Jurnal Mandiri IT
Vol. 10 No. 2, January (2022), pp. 57-62

ISSN 2301-8984 (Print), 2809-1884 (Online)
Published by Institute of Computer Science

Total Prediction Decision Support System Bakery and Cake Production Using Mamdani Fuzzy Method *(Case Study: Neko-Neko Bakery & Cake Branch Burned Stone, Deli Serdang)*

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A R T I C L E I N F O

Article history:

Received Dec 01, 2021
Revised Dec 15, 2021
Accepted Des 26, 2021

Keywords:

Bakery and Cake;
Fuzzy Mamdani;
Prediction of Total Production.

ABSTRACT

The decision support system for predicting the amount of bakery and cake production using the fuzzy mamdani method is one of the processes for determining the prediction of the amount of bakery and cake production for the next month so that the desired production amount is according to needs. Neko-Neko Bakery & Cake so far in predicting the amount of production where the demand for bakery and cake is sometimes not fulfilled considering that the available bakery and cake production is not sufficient because the bakery and cake supplies in the production section do not meet and vice versa, namely the amount of production sometimes experiences excess in production. production so that it is not in accordance with demand, then there is often an error in predicting the amount of production in producing bakery and cake because the number of bakery and cake productions produced is not really needed while bakery and cake which are often needed are not produced since so far the Neko-Neko Bakery and Cake in Prediction data collection on the number of bakery and cake productions only relies on the Microsoft Office Excel application system where the data that is processed or processed is sometimes double in value. The method used in the decision support system to predict the amount of bakery and cake production is fuzzy mamdani. Mamdani fuzzy method is one method that has a simple structure and easy to understand. Mamdani fuzzy logic uses MIN-MAX or max-product operations with a predetermined set of rules, namely the previous IF…AND…THEN. Based on the application of this mamdani fuzzy method in predicting the amount of bakery and cake production, it can be stated that it is very feasible to apply to Neko-Neko Bakery & Cake. This decision support system was built using the PHP programming language and MySQL database.

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1. INTRODUCTION

Neko-Neko Bakery & Cake is a company engaged in the marketing and supply of all types of bakery and cake. Neko-Neko Bakery & Cake is located on Jln. Burnt Batu, Lubuk Pakam, Deli Serdang. Where this company is one of the most successful companies that already has several branches in several cities and regions (Storper & Harrison, 1991). But in running the business can

not be separated from controlling the amount of bakery and cake production every day (NAKANE & HALL, 1991). Controlling the prediction of the amount of bakery and cake production in question is to coordinate various activities in the processing of raw materials to produce bakery and cakes that are finished and ready to be marketed, so that by controlling the prediction of the amount of production it will minimize production costs, the amount of production in accordance with market demand and in making it effective and efficient (Ruteri & Xu, 2009), (Myroshnyk, 2013). For this reason, it is necessary to make a decision support system to assist in predicting the amount of bakery and cake production each month using the fuzzy mamdani method (Ali & Ali Kulaib, 2020) (Allais et al., 2007). The mamdani fuzzy method is one of the methods used in building a decision support system for predicting the amount of bakery and cake production, because the mamdani fuzzy has a simple structure and is easy to understand. Mamdani fuzzy logic uses the MIN-MAX or max-3 product operation with a set of predetermined rules, namely the previous IF…AND…THEN. Mamdani's Fuzzy Logic is very flexible, has tolerance for inaccurate data and is able to model very complex non-linear functions.

According to Andreas Widiyantoro (2020:2) "The Mamdani fuzzy method is often used in applications because of its simple structure, which uses the MIN-MAX or MAX PRODUCT operation and to get the output using the Mamdani fuzzy method, namely by forming fuzzy sets, the application of the implication function , rule composition and defuzzification". Previous research which is similar to the title of this research is about determining the amount of production of the amulet lantak where in this study using Matlab and from the calculation process using the Mamdani fuzzy method, the crisp value is 648 (Saepudin et al., 2019). Then in a similar study, namely in a decision support system for the production of jenang, in this study successfully applied the fuzzy mamdani method using a visual basic application and the results of the application of the fuzzy mamdani method of jenang to be produced were 74 packs of sesame jenang type (Iriyanto, 2008). And the research conducted by (Marbun & Marbun, 2009) "Planning the Amount of Bread Production Using the Fuzzy Mamdani Method" with the results of system testing, it can be concluded that the application of Mamdani fuzzy logic is effectively applied in applications to help companies in particular Judens Bakery in planning the amount of bread production based on inventory data and the number of requests.

