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A Model for Determine Upgrades for MSMEs using Analitical Hyrarcy Process

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Abstract

The various problems that have occurred in MSMEs affected by the pandemic have been felt by business actors. The Government recognizes the importance of developing the competitive advantage of MSMEs by empowering MSMEs to become more skilled and competitive businesses. Every MSME has the opportunity to Upgrade Classes. However, this implementation experienced difficulties in obtaining data on the results of appropriate, fast, and accurate assistance related to the results of the MSMEs criteria for upgrading at the Center for Integrated Service of SMEsCO (PLUT) Banten Province. The concept of a decision support system can be used as a tool for determining upgrade classes for MSMEs. One of the methods involved in determining the precedence level of criteria and performing consistency score calculations is the Analysis Hierarchy process method. The result of this research is a system that can provide SMEs with alternate recommendations for upgrade classes where the hierarchy formed is acceptable. The results of the sampling taken from 56 SMEs in this study can be obtained grade up by process max 0.46, min 0.25 and by output is max 0.75, min 0.36 So these values can be used as a decision support for MSMEs to go up a good grade in process and output.

Keywords: Analytical Hierarchy Process, MSMEs, Decision Support.

1. Introduction

According to the Ministry of Cooperatives and SMEs, as of March 2021, the number of MSMEs in Indonesia will be 64.2 million, contributing 61.07 percent of the country's gross domestic product (GDP) or IDR 8,573.89 trillion. Micro, Small and Medium Enterprise (MSME) is a general term in the business world to refer to a productive economic enterprise owned by a person or company and regulated by Law No. 20 of 2008[1][2]. MSMEs play an important and strategic role in Indonesia's economic development as they create job opportunities, absorb labor force and contribute to Indonesia's GDP. In addition, it provides low-income communities with a safety net for productive economic activity[3]. Therefore, the Ministry of Cooperatives and Small and Medium Enterprises has a legal basis to support MSMEs based on Cooperatives Law No. 25 of 1992, Law No. 20 of 2008 on MSMEs and Small and Medium Enterprise Comprehensive Service Center Technical Guidelines. increase. Cooperatives and MSMEs [4].

In line with its mandate, the Coordinates Commerce Benefit Center for Cooperatives and MSMEs in Banten Territory (PLUT Banten) gives comprehensive and coordinates non-financial administrations to cooperatives and MSMEs to upgrade their generation Production generation Synonyms and promoting execution, get to financing, and human asset advancement through capacity building in business enterprise, specialized and administrative aptitudes, and regulation execution to make strides their competitiveness [5]. To achieve this, mentoring is a strategic step to increase productivity, competitiveness, and performance[6]. The PLUT program for cooperatives and MSMEs, it is expected to accelerate the creation of new entrepreneurs who still require mentoring, training, internships, benchmarking, legal advocacy for business legalization, access to appropriate technology, financing, and market information[7].

However, MSMEs currently face several challenges, such as product marketing, branding, financing, improving human resource quality, digitalization, network collaboration, institutional development, and production quality[8]. TTherefore, PLUT's responsibility to Banten cooperatives and MSMEs is to measure the success of its services and mentoring (monitoring and evaluation) in order to achieve promotion of MSMEs[9] [10]. MSME promotion has two factors: process improvement and capacity building, including marketing, branding, access to financing, improving human resource quality, digitalization, network collaboration, institutional development, and production quality[11][12]. In practice, PLUT consultants face challenges and issues in monitoring and evaluating the decision-making process for MSME promotion due to the lack of tools or indicators that support the monitoring and evaluation of mentoring outcomes[13]. Hence, monitoring and evaluation of the decision making process for MSME promotion cannot be accurately and maximally reported to date. The development of a DSS is expected to help solve these issues at PLUT for Cooperatives and MSMEs in Banten Province[14].

In summary, MSMEs play an important role in the Indonesian economy by creating job opportunities, absorbing the labor force and contributing to the country's GDP. To assist MSMEs, the ministry has provided a legal basis for cooperatives and SMEs, and the Integrated Business Service Center for Cooperatives and MSMEs in Banten has a comprehensive and integrated approach to improve performance. provides non-financial services. However, MSMEs still face several challenges, and mentoring is a strategic step to increase productivity, competitiveness, and performance. In order to promote MSMEs, Banten cooperatives and PLUT for MSMEs need tools and indicators to support monitoring and evaluation of teaching outcomes. Therefore, the development of a decision support system is required to solve the problems her PLUT consultants face in monitoring and evaluating decision-making processes for promoting MSMEs.

