



## A Health Level and Risk Rating Monitoring System of Village Credit Institutions



I Gede Made Karma <sup>a</sup>  
I Made Dwi Jendra Sulastra <sup>b</sup>  
Ni Wayan Kurnia Dewi <sup>c</sup>

### Article history:

Submitted: 09 July 2022

Revised: 18 August 2022

Accepted: 27 September 2022

### Keywords:

health level;  
management;  
monitoring;  
risk rating;  
village credit institution;

### Abstract

As a financial institution that is very vulnerable to negative issues, Bali Governor Regulation No 44/2017, which regulates the management of an LPD (Village Credit Institution) directs that LPDs be managed carefully. Performance indicators that must be considered are the level of health and risk rating of the LPD, which are determined by some factors/components related to the financial condition and procedures for managing the LPD. The procedure for determining it is clear, but requires careful calculations and seems difficult for those who do not understand it. Knowledge of the level of health and risk rating will make it easier to find alternative solutions when the LPD has problems. Building a health level and risk rating monitoring system is a solution. The system is built using the Waterfall method with an object-oriented system approach. This system will greatly assist the manager and the supervisory team to maintain good LPD performance, and can quickly anticipate situations that cause the LPD's performance to decline, which is shown from the factors/components of the health level monitoring results and risk ratings in this system.

*International research journal of management, IT and social sciences* © 2022.

*This is an open access article under the CC BY-NC-ND license*

*(<https://creativecommons.org/licenses/by-nc-nd/4.0/>).*

### Corresponding author:

I Gede Made Karma,  
Accounting Department  
Politeknik Negeri Bali, Badung, Indonesia.  
Email address: [igmkarma@pnb.ac.id](mailto:igmkarma@pnb.ac.id)

<sup>a</sup> Politeknik Negeri Bali, Badung, Indonesia

<sup>b</sup> Politeknik Negeri Bali, Badung, Indonesia

<sup>c</sup> Politeknik Negeri Bali, Badung, Indonesia

## 1 Introduction

Balinese people are people who depend on the world of tourism. The prolonged COVID-19 pandemic that has not shown any signs of ending will have a profound impact on people's lives in general. The economic capacity and purchasing power of the people have decreased drastically, which has an impact on the decline or loss of their ability to fulfil their obligations, especially in paying credit, so that they have the potential to become bad loans (Wijaya et al., 2020). People began to withdraw their savings or deposits. This situation is of course also worrying because it can disrupt the economy of a country. In this case, the government has an important role in maintaining the health of a financial institution (Stella & Puspitasari, 2020).

Every traditional village in Bali generally has a business entity in the form of a financial institution called the Village Credit Institution (LPD), with the operating area limited to the area of the traditional village concerned (Seibel, 2013). The main activity of the LPD is to collect funds from indigenous village communities through various types of savings products and channel them back to the community through credit disbursement. The management of this LPD is regulated based on Bali Governor Regulation No 44/2017 and the customary rules that apply in the traditional village. Traditional village heads are directly involved in determining LPD operational policies, by including social norms and customary sanctions (Arsyad, 2006; Kosasih & Hendrawan, 2016). The traditional village, as the owner of this financial institution, is entitled to a portion of the profits obtained by the LPD, which is then used as village development funds (Misra, 2008). In terms of regulation, financial indicators and coverage, LPD shows very good and promising things (Arsyad, 2005).

Behind the good and promising performance, it turns out that this LPD is very vulnerable to negative news that befalls financial institutions. The decline in the economic capacity of the community was also felt by financial institutions, such as banks, cooperatives, LPDs and others, especially institutions that provide credit services to their customers or customers (Astuti & Simarmata, 2020). Recently, there have been reports that some financial institutions, including LPDs, are experiencing liquidity difficulties, due to the huge public interest in withdrawing their savings, while on the other hand, many people are unable to pay their debts to repay their loans. Mistakes in addressing this situation can of course have an impact on the survival of the LPD itself. The news of the collapse of an LPD in another village caused unrest in some other village communities. There is fear and worry that the LPDs in their village will suffer the same fate. This of course greatly affects the level of public confidence in the LPD itself (Bize et al., 2007; Cohen et al., 2000).

Another factor that is no less important for LPD managers/supervisors to maintain public trust in their LPDs is the extent to which the LPD's ability to benefit. Getting a profit, especially with a sizeable value at a difficult time like today, is an extraordinary achievement. The community will increasingly trust the financial institutions belonging to their village and will prevent unwanted things from happening. Unfortunately, many parties focus too much on the magnitude of the benefits to assess the success of an LPD and ignore other factors that can be used as indicators of performance assessment, namely the level of health and risk rating of an LPD.

The soundness of a financial institution indicates the institution's ability to carry out its activities formally, fulfil all its responsibilities and comply with banking regulations (Christian et al., 2017; Gunawan & Arvianda, 2019). This level of soundness also reflects the financial position of the institution (Rauf, 2016; Lisa & Hermanto, 2021). Therefore, a periodic analysis must be carried out to anticipate possible vulnerabilities (Sahota & Dhiman, 2017). Various methods such as the CAMEL method, RGEC, fuzzy zero-order Takagi-Sugeno-Kang (TSK) and Risk Based Bank Rating can be applied to measure the level of health, taking into account different factors and conditions. The factors used include the determinants of profit growth rates, corporate governance, income, capital, management, the level of total assets, loans and trading assets of these financial institutions (Abadi, 2016; Akhyar et al., 2018; Candara & Jayanto, 2017; Morgan, 2002).

