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Comparisons Among Credit Evaluation Methodology for Micro Enterprise: Evidence from Credit Evaluation Model for Micro Enterprise of KOREG in Korea

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Abstract

The purpose of this study was to understand which variable can most effectively benchmark subrogation and use the result to establish a more stable guarantee policy. In this study, credit ratings are calculated from the model to evaluate micro-enterprises using data mining technique for micro-enterprises. The model to evaluate micro-enterprises is obtained from the local credit guarantee foundation. With respect to prediction accuracy of each of the models from the study result, out of decision tree, CHAID was 67.7% and it is the highest model prediction accuracy and prediction of subrogated performance using CHAID model out of decision tree can bring good result of prediction. In addition, because in CHAID model of decision tree the combination grade for which added points are not applied was 79% and this shows predictor importance, it is necessary that the combination grade for which added points are not applied predicts subrogated performance as the optimum predictor and uses the result of prediction for guarantee policy. Suggestions through the study result are like the following. The result of prediction of occurrence of subrogated performance for guaranteed enterprise through evaluation model for Micro enterprisers should be reflected to guarantee supply policy to lower the rate of subrogated performance and through these basic materials that make the tax of government used efficiently are provided. Because of this, suggested is the appropriateness that each of the local foundations can predict subrogated performance through credit evaluation model and use the result of prediction for adjustment of guarantee rate before supplying guarantee, and Korean Federation of Credit Guarantee Foundations should decide whether the model to evaluate credit of Micro enterprisers was reflected or not in audit of supplementation through reguarantee. In addition, likewise Credit Scoring System(CSS) used for individual guarantee should reflect the result of prediction of subrogated performance and decide guarantee limit or whether or not of approval of guarantee. Therefore, the outcome of this study would have great significance as the method to reduce guarantee risk.

Keywords: *Evaluation Model for Micro Enterprises, Data Mining, Credit Rating, Subrogated Performance*

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1. Introduction

Domestic financial services have undergone many changes due to economic recession following IMF foreign currency crisis in 1998 and financial crisis in 2008. Many financial institutions are making efforts to lower loss rate through risk management and credit evaluation for risk hedge responding to such changes [1].

For classification of grades by credit evaluation, ratings are classified generally using credit scorecard. However, researchers who thought that such standards of credit ratings were not suitable for all financial fields are saying that credit evaluation model necessary for particular classes such as low credit classes should be developed using mobile communication data and credit quiz (psychological technique) *etc.*, For example, Yun [2] said that sales analysis and business district analysis based on GIS should be used for development of credit evaluation model for Micro enterprisers.

In addition, since 2013, Financial Supervisory Service has push ahead with introduction of credit evaluation model for people with low credit reflecting the characteristics of the people with low credit and presently commercial banks established their own credit evaluation model for people and are carrying out loan. Likewise, Korean Federation of Credit Guarantee Foundations established separate credit scoring system for effectiveness of guarantee for sunshine loan that is for people with low credit, low income, and promotes adjustment of scale of guarantee object and effective risk management.

In order to develop models to decide whether or not to approve loan or guarantee and credit evaluation grade, data mining technique is used and such a data mining is a technique to carry out analysis such as prediction or classification, colonization and correlation analysis and suggest solutions. Particularly, the factors which decide whether or not to approve loan or guarantee are classification and prediction, which are determined by analysis techniques such as logistic regression, decision tree, neural network and SVM (Support Vector Machine) on the values previously obtained using data mining techniques. This study suggested that the accuracy of prediction model and credit evaluation model obtained using logistic regression, decision tree, and neural network, have significant influence on subrogation performance, which suggests that they can be used for the decision of approving the guarantee. This is a further development from the method of use that appropriates only evaluation of credit ratings and limit in the existing credit evaluation model and will be used as important basic materials to decide whether or not to approve guarantee checking the condition of subrogated performance.