2. Literature Review

2.1 PLUT KUMKM (Integrated Business Service Center for Micro, Small, and Medium Enterprises Cooperatives) Banten Province.

PLUT KUMKM (Coordinates Benefit Center for Miniaturized scale, Little, and Medium Endeavors Cooperatives) is an institution that gives help and strengthening to cooperatives and small scale, little, and medium ventures in Banten Area in an coordinates way to extend generation, efficiency, included esteem, and competitiveness[15][16]. (1) Training, (2) Confidence, (3) Behavior of participation, and (4) Innovation. Particularly, preparing and certainty have a noteworthy positive affect on advancement, whereas the behavior of participation incorporates a noteworthy positive affect on both development and maintainable competitive advantage[18]. Provincial KUMKM PLUTs are managed by the provincial regional apparatus to coordinate district/city PLUT KUMKM activities throughout the province and at the same time carry out other assistance and empowerment functions to cooperatives and MSMEs in districts/cities that do not yet have KUMKM PLUTs in the province[19].

2.2 Small and Medium Enterprises (MSMEs)

Cooperatives are commerce substances comprising of individuals or lawful agreeable bodies by realizing accomplishment exercises based on agreeable standards and at the same time as a people's financial development based on the guideline of kinship[20]. Micro, Small, and Medium Undertakings (MSMEs) are trade units as directed in Law Number 20 of 2008 concerning Miniaturized scale, Little, and Medium Endeavors[21][22]. Assistance is an increase in the process of productivity and competitiveness of cooperatives and MSMEs through guidance, consultation, and advocacy carried out by mentoring institutions and/or individual assistants[23]. Assisting consultants are individual assistants who carry out the duties and functions of assisting cooperatives and MSMEs who have mentoring competencies. MSME Upgrade Class is a business condition when it achieves sales (turnover) or an increase in capital/assets according to the criteria (micro, small and medium)[24].

2.3 Decision Support System (DSS)

Choice Back Framework may be a computer-based framework that makes a difference a individual make choices from different sorts of choices to fathom unstructured and semi-structured problems[25]. Choice Back System is an intelligently computer-based framework designed to create it simpler for clients to form choices by utilizing information and models to unravel unstructured problems[26]. A few of the objectives of a choice bolster framework (DSS) are to help supervisors in making choices on semi-structured issues, give back for chief contemplations, and are not aiming to supplant the manager's work, increment the viability of choices taken by supervisors[27]. More than progressing its effectiveness, computing speed, expanding efficiency, quality back, competitiveness, and overcoming cognitive confinements in handling and capacity. Clarifies that in utilize, choice back frameworks are not outlined to computerize decision-making, but can give intuitively instruments that empower decision-makers to carry out different analyzes utilizing accessible models.

Application, the choice bolster framework has a few stages, to be specific Insights, Plan, Choice, and Implementation[28]. The stages of Insights are the capacity to see data and keep up it as information to be decided. The plan organize may be a arrange or detail for an question or framework development to execute an movement or prepare or the result of that arrange or detail within the frame of a model, item, or prepare[29]. The Choice organize is carried out to decide a choice from different perspectives of look, assessment, and completion that can be made concurring to the demonstrate that has been outlined. The Execution Arrange is utilized to recognize and utilize code components or assets in programming that have been composed into computer programs[30].

Choice Back Framework may be a computer-based framework that makes a difference somebody in making choices from different sorts of choices to fathom unstructured and semi-structured issues. The purpose of a choice bolster framework is to help directors in making choices on semi-structured issues, increment the viability of choices taken by supervisors, and overcome cognitive restrictions in handling and capacity. In expansion, the stages in its application incorporate Insights, Plan, Choice, and Execution.