Knowing the soundness of financial institutions is in the interest of many parties, especially Bank Indonesia as the supervisory authority (Devianto & Dwiasnati, 2018). A good level of soundness in financial institutions will certainly increase public confidence, which in turn will support overall economic growth (Esomar et al., 2020; Octafilia & Wijaya, 2020). In the recent crisis, the implementation of good governance is important to prevent failure and fraudulent practices (Zainuddin & Djaelani, 2018). Institutionally, the determination of the LPD's health level has been determined using the CAMEL method. The CAMEL approach can be used to evaluate the performance and financial health of banks (Bansal & Mohanty, 2013; Majumder et al., 2017; Varghese, 2016), the level of bank profitability (Bustamam, 2017), examine the impact of the independent variables of the CAMEL model which include capital adequacy, asset quality, management, income, and liquidity on bank performance (Liu & Pariyaprasert, 2014; Tripathi

et al., 2014), to investigate the financial performance of public and private sector banks (Khan, 2018), to compare the performance of a bank before and after the implementation of a policy (Anwar, 2016), to find the relative weights that are important in all factors in CAMEL and to inform the best ratio to always be adopted by bank regulators in evaluating bank efficiency (Dzeawuni, 2008), identifying the determinants of performance exposed by bank financial ratios (Suvita & Xiaofeng, 2012), assessing the level of satisfaction and customer perceptions of bank services (Desta, 2016) and the level of efficiency of a bank's management (Hosen & Muhari, 2013). In addition to health issues, the risk level factor is an important thing to know in the economic crisis due to the recent COVID-19 pandemic (Susanti et al., 2021). For LPD officers, it is important to carry out supervision, caution and anticipation in the operational management of the LPD. To assist LPD in monitoring the level of health and risk rating, this monitoring system was developed (Guerrero et al., 2013; Broadbent & Laughlin, 2009).

## 2 Materials and Methods

Management procedures, policies and performance measurements of an LPD are regulated in full and in detail in Bali Governor Regulation No. 44/2017. This regulation is then used as a reference in setting policies for the management of an LPD.

### 2.1 Determination of LPD Health Level

LPD health level is assessed by a qualitative approach on 5 (five) factors that influence the condition and development of LPD as a financial institution, namely: capital, productive asset quality, management, earnings or profitability and liquidity. These factors have several components that are given a weighting determinant of LPD health as presented in Table 1.

Table 1  
Factors, components and weights that determine LPD health level

Factors	Components		Weights
Capital	Capital Adequacy Ratio (CAR)	Percentage comparison between LPD Capital and risk-weighted assets (RWA)	25%
Productive Assets	Earning Asset Quality (EAQ)	Percentage comparison between earning assets classified as total earning assets.	25%
	Doubtful Loan Reserve (DLR)	Percentage of comparison between the DLR formed and the DLR that must be established.	10%
Management	Consists of 25 management questions and each question are rated between 0 to 4.		10%
Earning / Profitability	ROA	Percentage comparison between profit to total assets	10%
	The ratio of Operating Expenses and Operating Income	Percentage comparison between cost to revenue	10%
Liquidity	Liquid assets ratio	Percentage comparison between liquid assets and current liabilities	5%
	LFR	Percentage comparison between loans given to funds received	5%
Total			100%

#### a. Valuation of Capital

Intended to assess LPD capital adequacy, namely the percentage comparison between LPD capital and risk-weighted assets (RWA), or presented in the form of a formula:

$$\text{Capital Adequacy Ratio (CAR)} = \frac{\text{LPD Capital}}{\text{Risk Weighted Assets (RWA)}} \times 100\%$$

b. Appraisal of Earning Assets

It consists of 2 (two) components assessed, namely the Earning Assets Quality (EAQ) ratio and the Doubtful Loans Reserve (DLR) ratio.

(1) Earning Asset Quality (EAQ) Ratio; Intended to assess the quality of earning assets, namely the percentage comparison between earning assets classified to total earning assets or presented in the following formula:

$$\text{EAQ Ratio} = \frac{\text{Earning assets classified}}{\text{Productive asset}} \times 100\%$$

(2) Loan Reserve Doubtful (LRD) Ratio; It is intended to assess the adequacy of the provision of LRD, namely the percentage comparison between the LRD established and the LRD that must be established, or presented in the following formula:

$$\text{LRD Ratio} = \frac{\text{LRD established}}{\text{LRD that must be established}} \times 100\%$$

c. Management Assessment

LPD management assessment is based on questions or statements related to general management and risk management. The general management assessment focuses on components such as: (a) strategy/target; (b) organizational structure; (c) systems and (d) leadership. Risk management assessment is focused on components such as; (a) liquidity risk; (b) credit risk; (c) operational risk; (d) legal risk and (e) owner risk. The assessment is carried out by filling in each question/statement with a value between 0 to 4 with the following criteria: (0) = not at all/does not want to be fulfilled; (1) not yet but there are plans to fulfil; (2) already fulfilled, mostly lacking; (3) has been fulfilled, but some are lacking; (4) has been fulfilled, complete.

d. Assessment of Earnings / Profitability

Consists of 2 (two) components, namely the ratio of return on assets (ROA) and the ratio of cost-effectiveness to income (ratio of operating expenses and operating income).