2. METHOD

The research framework is a research concept that links the visualization of one variable to another, so that research is structured systematically and can be accepted by all parties. The research framework in this research is as shown in the following figure:

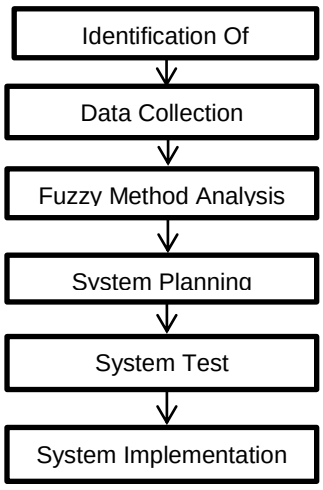

Figure 1. Research Framework

a. Identification of problems
   Identifying problems is a problem identification or problem inventory because problem identification in aresearch is a very important stage or process to determine the quality of research (Basadur et al., 1982), (Fitzgerald & Shullman, 1993).
b. Data collection
   Data collection was carried out by means of literature studies carried out by studying books, journals, internet searches and or other references related to research using the Mamdani fuzzy logic method. And the process of collecting data by conducting direct interviews in the Production Department at Nek-Neko Bakery & Cake, while the respondents in this interview process were Mrs. Khodizah, S.E as Production Manager at Neko-Neko Bakery & Cake Bakaran Batu Branch, Deli Serdang Regency.
c. Mamdani Fuzzy Method Analysis
   The analysis stage is a stage in analyzing a system in research, namely the formation of fuzzy sets, application of implications functions, composition of rules and affirmations (defuzzification) (Rizki, 2021), (Ariani & Endra, 2013), (Yogachi et al., 2021).
d. System planning
   At the system design stage, namely designing or designing a good system whose contents are the operating steps in the data processing process and process procedures to support system operations (Cavalieri & Pezzotta, 2012) (Sakao & Shimomura, 2007).
e. System Testing
   System testing is the most important thing that aims to find errors or deficiencies in the software or system that has been built or tested (McMinn, 2004).
f. System Implementation
   System implementation is the stage of system implementation that will be carried out if the system is approved, including programs that have been made at the system design stage and system testing, then the system implementation is carried out with the aim that the system that has been built can be used.

3. RESULTS AND DISCUSSIONS

The data taken to be used in the design of a decision support system to predict the amount of bakery and cake production by applying the fuzzy mamdani method at Neko-Neko Bakery & Cake is in the form of demand, supply and production data every day for one month.

a. The data on demand, supply and production of "Bika Ambon" for the period March 2021 at Neko-Neko Bakery & Cake can be seen in the following table:

Table 1.
Demand, Supply, and Production of Bika Ambon in March 2021

Num	Date	Request	Supply	Production
1	1 March 2021	17	8	6
2	2 March 2021	6	8	7
3	3 March 2021	8	12	6
4	4 March 2021	12	6	7
5	5 March 2021	4	13	4
6	6 March 2021	13	7	6
7	7 March 2021	6	8	6
8	8 March 2021	8	4	8
9	9 March 2021	3	4	6
10	10 March 2021	15	16	9
11	11 March 2021	18	10	8
12	12 March 2021	9	10	6
13	13 March 2021	12	12	8
14	14 March 2021	11	10	6
15	15 March 2021	8	9	10
16	16 March 2021	9	10	6

b. Range
The prediction range of bakery and cake for each fuzzy variable is as follows:

Table 2.
Predictors of Bakery and Cake

Function	Variable	Set	Range
Input	Request	Down	[3-12]
		Normal	[8-17]
		Ride	[15-24]
	Supply	A little	[4-13]
		Currently	[10-19]
		Lots	[16-25]
Output	Production	Reduce	[2-6]
		Normal	[4-8]
		Increase	[6-10]

c. Fuzzy Rules
Based on the reasoning unit in fuzzy inference, fuzzy rules can be formed, including the following:

Table 3.
Fuzzy Rules (Rule)