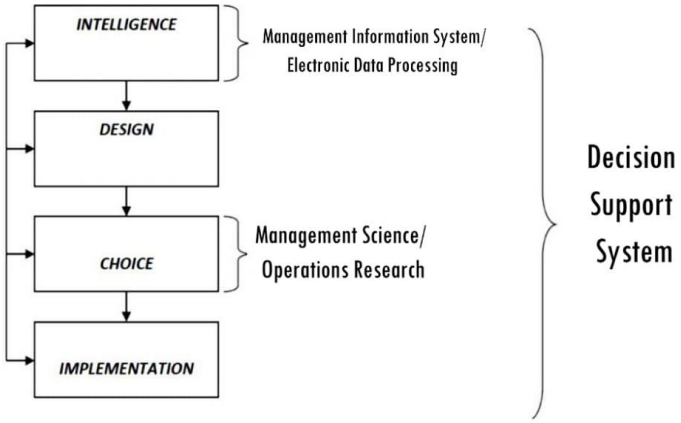

Figure 2.3. *Phases in Decision Making*

3. Research Methods

3.1. Data Analysis Method

Thought flow of research process from study to end of study of MSME upgrade selection decision support system using Analytical Hierarchical Process (AHP) methodology so that MSME upgrade selection decisions in Banten are made regularly PLUT UMKM Banten state care and support. In implementing the system running the AHP method. Flow chart of the way the system can be seen in Table 3,2.

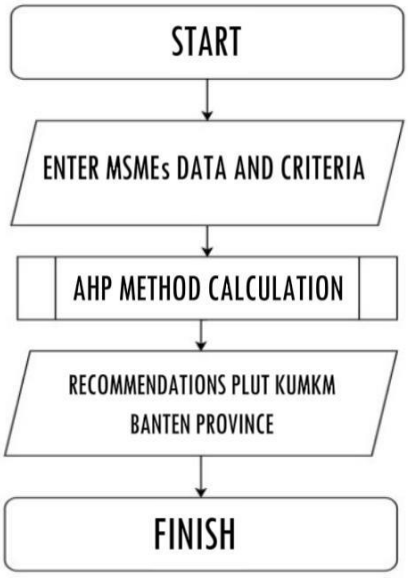

Figure 3.1 *Process Flowchart in general*

Process Class Promotion Criteria on the AHP Method

The process of AHP method is the process of giving weight to each criterion given to the user. The criteria used are the ratio of the KUMKM PLUT mentoring process, increasing human resources, having market access, having access to finance, having cooperative networks, having business institutions, having production quality, mastering technology and, having capital. The weight value of each criterion is taken from the data currently available at PLUT KUMKM Banten Province. The data taken is data for 2022 Beginning and End.

Table 3.1. *Table of Detailed Determination of Criteria by Process*

No	Criteria	Score(sample)
1.	Improvement of Human Resources	15
2.	Increasing Market Access	10
3.	Have access to financing	10
4.	Have a Cooperation Network	10
5.	Has Institutional Legality	15
6.	Product Quality Improvement	15
7.	Use of Technology	10
8.	Total Turnover and Capital/Assets currently owned	15

The output criterion for Class Promotion on AHP used in determining MSME Class Promotion is determined based on the total annual business turnover (Sales) and Total Capital (Assets) of the current business, which can be seen within the taking after table:

Table 3.2. *Output Criteria Determination Table*

No	Description	Capital	Turnover
1.	Micro	< 1,000,000,000.-	< 2,000,000,000.-
2.	Small	> 1,000,000,000.- to < 5,000,000,000,-	> 2,000,000,000,- up to < 15,000,000,000,-
3.	Medium	> 5,000,000,000,- to <10,000,000,000,-	> 15,000,000,000,- to <50,000,000,000,-

Table 3.3. *Class Category Table*

No	Class Category
1.	Class Up Process
2.	Level Up in Output

It can be explained that bringing upgrades in a process is an increase in the value of the process before mentoring and after mentoring from aspects which include improvement, Increasing Human Resources, Increasing Market Access, Having Access to Finance, Having Cooperation Networks, Having Institutional Legality, Improving Product Quality, and Use of Technology in business activities.

Upgrading in output is an increase in the number of Turnover/year and the Current Amount of Capital (Assets). Before mentoring and after mentoring. Conclusion Process and output class upgrades are where from the aspect of process and output criteria both experience a change or increase either slowly or significantly. The determination of the above criteria is

based on Government Regulation No.7 of 2021, and Deputy Decree No. 7 of 2019 concerning Central Program Technical Guidelines. Integrated Business Services, Rudy Suryanto and Junaidi, 2022. And various journal references and personal experiences.