(1) Return on Asset (ROA); Intended to assess the ability of LPD to generate profits against the average assets owned or presented in the formula:

$$\text{ROA} = \frac{\text{Current year profit}}{\text{Average Asset}} \times 100\%$$

(2) The ratio of Operating Expenses and Operating Income (OEOI); is intended to assess LPD spending savings, namely the percentage comparison between operational costs and LPD operating income or presented in the formula:

$$\text{OEOI Ratio} = \frac{\text{Operating costs}}{\text{Operating Income}} \times 100\%$$

e. Assessment of Liquidity

Consists of 2 (two) components, namely the ratio of liquid assets and the ratio of loans to funds received (LFR).

(1) Liquid assets ratio; intended to assess the ability of LPD to meet current liabilities, namely the percentage ratio between liquid assets and current liabilities or with the following formula:

$$\text{Liquid assets ratio} = \frac{\text{Cash} + \text{Interbank Assets}}{\text{Current Liabilities}} \times 100\%$$

(2) LFR; is intended to assess the ratio of loans granted to funds received, calculated by the formula:

$$\text{LFR} = \frac{\text{Loans granted}}{\text{Funds received}} \times 100\%$$

The health value is used as a determinant of LPD health criteria. LPD health criteria are set with values as shown in Table 2.

Table 2  
LPD health criteria

Total health score	Criteria
81 – 100	Healthy
66 – <81	Healthy enough
51 – <66	Unhealthy
0 – <51	Not healthy

## 2.2 LPD Risk Rating Assessment

The risk rating assessment is carried out by determining the amount of the penalty value for the risk factor set from 100 to 500. The assessment of factors and components is carried out with a weighted value set from 0 to 100. The results of the assessment based on the weight and value of the penalty can be added if there are violations whose sanctions are associated with the provisions of the LPD risk warning. The qualification results of the components are further assessed by taking into account information and other aspects that materially affect the condition and development of each factor. Based on the assessment, five LPD risk ratings are set as shown in Table 3.

Table 3  
LPD Risk Rating, Predicate and Penalties

Risk Rating	Predicate	Penalties
1	Very low	100
2	Low	200
3	Moderate	300
4	High	400
5	Very high	500

The LPD penalty value is based on the average penalty value, which is obtained from the sum of the total values divided by the number of calculated risk factors, as presented in Table 4.

### a. Credit Risk Factor

Determination of credit risk factors is based on the Earning Asset Quality (EAQ) component based on 2 ratios, namely:

(1) Earning asset quality ratio is a comparison between earning assets classified as earning assets.

$$\text{EAQ Ratio} = \frac{\text{Earning assets classified}}{\text{Productive asset}} \times 100\%$$

(2) The ratio of allowance for possible losses on earning assets is the ratio between the allowance for doubtful accounts established by the LPD to the reserve for doubtful accounts that must be established by the LPD.

$$\text{LRD Ratio} = \frac{\text{LRD established}}{\text{LRD that must be established}} \times 100\%$$

b. Liquidity Risk Factors

Determination of liquidity risk factors is based on 2 (two) ratios, namely:

- (1) The ratio of Basic Surplus to liabilities can be paid immediately; the Basic surplus is the difference between liquid assets that can be used and liabilities that can be paid immediately in the next week. If the liquid assets are greater than the liabilities that can be paid immediately, it will be an excess difference (positive) and a less difference (negative).
- (2) Liquidity Index Ratio; Liquidity index is a number that shows the ratio between the number of multiplication of liabilities with their respective weights to the amount of multiplication of assets with their respective weights.

Table 4  
Risk factors, components, weights and penalties

Risk Factors	Components	Weights	Penalties				
			1	2	3	4	5
1. Credit		40%	100	200	300	400	500
	a. Ratio of classified assets to earning assets	20%	50	100	150	200	250
	b. The ratio of allowance for possible losses on earning assets to earning assets that must be established.	20%	50	100	150	200	250
2. Liquidity		24%	60	120	180	240	300
	a. Basic Surplus	12%	30	60	90	120	150
	b. Liquidity Index	12%	30	60	90	120	150
3. Operational		6%	15	30	45	60	75
	a. Effectiveness	1%	2.5	5	7.5	10	12.5
	b. Efficiency	1%	2.5	5	7.5	10	12.5
	c. Economical	1%	2.5	5	7.5	10	12.5
	d. Fluent	1%	2.5	5	7.5	10	12.5
	e. Safe	1%	2.5	5	7.5	10	12.5
	f. Orderly	1%	2.5	5	7.5	10	12.5
4. Capital	The capital-to-asset ratio is risk weighted.	30%	75	150	225	300	375
	Total	100%	250	500	750	1,000	1,250
	Average Penalty Risk		62.5	125	187.5	250	312.5

c. Operational Risk Factors

Determined based on 6 (six) LPD operational performance ratios:

- (1) Effectiveness ratio, based on the LPD's credit score achievement.
- (2) The efficiency ratio is based on the ratio between operating costs and operating income at the end of the reporting month.
- (3) The economical ratio is calculated based on the ratio between total assets to the number of human resources. This ratio is compared at the end of each month/period and from this comparison, the progress is calculated with the average for the last quarter/period.
- (4) The fluent ratio is measured from the average length of loan disbursement after documents are received in full.