Aturan	Permintaan	Persediaan	Fungsi Implikasi	Produksi
R1	Down	Lots	⇨	Reduce
R2	Down	Currently	⇨	Reduce
R3	Down	A little	⇨	Reduce
R4	Normal	Lots	⇨	Reduce
R5	Normal	Currently	⇨	Reduce
R6	Normal	A little	⇨	Reduce
R7	Ride	Lots	⇨	Reduce
R8	Ride	Currently	⇨	Reduce
R9	Ride	A little	⇨	Reduce
R10	Down	Lots	⇨	Normal
R11	Down	Currently	⇨	Normal
R12	Down	A little	⇨	Normal
R13	Down	Lots	⇨	Nornal
R14	Normal	Currently	⇨	Normal
R15	Normal	A little	⇨	Normal
R16	Ride	Lots	⇨	Normal

To determine the application of the implication function using the Mamdani fuzzy method, there are four fuzzy rules, namely as follows:

1) [R-1] If demand is down and supply is a lot, then production DECREASE BREAKFAST AND Cake
α-Predikat1 = μpmtTURUN ∩ psdBANYAK

= min(μpmtTURUN(15) ∩ μpsdBANYAK(10))
= min(0; 0)
= 0

2) [R-2] If demand is down and supply is medium then production DECREASE BREAKFAST AND Cake
α-Predicate2 = pmtDOWN psdMED
= min(μpmtDOWN(15) ∩ psdMEDIUM(10))
= min(0; 0)
= 0

3) [R-4] If Permintaan NORMAL And Persediaan BANYAK Then Produksi Bakery dan Cake BERKURANG
α-Predikat4 = μpmtNORMAL ∩ μpsdBANYAK
= min(μpmtNORMAL(16) ∩ μpsdBANYAK(10
= min(0.66667; 0)
= 0

4) [R-6] *If* Permintaan NORMAL *And* Persediaan SEDIKIT *Then* Produksi Bakery dan Cake BERKURANG
α-Predikat6 = μpmtNORMAL ∩ μpsdSEDIKIT
= min(μpmtNORMAL(16) ∩ μpsdSEDIKIT(10))
= min(0.66667; 0.5)
= 0.5

And so on until the whole up to R-16
The defuzzification method used is the centroid method. So the first step is to calculate the moment for each membership value, namely M1, M2, M3 and M4, as follows:

Momen 1

$$M_1 = \int_0^4 0.5\ z\ dz$$

$$M_1 = \frac{0.5\ Z^2}{2} \Big|_0^4$$

$$M_1 = 0.25\ (4)^2 - 0$$

$$M_1 = 0.25 * 16 - 0$$

$$\mathbf{M_1 = 4}$$

The conclusion is that the bakery and cake production plan with the "Bika Ambon" type for April 1, 2021 based on the calculation of the decision support system using the fuzzy mamdani method is 2.928574 or as many as 3 (three) boxes (after rounding up).

4. CONCLUSION

The design of a decision support system for predicting the amount of bakery and cake production using the fuzzy mamdani method (Case Study: Neko-Neko Bakery & Cake Branch Bakaran Batu, Deli Serdang) using UML (Use Case Diagram, Activity Diagram and Class Diagram) modeling, and built with using the PHP programming language and MySQL database. With the system that has been built, the Production Manager at Neko-Neko Bakery & Cake Branch Bakaran Batu, Deli Serdang is easier to predict the amount of bakery and cake production each month, and can also save time and costs by applying the fuzzy mamdani method in predicting the amount of

bakery and cake production at Neko-Neko Bakery & Cake Bakaran Batu Branch, Deli Serdang can be used to build a decision support system for predicting the amount of bakery and cake production at Neko-Neko Bakery & Cake Bakaran Batu Branch, Deli Serdang based on the variables of demand, supply and production. The results obtained from mamdani fuzzy calculations show the results of defuzzification or confirmation of the number of bakery and cake production predictions. Based on system testing using data on bakery and cake items at Neko-Neko Bakery & Cake, Bakaran Batu Branch, Deli Serdang, the fuzzy mamdani method can be used to predict the amount of bakery and cake production at Neko-Neko Bakery & Cake Bakaran Branch. Batu, Deli Serdang.

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