3.2. The Process Analytical Hierarchy (AHP)

Demonstrate could be a decision-making instrument created by Thomas L. Saaty to address complex multi-criteria issues. AHP speaks to such issues in a various leveled structure of variables, criteria, sub-criteria, and options. This demonstrate is favored over other strategies due to its progressive structure, thought of approval and consistency of criteria and choices chosen by the choice producer, and affectability investigation yield toughness.

The AHP strategy has a few strategies or steps, beginning with characterizing the issue and compiling a pecking order of the experienced issues. The another step includes deciding need by making pairwise comparisons and speaking to the relative significance of the components. A while later, union is done by considering the pairwise comparisons and overlooking need. Measuring consistency is at that point performed by calculating the consistency record (CI) and the consistency proportion (CR). The consistency proportion is calculated utilizing the equation CR = CI / RC, where CI is the consistency record and RC is the arbitrary consistency list. At last, the consistency of the chain of command is checked to guarantee precise comes about.

Table 3.4. *Hierarchical Element Rating Scale (Saaty, 1993)*

Matrix Size	Indeks Random (IR)
1, 2	0.00
3	0.58
4	0.90
5	0.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49
11	1.51
12	1.48
13	1.56

Principles of Process Analytical Hierarchy Method (AHP).

A few standards must be caught on in completing the Explanatory Progression Prepare (AHP) Strategy, counting Decay, Comparative Judgment, Amalgamation of Need, and Coherent Consistency (Sri Multono, 2007:220). Decay After the issue is characterized, it is fundamental to break down it, to be specific by tackling the full issue into its components. Hence, the method of examination is called a progression (chain of command). There are two sorts of progressions, total and fragmented, all components at one level have all the components at the another level. In case not, it is called an fragmented pecking order.

In surveying the relative significance of two components, the Reciprocal principle applies, that is, if element A is considered more important than element B as much as n times, then the intensity of interest in element B is equal to 1/n of element A. The arrangement of the intensity of interest can be made in the form of a matrix like the following:

Table 3.5. *Pairwise Comparison Matrix*

C	A1	A2	A3	A4	A5
A1	1				
A2		1			
A3			1		
A4				1	
A5					1

Comparative Judgement

In rule, it makes sense to the relative significance of two components at a given level around the level over. This evaluation is from the Explanatory Progression Handle (AHP) strategy since it'll influence the need of the components, in compiling this significance scale, references are utilized as appeared in Table 3 underneath.

Table 3.6. *Priority Scale in Process Analytical Hierarchy (AHP)*

Numerical Value	Importance Level (Preference)
1	Equal importance compared to others (Equal Importance)
3	Slightly more important than others (Slightly more Important)
5	Quite important compared to the others (Materially more Importance)
7	Very important compared to the others (significantly more)
2,4,6,8	A score between two adjacent assessments
Resiprokal	If element I have one of the above numbers compared to element j, then j has the opposite value when compared to i

Calculation of Process Analytical Hierarchy Method (AHP).

The components in each push of the square network are the comes about of pairwise comparisons, each pairwise comparison framework is looked for its eigenvectors to urge nearby need. The pairwise comparison scale is based on the basic values of the Expository Chain of command Prepare (AHP) with weights from I for similarly vital to 9 for exceptionally imperative. Capacity of consistency is communicated within the consistency list gotten from the equation: Calculating the most extreme EigenValue / most extreme Eigenvalue (λ max), as takes after:

$$\lambda \text{ max} = \frac{\text{Calculate elements in the matrix Y}}{\text{N}}$$

Calculate the value Consistency Index (CI)

$$CI = \frac{\lambda \text{ max} - N}{N-1}$$

Calculate the value Consistency Ratio (CR)

$$CR = CI$$

Explanation:
λ max = (Maximum EigenValue)
N = (Matrix Size)
CR = (Consistency Ratio)
CI = (Consistency Index)
Y = Calculate elements in the matrix)

The Expository Progression Prepare (AHP) strategy for decision-making includes characterizing the issue, making a various leveled structure, shaping a pairwise comparison network, normalizing information, calculating eigenvector values, and testing for consistency. This prepare is rehashed for all levels of the pecking order to prioritize components and accomplish the objective. The chain of command is tried for consistency, and on the off chance that the CR < 0.100, the appraisal must be rehashed.