- (5) The safe ratio is measured by the number of events that harm the LPD due to manipulation, corruption, collusion, nepotism and calamities in the last year. (Taken from last year's data).
- (6) Orderly ratio, measured by the number of violations of the applicable provisions within a year. (from the results of the last inspection).

d. Capital Risk Factor

The capital risk factor is the risk due to insufficient capital as the main source of financing for LPD operational activities so it is not sufficient to cover all business risks faced. A capital risk factor is assessed from the ratio of minimum capital adequacy (RMCA) which is the ratio between capital to risk-weighted productive assets (RWA) expressed in percent. Calculated by the formula :

$$\text{RMCA} = \frac{\text{Capital}}{\text{Earning assets are risk - weighted}} \times 100\%$$

### 2.3 Methodology

The development of this system is carried out with a structured approach with the Waterfall development method (Pressman, 2005), which is a system development method that divides work activities into a gradual and continuous process with each other. The approach used is an object-oriented system approach with modelling using UML (Unified Modeling Language) (Larman, 2005; Booch et al., 2004), with the MS programming language. Visual Basic.Net version 2012 and MySQL as the database.

## 3 Results and Discussions

Referring to the analysis of system requirements and the provisions and rules for determining the health level and risk rating of an LPD as regulated in Bali Governor Regulation No. 44 of 2017, the system requirements can be presented in a use case diagram, as shown in Figure 1. The system will be operated by users, who are divided into 2 (two) groups, namely ordinary users and appraisers. Ordinary users only serve as input data needed by the system, namely related to financial data and management data (Burke et al., 2011; Legg & Nagy, 2006). The users of the assessment are the managers and supervisors of the LPD, in addition to inputting data, they can also conduct an assessment of the health level and risk rating of the LPD.

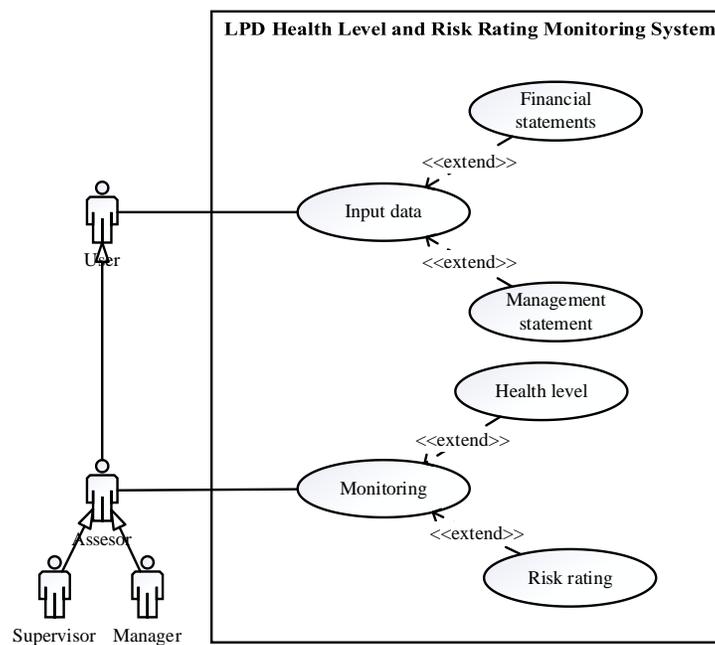


Figure 1. Use a case diagram of the system

Referring to the needs of this system, then a system design is developed which is outlined in a Design Class Diagram (DCD) and Sequence Diagram (SD), as shown in Figures 2 and 3. The DCD describes the components that will form the system to be built. This component consists of 9 (nine) classes that interact with each other. Each class has an identity and can have data and procedures related to the needs of data processing and the processes that can be carried out. The sequence of interactions between these components is presented in SD.

