Compute the value of “S”**

The calculation stage of the normalized S value is performed for each alternative (R) that has been specified. The implementation of the alternative values used in this study can be seen in table 5.2.

**Table 5.2 Value of sample 4 alternatives**

Alternative	C 1	C2	C3	C4
R1	522.511.120	1	1	0.238
R2	120.088.660	21	1	0.304
R3	471.011.096	6	1	0.358
R4	265.678.728	57	34	0.148

Results of calculation using equation 2 obtained results that can be seen in table 5.3.

**Table 5.3 Value of S**

Alternative	S
R1	$(522.511.120^{03.0}) \times (1^{-0.30}) \times (1^{-0.10}) \times (0.238^{0.30}) = 268.16$
R2	$(120.088.660^{03.0}) \times (21^{-0.30}) \times (1^{-0.10}) \times (0.304^{0.30}) = 74.48$
R3	$(471.011.096^{03.0}) \times (61^{-0.30}) \times (1^{-0.10}) \times (0.358^{0.30}) = 171.64$
R4	$(265.678.728^{03.0}) \times (57^{-0.30}) \times (34^{-0.10}) \times (0.148^{0.30}) = 39.67$

**5.3. Compute the value of “V”**

The calculation of the V value is used to obtain the value of the result that will be used as the best alternative. This calculation uses the result of the S calculation performed at the previous stage.

Results of calculation using equation 3 obtained results that can be seen in table 5.4.

**Table 5.4 Value of V**

Alternative	S
R1	$268.16 / (268.16 + 74.48 + 171.64 + 39.67) = 0.484$
R2	$74.48 / (268.16 + 74.48 + 171.64 + 39.67) = 0.134$
R3	$171.64 / (268.16 + 74.48 + 171.64 + 39.67) = 0.310$
R4	$39.67 / (268.16 + 74.48 + 171.64 + 39.67) = 0.072$

**5.4. Descending Order the value of “V”**

The next stage is the sequencing of V values from each alternative. This study uses descending sorting to obtain the submission of the restructuring of the largest value to the smallest value. The sequencing is carried out simultaneously with filtering with a specific parameter for each alternative taking into account the outstanding values (balance), DPD, Tenor and Interest (rate).

Consideration is made to make a decision if there are values that do not match these 4 criteria then alternatives are not automatically processed or placed in the lowest order. This requirement must be met because the criteria values are absolute.

Examples of implementation of the Descending Order process can be seen in table 5.5 which contains the restructuring data that has been done sequencing based on the process discussed above.

**Table 5.5 Descending Order based on Value of V**

Alternative	V	Outstanding	DPD	Tenor	Interest
R1	0.484	522.511.120	1	1	0.238
R3	0.310	471.011.096	6	1	0.358
R2	0.134	120.088.660	21	1	0.304
R4	0.072	265.678.728	57	34	0.148

Examples of the establishment of 4 criteria for submission of restructuring are made in the form of table 5.6 filling.

**Table 5.6 Standard Criteria**

Min. Outstanding	Max. DPD	Max. Tenor	Min. Interest
5.000.000	90	24	0.25

The result of descending order based on Standard Criteria as shown in table 5.7.

**Table 5.7 Descending Order based on Standard Criteria**

Alternative	V	Outstanding	DPD	Tenor	Interest
R3	0.310	471.011.096	6	1	0.358
R2	0.134	120.088.660	21	1	0.304
R1	0.484	522.511.120	1	1	0.238
R4	0.072	265.678.728	57	34	0.148

Based on the above explanation, it can be seen that the implementation of the Weighted Product (WP) method can work well and can perform calculations of data in numerical form with the appropriate results in particular performing the corresponding scaling or sequencing of the standard.

The following explanation will present a user interface view of the application created with the specifications that have been described in section 4 above.

Parameters or criteria that can be set by the bank as a benchmark for the restructuring process. View Parameters already set in the system like Figure 5.1.

Parameter				
Tanggal Maximal Booking	Minimal Outstanding	Maximal DPD	Max Tenor	Min Interest Rate
01-Jan-2018	1,000,000	90	24	0.25
Nilai S Total (SUM)	6838.687			

**Figure 5.1 User Interface Parameter or Criteria**

Parameters can be updated by the bank to adjust the data restructuring needs with the user interface appearance as shown in Figure 5.2.

**Update Set Paramater**

Tanggal Maximal Booking <input type="text" value="Masukkan tanggal"/>	Minimal Outstanding <input type="text" value="Masukkan Minimal Outstanding"/>
Max DPD <input type="text" value="Masukkan Max DPD"/>	Max Tenor <input type="text" value="Masukkan Max Tenor"/>
Min Interest <input type="text" value="Masukkan Min Interest"/>	Remarks <input type="text" value="Masukkan keterangan perubahan parameter"/>

**Figure 5.2 User Interface Update Parameter Setup**

The result of the calculation process or sequencing of the restructuring submission data is shown as a list already sorted by calculation using the WP method and can be seen in Figure 5.3.

No	VIEW	Nilai S	Nilai V	Status	Category Product *	Los App Number	Loan CIF number	Full Release Date	Loan Term	
1	<a href="#">view</a>	169.300724	0.024756214168012		100615746500	502181	11220000142287	15-Sep-2014	24	0.
2	<a href="#">view</a>	110.141856	0.016105430764707		100615746700	486313	11220000142289	21-Jun-2013	36	0.
3	<a href="#">view</a>	105.145194	0.015375758533765		100615745700	486313	11220000142279	21-Jun-2013	36	0.
4	<a href="#">view</a>	90.438912	0.013224760834938		100615743500	502181	11220000142257	15-Sep-2014	24	0.
5	<a href="#">view</a>	89.642394	0.013107779314947		100615742400	719895	11220000142246	31-Aug-2015	48	0.
6	<a href="#">view</a>	88.948926	0.013006882753956		100615747500	502181	11220000142297	15-Sep-2014	24	0.

Figure 5.3 User Interface List of Data

This research has minimal results in this research especially in the technical implementation of the use of systems and data architecture. The first discussion is the implementation of the Weighted Product method which requires the process of calculating total S values and calculating V values. The existing process indicates the existence of repeated calculations that affect the memory and processor performance loads.

## 6. CONCLUSION

1. The Weighted Product (WP) method can be well implemented and produce numerical calculations for all criteria.
2. The calculation of criteria using the Weighed Product Method (WP) can be implemented by combining server-side scripting in PHP and client-side scripting in Javascript.
3. The overall results can meet the requirements of the research problem, i.e. to automate the priority process of submission of credit restructuring in XYZ Bank
4. Further research can be done with the development of algorithms or other technological infrastructure so that the performance burden can be reduced and does not affect the processing of data of large amounts of restructure submissions. (big data)

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