3.3. Criteria Comparison Level

There are 2 categories in MSME Class Up, where these 2 categories are important indicators in knowing the increase in MSME grade up, the criteria aspects are taken based on the PLUT Technical Guidelines, References, and ongoing work experience carried out by PLUT KUMKM Prov. consultants. Banten.

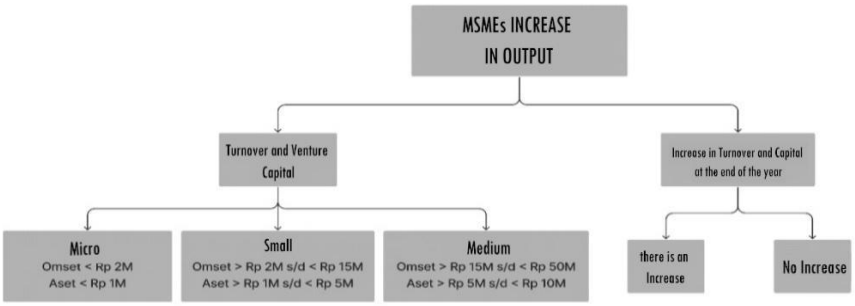

Figure 3.4. *Criteria for MSME Upgrading in Output*

In the picture above, it explains the 2 levels of MSME upgrades in output in the first level, namely the criteria for turnover and business capital and an increase in turnover and capital at the end of the year, whereas, at the second level, 5 criteria describe matters related to turnover and business capital criteria.

3.5. System Design Method

To encourage the advancement prepare, the creators embraced the Framework Improvement Life Cycle (SDLC) strategy, which may be a precise approach to making and altering data frameworks. SDLC includes different models and techniques for creating vigorous and productive frameworks. In this think about, the web-based framework plan was made utilizing the SDLC strategy, which comprises of seven particular phases/steps that the analysts ought to attempt. These stages incorporate Prerequisites, Plan, Advancement, Testing, Sending, and Support.

Within the realm of software development, there are four commonly used SDLC methods: Waterfall, Prototype, Agile, and Fountain. For this particular study, the prototype method was employed. The prototype method allows users to gain an initial understanding of the software being developed, enabling them to conduct preliminary testing before the final

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release. This approach facilitates user engagement and feedback, ensuring that the software meets the intended requirements and objectives. By utilizing the prototype method, the researchers can iteratively refine and improve the software based on user input, ultimately enhancing the final product's usability and effectiveness.

4. Result and Discussion

Based on the findings of this research, it is evident that the monitoring and evaluation of the MSMEs' progress by PLUT KUMKM in Banten Province are encountering significant challenges. One of the major issues identified is the lack of suitable tools or indicators to support these activities. Specifically, there is a notable absence of a system that effectively monitors and evaluates the outcomes of the data processing assistance provided through the CIS SMART application. This limitation hampers the ability to accurately assess the effectiveness and impact of the support offered to MSMEs. To address this issue, the research team developed the SMART CIS platform using a decision support system that incorporates the Analytical Hierarchical Process (AHP) methodology. This platform aims to provide a comprehensive solution by facilitating efficient monitoring and evaluation of the MSMEs' progress, enabling decision-makers to make data-driven decisions based on accurate assessments.

The developed platform consists of various components to streamline the monitoring and evaluation process. The Dashboard, built on top of the MySQL Database, serves as the main interface for users, providing essential information about the CIS SMART application and offering guidance on its utilization. Additionally, the system includes a registration page and an input page to collect user information and business data. The input page ensures a user-friendly and convenient format for users to provide their personal and business details. Subsequently, the system generates a Business Data Page, presenting the collected data for users to review. Users are then directed to the Input Questionnaire page, where they are prompted to answer specific questions related to their current business data. This questionnaire acts as crucial input for data processing, facilitating the generation of accurate results. The Preliminary Report Page displays the processed questionnaire data, serving as a report generated using the AHP method to assess the potential growth of MSMEs. It's important to note that the information presented on this page constitutes the first insight before making a full comparison of your business data. Overall, the SMART CIS Platform offers an integrated approach to enhance the monitoring and evaluation of MSMEs, providing valuable insights for decision-making and improving the overall support provided to these enterprises in Banten Province.