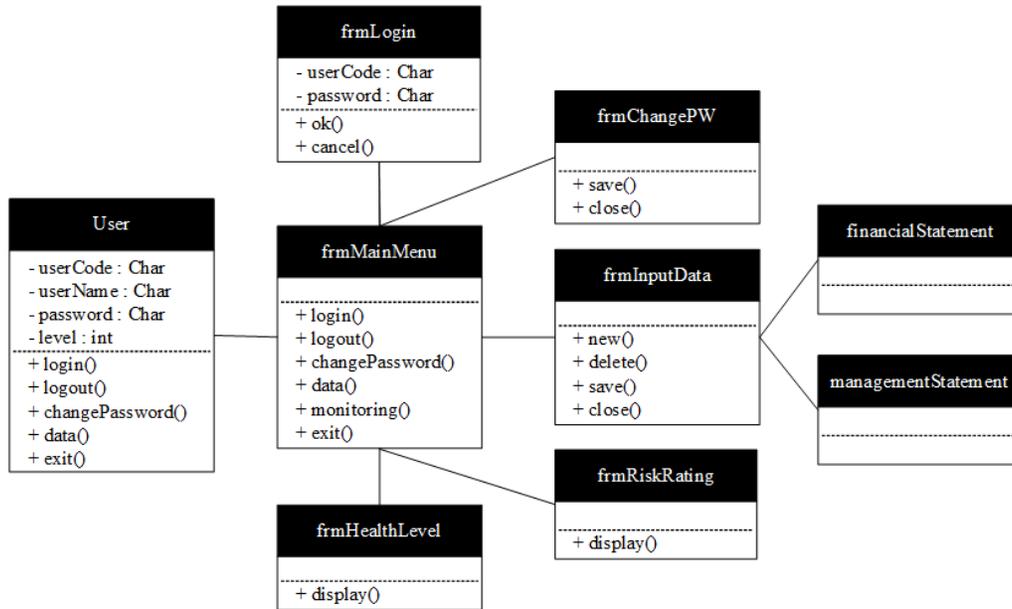


Figure 2. Design class diagram of the system

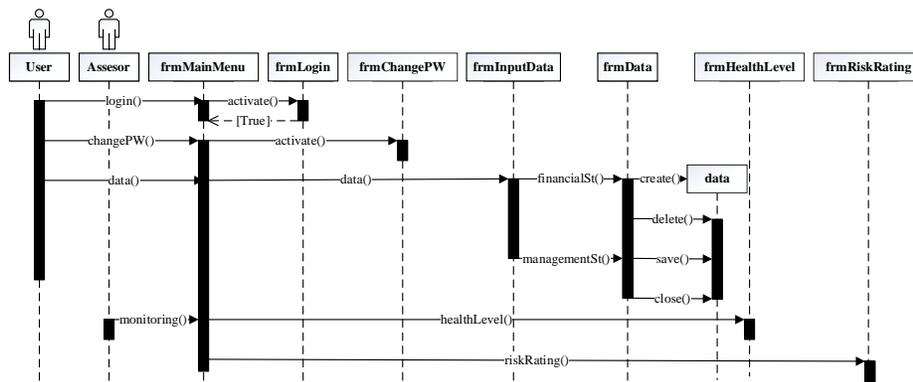


Figure 3. Sequence diagram of the system

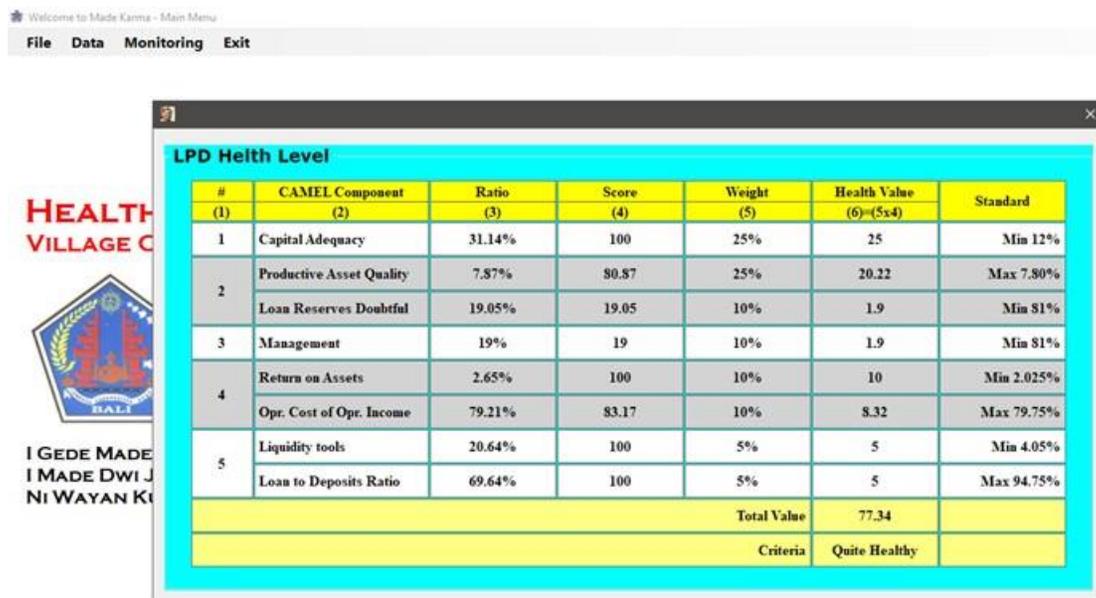
The system to be built has an interface represented by the frmMainMenu class. This interface will serve as the main menu of the system when the system is operated. Those who have the right to operate this system are users who are described as the User class. When a user wants to operate the system, he must first login via the Main Menu, which is done by selecting the Login menu and will be handled by the form login class (Mahatama & Wardana, 2021). By filling in the username and password, and when successful, the system will display a menu of options according to the category of the user. In addition to the Monitoring menu which is specifically intended for assessor users, all menus will be available for selection (Treacy & Carey, 2000; Boneet al., 2013).

Each user can register a new user according to the category/level they have or those below. If necessary, to maintain his security, a user can also make changes to the previously registered password. This can be done via the Change Password menu, which is handled by the frmChangePW class.

All users can input and change data owned by the system. This can be done through the Data menu, and the user will be given the option to handle the type of data held by the system. This will be handled by the frmInputData class, and users will be able to manage financial data in the form of Balance Sheets and Profit and Loss, as well as management-related data. This overall availability of data will be used to monitor the health level and risk rating of the LPD.