Some of the credit evaluation models for micro-enterprises that are calculated using data mining techniques include model grade for which added points are not applied, model grade for which added points are applied, combination grade for which added points are not applied, combination grade(final grade) for which added points are applied and individual CB(Credit Bureau) grade. The goal of this study is to understand which credit evaluation model can be used to most accurately predict subrogated performance, and to use the result to establish a more stable guarantee policy.

2. Theoretical Background

2.1. Evaluation Model for Micro Enterprisers

Credit evaluation is an investigation into all managerial facts that have influence on the credit condition of an enterprise and can be said to be comprehensive decision of credit rating of the enterprise made based on the result of analysis [3]. In order to develop credit evaluation model, classification criteria which differentiates good customer from bad customer should be established first. Such credit evaluation can be divided into enterprise credit evaluation and individual credit evaluation, and for enterprise credit evaluation for micro-enterprise. Progression of work according to credit evaluation model can be a help to realization of credit society and economic development with loan following credit

evaluation and further it can be the foundation of development of financial market in macroscopic aspect. In microscopic aspect, it can maintain promptness and consistency, and it is connected with trust process with customers and can exercise the effect to enhance customer satisfaction, and through minimization of distressed-debt it can heighten profitability and by adjusting customers who can be delinquent borrowers to fit the ability of customers, it can achieve the effect of minimization of bad credit [1-4].

Because studies on the characteristic of Micro enterprisers are in the present progressive form and Micro enterprisers in many countries show characteristics different from each other depending on country, in each of the countries the characteristics of Micro enterprisers are analyzed. In the country, local credit guarantee foundations are specializing the object of guarantee as Micro enterprisers to handle works and operating separate evaluation model for Micro enterprisers. Such credit evaluation model for Micro enterprisers appears well in the article 7 of 「Method to handle guarantee for fund to support Micro enterprisers」of the 'Local credit guarantee foundation act and enforcement ordinance that was proposed in March 2000, and the credit rating, financial condition and item of ability of manager were considered in the aspect of individual credit of the enterprisers, and evaluation of type of business, level of contribution to local economy, competitiveness, growing power and opinion of evaluator were considered in the aspect of enterprise credit to progress credit evaluation. In the United State, definition of Micro enterprisers was not done separately and system to support small amount loan for micro business is operated and in 1998 some large-scale bank in the US introduced credit evaluation model for small business [2-3] and [5-7].

2.2. Preceding Studies on Evaluation Model for Micro Enterprisers

In the preceding studies on credit evaluation of micro-enterprises, Park [6] emphasized the role of credit evaluation model for the process of establishing a support system for micro-enterprises, and Yang [7] led the discussion of sophistication of credit evaluation model while applying the classical analytic technique for development of credit evaluation model for micro-enterprisers. In 2006 and in 2007, multilateral studies on credit evaluation model for micro-enterprisers were done by Yun, Roh & Kwon [4], who stated that if credit evaluation models for micro-enterprises were developed using sales information of credit card, better credit evaluation could be achieved. Lee *et. al.*, [3] stated that it was important to use AHP analysis technique to establish credit evaluation model for micro-enterprises. Yun [2] stated that establishment of credit evaluation model for micro-enterprises based on GIS can improve the accuracy of credit evaluation, and more sophisticated model can be made using materials of sales analysis and business area analysis.

2.3. Difference of this Study

Based on the existing studies on the credit evaluation models for micro-enterprises used by local credit guarantee foundations, this study finds the factors that determine each grade of credit evaluation that according to the evaluation model on the subrogation performance. In addition, optimum models that predict subrogate performance are obtained. This model reflect predicted condition of subrogate performance and adjust the limit of guarantee supply and reguarantee system of Korean Federation of Credit Guarantee Foundations. This increases the complexity of the existing credit evaluation model for micro-enterprises, and through the minimization of distressed-debt, one can maximize the profitability and minimize the bad credit by filtering out potential delinquent borrowers [9].