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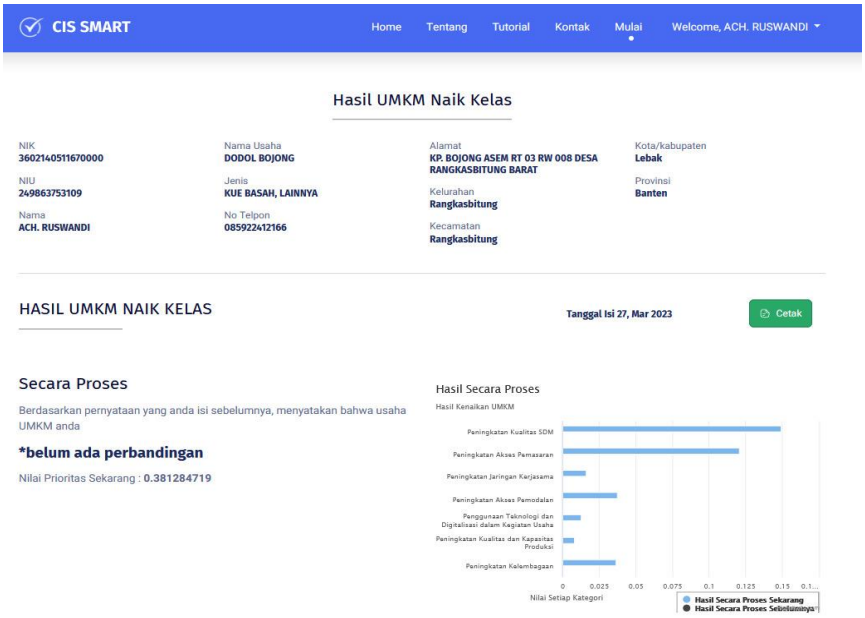
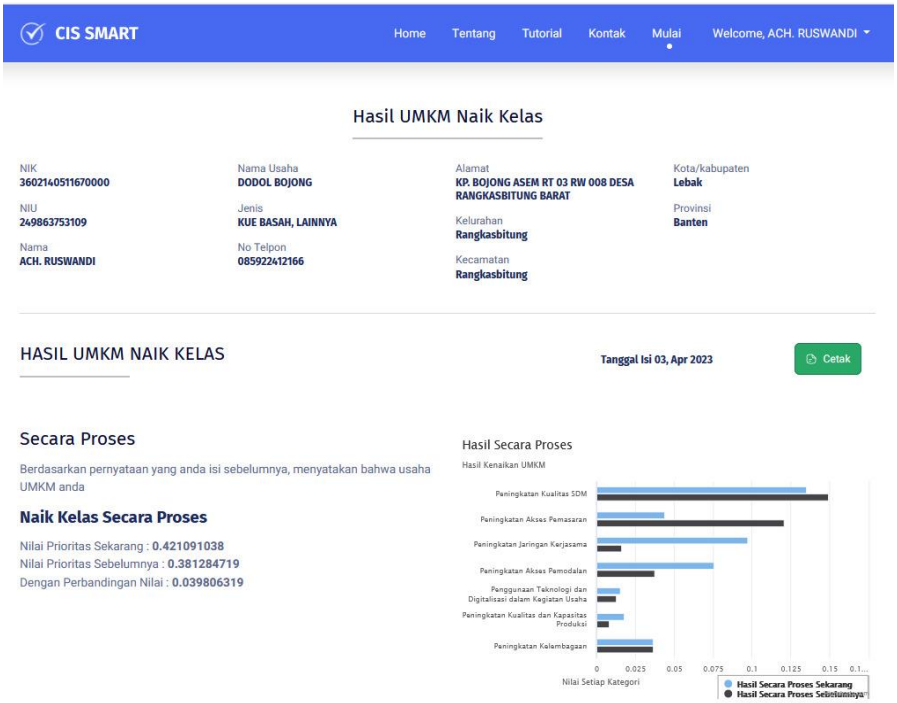
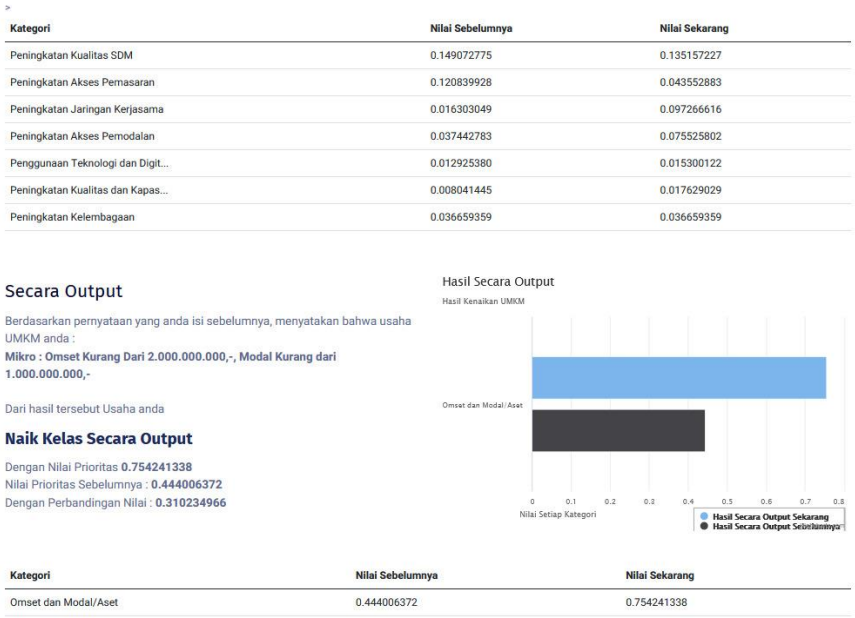