The user of the assessment consisting of the Manager and the LPD Supervisory Team can monitor the health level and risk rating of the LPD through the Monitoring menu. The system will display the choice of whether to check the health level or LPD risk rating. Each of these options will be handled by the frmHealthLevel and frmRiskRating classes.

The determination of the health level of the LPD is based on several calculations, following the components and provisions that have been regulated in Governor Regulation No. 44 of 2017, as previously explained. To obtain a more detailed picture, each calculation result for each component is displayed, and then compared with the standards that apply to each component. Furthermore, the overall score is accumulated according to the specified weight and then compared with the applicable provisions, to obtain the LPD health level criteria following the existing data. An example of the display of LPD health level determination results can be seen in Figure 4.



# (1)	CAMEL Component (2)	Ratio (3)	Score (4)	Weight (5)	Health Value (6)-(5x4)	Standard
1	Capital Adequacy	31.14%	100	25%	25	Min 12%
2	Productive Asset Quality	7.87%	80.87	25%	20.22	Max 7.80%
	Loan Reserves Doubtful	19.05%	19.05	10%	1.9	Min 81%
3	Management	19%	19	10%	1.9	Min 81%
4	Return on Assets	2.65%	100	10%	10	Min 2.025%
	Opr. Cost of Opr. Income	79.21%	83.17	10%	8.32	Max 79.75%
5	Liquidity tools	20.64%	100	5%	5	Min 4.05%
	Loan to Deposits Ratio	69.64%	100	5%	5	Max 94.75%
Total Value					77.34	
Criteria					Quite Healthy	

Figure 4. LPD health level output display

Like the LPD's health level, the risk rating is also determined by several factors/components regulated in the Governor's Regulation No. 44 of 2017. There are 4 (four) risk components, some of which are determined by several ratios, which have different weights. Each ratio has its standards and risk criteria, which will affect the amount of penalty given. The total amount of this penalty will determine the LPD risk rating in general (Perez at al., 2011; Giné, 2011). To obtain more complete details about the risk rating, each risk component is also shown. This will help the manager/supervisor to make improvements if the results of the risk rating are not as desired. An example of the results of LPD risk ranking based on available data can be seen in Figure 5.

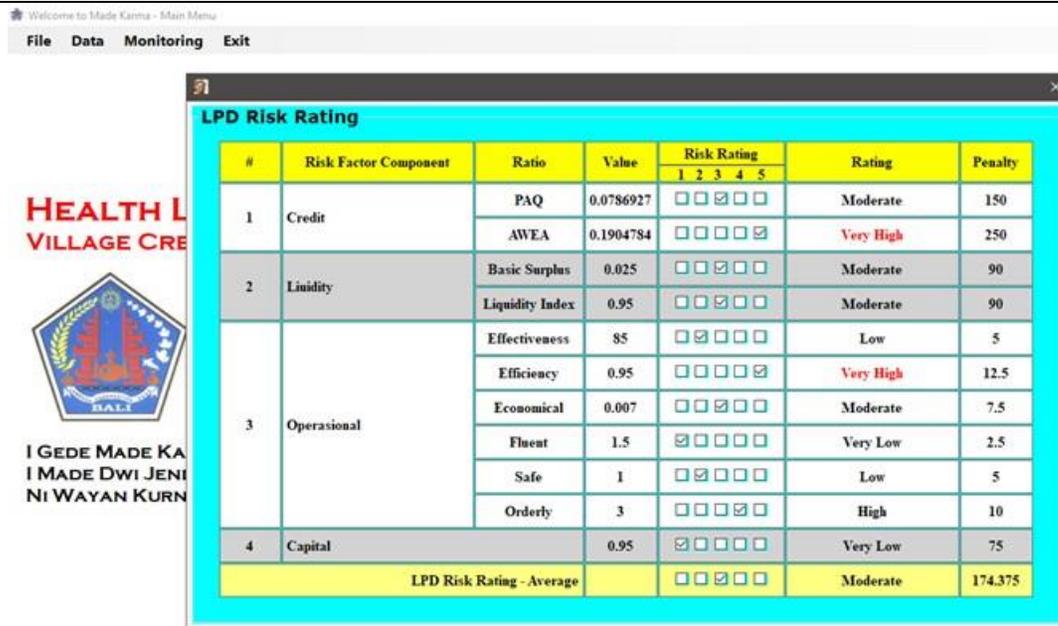


Figure 5. LPD risk rating output display

#### 4 Conclusion

As a component of determining the performance of an LPD, the level of health and risk rating should be maintained. This LPD health level monitoring system and risk rating system will be able to provide information related to the LPD health level and risk rating in general and in good detail, according to the components that determine it. This will be useful in selecting and determining anticipatory steps if something unexpected happens. The existence of this system can of course increase the vigilance of LPD managers and supervisors in maintaining the level of prudence in carrying out LPD operations.

#### Conflict of interest statement

The authors declared that they have no competing interests.

#### Statement of authorship

The authors have a responsibility for the conception and design of the study. The authors have approved the final article.

#### Acknowledgements

The authors would like to express our gratitude to the Director of the Politeknik Negeri Bali and the Head of the Research and Community Service Unit of Politeknik Negeri Bali who has provided grants to finance this research. To Mr, I Made Ariana, SE., M.Si, Ak and Mr I Ketut Suwintana, S.Kom, MT., who have provided many directions, inputs and guidance in developing the monitoring system produced in this research. Thank you and the highest appreciation.

## References

- Abadi, A. (2016). A new method to analyze bank performance level in Indonesia using fuzzy model. In *Int. Math. Forum*.
- Akhyar, C., Marzuki, M., Azhar, A., & Syamni, G. (2018). Profit growth in Indonesian sharia bank: The impact of RGEC. *International Journal of Engineering & Technology*, 7(3.30), 587-591.
- Anwar, A. N. (2016). Analysis of Indonesian Islamic and conventional banking before and after 2008. *International Journal of Economics and Finance*, 8(11), 193-199.
- Arsyad, L. (2005). An assessment of microfinance institution performance. *Gadjah Mada International Journal of Business*, 7(3), 391-427.
- Arsyad, L. (2006). Assessing Factors Affecting The Repayment Rate Of Microfinance Institutions. *Gadjah Mada International Journal of Business*, 8(2).
- Astuti, T., & Simarmata, M. M. (2020). Participation and community motivation to protect the Forest Park Tahura of Bukit Barisan. *International Research Journal of Management, IT and Social Sciences*, 7(5), 78-88. <https://doi.org/10.21744/irjm.v7n5.973>
- Bansal, R., & Mohanty, A. (2013). A Study on financial performance of commercial banks in India: Application of Camel model. *Al-Barkaat Journal of Finance & Management*, 5(2), 60-79.
- Bize, R., Johnson, J. A., & Plotnikoff, R. C. (2007). Physical activity level and health-related quality of life in the general adult population: a systematic review. *Preventive medicine*, 45(6), 401-415. <https://doi.org/10.1016/j.ypmed.2007.07.017>
- Bone, C., Wulder, M. A., White, J. C., Robertson, C., & Nelson, T. A. (2013). A GIS-based risk rating of forest insect outbreaks using aerial overview surveys and the local Moran's I statistic. *Applied Geography*, 40, 161-170. <https://doi.org/10.1016/j.apgeog.2013.02.011>
- Booch, G., Jacobson, I., & Rumbaugh, J. (2004). The unified modeling language reference manual Second Edition.
- Broadbent, J., & Laughlin, R. (2009). Performance management systems: A conceptual model. *Management Accounting Research*, 20(4), 283-295. <https://doi.org/10.1016/j.mar.2009.07.004>
- Burke, L. E., Wang, J., & Sevick, M. A. (2011). Self-monitoring in weight loss: a systematic review of the literature. *Journal of the American Dietetic Association*, 111(1), 92-102. <https://doi.org/10.1016/j.jada.2010.10.008>
- Bustaman, U. S. A. (2017). CAMEL ratio on profitability banking performance (Malaysia versus Indonesia). *International Journal of Management, Innovation & Entrepreneurial Research*.
- Candra, V. E., & Jayanto, P. Y. (2017). The Effect of RGEC Method, Management, and Cooperation Identity on The Health Level of BMT. *Accounting Analysis Journal*, 6(3), 478-491.
- Christian, F. J., Tommy, P., & Tulung, J. (2017). Analisa kesehatan bank dengan menggunakan metode RGEC pada Bank BRI dan Mandiri periode 2012-2015. *Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi*, 5(2).
- Cohen, D. A., Scribner, R. A., & Farley, T. A. (2000). A structural model of health behavior: a pragmatic approach to explain and influence health behaviors at the population level. *Preventive medicine*, 30(2), 146-154. <https://doi.org/10.1006/pmed.1999.0609>
- Devianto, Y., & Dwiasnati, S. (2018). Banking Health Assessment Using CAMELS And RGEC Methods, Using OJK's Banking Financial Statement Data. *International Journal Of Engineering And Computer Science*, 7(8), 24187-24196.
- Dzeawuni, W. A. (2008). CAMELS and banks performance evaluation: The way forward. *Professor Muhammad, CAMELS and Banks Performance Evaluation: The Way Forward (June 24, 2008)*.
- Esomar, M. J. F., Loppies, L., & Turukay, E. (2020). The analysis of the influence of risk profile, good corporate governance, earning and capital (RGEC) towards the company value in the sub-sector of foreign exchange private national commercial bank which is listed on the Indonesia stock exchange (IDX). *Int. J. Adv. Sci. Technol.*
- Giné, X. (2011). Access to capital in rural Thailand: An estimated model of formal vs. informal credit. *Journal of Development Economics*, 96(1), 16-29. <https://doi.org/10.1016/j.jdeveco.2010.07.001>
- Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste management*, 33(1), 220-232. <https://doi.org/10.1016/j.wasman.2012.09.008>
- Gunawan, B., & Arvianda, K. M. (2019). Bank Health Level Analysis Using CAMELS and RGEC Methods on PT Bank Panin Dubai Syariah Ltd. In *5th International Conference on Accounting and Finance (ICAF 2019)* (pp. 20-26). Atlantis Press.
- Hosen, M. N., & Muhari, S. (2013). Efficiency of the sharia rural bank in Indonesia lead to modified camel. *International Journal of Academic Research in Economics and Management Sciences*, 2(5), 34.