Figure 4.7 *Preliminary Report Page Before Comparison*

Last Report Page Results After Comparison The information on this page is obtained from a comparison of business data before and after. The dashboard displays complete information about business data, processing results, and output before and after, and displays graphs to provide information on whether MSMEs have increased or even decreased.





Kategori	Nilai Sebelumnya	Nilai Sekarang
Peningkatan Kualitas SDM	0.149072775	0.135157227
Peningkatan Akses Pemasaran	0.120839928	0.043552883
Peningkatan Jaringan Kerjasama	0.016303049	0.097266616
Peningkatan Akses Pemodalan	0.037442783	0.075525802
Penggunaan Teknologi dan Digit...	0.012925380	0.015300122
Peningkatan Kualitas dan Kapas...	0.008041445	0.017629029
Peningkatan Kelembagaan	0.036659359	0.036659359

Kategori	Nilai Sebelumnya	Nilai Sekarang
Omset dan Modal/Aset	0.444006372	0.754241338

Figure 4.8 *Report Results Page After Comparison*

Based on the results presented in Figure 4.8, analysis and testing performed on the MSME taxonomy maintenance model using the CIS SMART application resulted in a priority score of 0.44 and an output score of 0.75. These results show that this model greatly supports the decision-making process of MSMEs, especially in improving value creation in their business activities. Consequently, this support facilitates the advancement of MSMEs to higher classification levels and enables them to achieve their desired outcomes. The decision support system, which incorporates the MSME Classification Maintenance Model, is conveniently accessible through the user-friendly CIS SMART application.

5. Conclusion

The Government recognizes the importance of increasing the competitiveness of MSMEs by enhancing the capabilities of MSMEs and becoming more skilled and competitive enterprises. Every MSME has the opportunity to Upgrade Classes. However, this implementation experienced problems in obtaining data on the results of appropriate, fast, and accurate assistance related to the results of the MSME upgrading criteria at the UKMCO Integrated Service Center (PLUT) Banten Province. The decision support system concept can be used as a tool to determine improvement classes for MSMEs. One of the methods of consistency score calculation that is relevant in determining the priority level of criteria is the Analysis Hierarchy process method. The MSME Upgrade Designation Model can be an effective and efficient tool in facilitating the process of monitoring and evaluating the results of MSME assistance before and after assistance. The model was developed using the Unified Modeling Language (UML) system design and tested using the AHP method which is processed into an application that is accurate and easy to use by users.

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