- Khan, A. (2018). Financial performance analysis of public and private sector banks through camel model. *Asian Journal of Applied Science and Technology*, 2(2), 954-964.
- Kosasih, J. I., & Hendrawan, D. (2016). Existence of entities 'village credit institutions/lembaga perkreditasi desa (lpd)' local community in Bali viewed from financial control system in Indonesia learning from Bali local genius in increasing the local economy. *Int. J. Appl. Bus. Econ. Res.*
- Larman, C. (2005). *Applying UML and patterns: an introduction to object-oriented analysis and design and iterative development*. Pearson Education India.
- Legg, C. J., & Nagy, L. (2006). Why most conservation monitoring is, but need not be, a waste of time. *Journal of environmental management*, 78(2), 194-199. <https://doi.org/10.1016/j.jenvman.2005.04.016>
- Lisa, O., & Hermanto, B. (2021). Analysis of Risk Profile, Good Corporate Governance, Earnings, and Capital (Rgec) in Syariah Commercial Banks and Conventional Commercial Banks. *e-Repository Dosen Universitas Gajayana Malang*.
- Liu, J., & Pariyaprasert, W. (2014). Determinants of Bank performance: The application of the CAMEL model to banks listed in China's Stock Exchanges from 2008 to 2011. *AU-GSB e-journal*, 7(2).
- Mahatama, A. A. B. P., & Wardana, M. (2021). The role of brand image and customer commitment in mediating service quality towards customer loyalty. *International Research Journal of Management, IT and Social Sciences*, 9(1), 79-89. <https://doi.org/10.21744/irjmis.v9n1.2006>
- Majumder, M., Hossain, T., & Rahman, M. M. (2017). A camel model analysis of selected banks in Bangladesh. *Mohammed Mizanur, A CAMEL Model Analysis of Selected Banks in Bangladesh (November 9, 2017)*.
- Misra, R. (2008). Muntigunung Lembaga Perkreditasi Desa, Indonesia: Village Ownership as a Model for Remote Outreach of Financial Services.
- Morgan, D. P. (2002). Rating banks: Risk and uncertainty in an opaque industry. *American Economic Review*, 92(4), 874-888.
- Octafilia, Y., & Wijaya, E. (2020). Study of Conventional Bank Health in Indonesia from 2012 to 2017. In *6th Annual International Conference on Management Research (AICMaR 2019)* (pp. 64-68). Atlantis Press.
- Perez, F., Gonzalez, C. J., & Aaronson, X. (2011). Village banking development model: FINCA Costa Rica. *Journal of Business Research*, 64(3), 316-324. <https://doi.org/10.1016/j.jbusres.2009.11.019>
- Pressman, R. S. (2005). *Software engineering: a practitioner's approach*. Palgrave macmillan.
- Rauf, A. L. (2016). Towards Increasing the financial performance: An application of CAMEL Model in banking sector in the context of Sri Lanka. *Research Journal of Finance and Accounting*, 7(5), 66-71.
- Sahota, S., & Dhiman, B. (2017). Relative performance analysis of scheduled commercial banks in India: A CAMEL model approach. *Indian Journal of Finance*, 11(5), 40-57.
- Schicks, J. (2013). From a supply gap to a demand gap? The risk and consequences of over-indebting the underbanked. In *Microfinance in Developing Countries* (pp. 152-177). Palgrave Macmillan, London.
- Stella, L. A., & Puspitasari, R. (2020). Analysis of Bank Rating with RGEC Method Case Study at PT Bank Mandiri (Persero) Tbk for the Period 2013–2017. In *2nd International Seminar on Business, Economics, Social Science and Technology (ISBEST 2019)* (pp. 240-245). Atlantis Press.
- Susanti, J., Karma, I. G. M., & Dewi, N. W. K. (2021). Application Development for Assessing the Health Level of Village Credit Institutions Using the RGEC Method. In *International Conference on Applied Science and Technology on Social Science (ICAST-SS 2020)* (pp. 66-71). Atlantis Press.
- Suvita, J., & Xiaofeng, H. (2012). A comparison of financial performance of commercial banks: A case study of Nepal. *African Journal of Business Management*, 6(25), 7601-7611.
- Treacy, W. F., & Carey, M. (2000). Credit risk rating systems at large US banks. *Journal of Banking & Finance*, 24(1-2), 167-201. [https://doi.org/10.1016/S0378-4266\(99\)00056-4](https://doi.org/10.1016/S0378-4266(99)00056-4)
- Tripathi, D., Meghani, K., & Mahajan, S. (2014). Financial Performance of Axis Bank and Kotak Mahindra Bank in the post reform era: Analysis on CAMEL model. *Economics and Applied Management Research*, ISSN, 2349-5677.
- Varghese, T. (2016). Evaluating performance of a service cooperative bank: An application of camel model. *Indian Journal of Finance*, 10(3), 7-27.
- Wijaya, J. H., Utanti, E. M., & Mohd Saudi, M. H. (2020). Effect of Bank Health Level (Using Rgec Method) on Profit Growth. *International Journal of Psychosocial Rehabilitation*, 24(2).
- Zainuddin, Z., & Djaelani, Y. (2018). Applying Risk Profile, Good Corporate Governance, Earning and Capital (RGEC) Method To Predict the Bank Health (Case Study on Pt. Bank Tabungan Negara). *ACCOUNTABILITY*, 7(02), 16-32.