3. Method to Study

3.1. Collection of Data and Composition of Sample

The data used for this study are the result of study progressed by local credit guarantee foundations (except for foundations in Seoul and Gyeonggi-do) that are operating credit guarantee system for domestic Micro enterprisers. They conducted the study using the materials of evaluation model for micro-enterprises from January 2011 to the end of December 2014. The dependent variable subrogate performance is the guarantee data which underwent verification using evaluation model for micro-enterprises of the local credit guarantee foundations. The independent variables are individual CB grades, model grade for which added points are not applied, model grade for which added points are applied, combination grade for which added points are not applied, combination grade (final grade) for which added points are applied, and also the guarantee data by evaluation model for micro-enterprises of the local credit guarantee foundations.

Table 1. Basic Statistics of Each Credit Grade Calculated by the Evaluation Model for Micro Enterprisers

(Unit: number, %)

Credit rating	CB Grade		Rate of subrogated performance
	Normal	Subrogated performance	
AAA(1)	12,141	58	0.48
AA(2)	14,499	145	0.99
A(3)	12,751	278	2.13
BBB(4)	15,874	446	2.73
BB(5)	13,200	646	4.67
B(6)	11,492	845	6.85
CCC(7)	4,966	629	11.24
CC(8)	427	103	19.43
C(9)	0	0	0.00
D(10)	0	0	0.00
No grade	9	1	10.0
Total	85,359	3,151	3.56

Credit rating	Application of added points_ Model grade Credit evaluation single grade		Rate of subrogated performance	Non-application of added points_Model grade Credit evaluation single grade		Rate of subrogated performance
	Normal	subrogated performance		Normal	subrogated performance	
AAA(1)	18,069	121	0.67	7,998	27	0.34
AA(2)	24,294	392	1.59	17,068	174	1.01
A(3)	18,686	697	3.60	18,623	342	1.80
BBB(4)	14,438	924	6.01	19,003	756	3.83
BB(5)	6,330	554	8.05	13,720	907	6.20
B(6)	3,284	422	11.39	7,206	682	8.65
CCC(7)	192	32	14.29	855	117	12.04
CC(8)	59	8	11.94	761	126	14.21

C(9)	7	0	0.00	117	19	13.97
D(10)	0	1	100.00	8	1	11.11
Total	85,359	3,151	3.56	85,359	3151	3.56

Credit rating	Non-application of added points_Combination grade		Rate of subrogated performance	Application of added points_Combination grade(Final grade)		Rate of subrogated performance
	Normal	subrogated performance		Normal	subrogated performance	
AAA(1)	1,846	1	0.05	4,013	6	0.15
AA(2)	3,505	9	0.26	7,449	38	0.51
A(3)	20,433	113	0.55	22,952	183	0.79
BBB(4)	24,952	432	1.70	24,267	617	2.48
BB(5)	23,196	1,149	4.72	20,297	1,361	6.28
B(6)	10,715	1,286	10.72	6,378	942	12.87
CCC(7)	648	145	18.28	3	2	40.00
CC(8)	58	12	17.14	0	1	100.00
C(9)	6	4	40.00	0	1	100.00
D(10)	0	0	0.00	0	0	0.00
Total	85,359	3,151	3.56	85,359	3,151	3.56

3.2. Study Model

As models and independent variables of this study, we established individual CB grade, model grade for which added points are not applied, model grade for which added points are applied, combination grade for which added points are not applied, and combination grade (final grade) for which added points are applied. As prediction models, we used analysis techniques such as logistic regression analysis, decision tree's C5.0, CART, Quest, CHAID and neural networks. The statistical program used for analysis is SPSS Modeler 17, and it is the program used a lot for data mining. The merit of Modeler is to enable various analysis methods to be confirmed at a glance and comparison of analysis method was made to be convenient. Especially, it provides importance of predictor and importance percentage to show which variable carries out the most important role in predicting dependent variable.

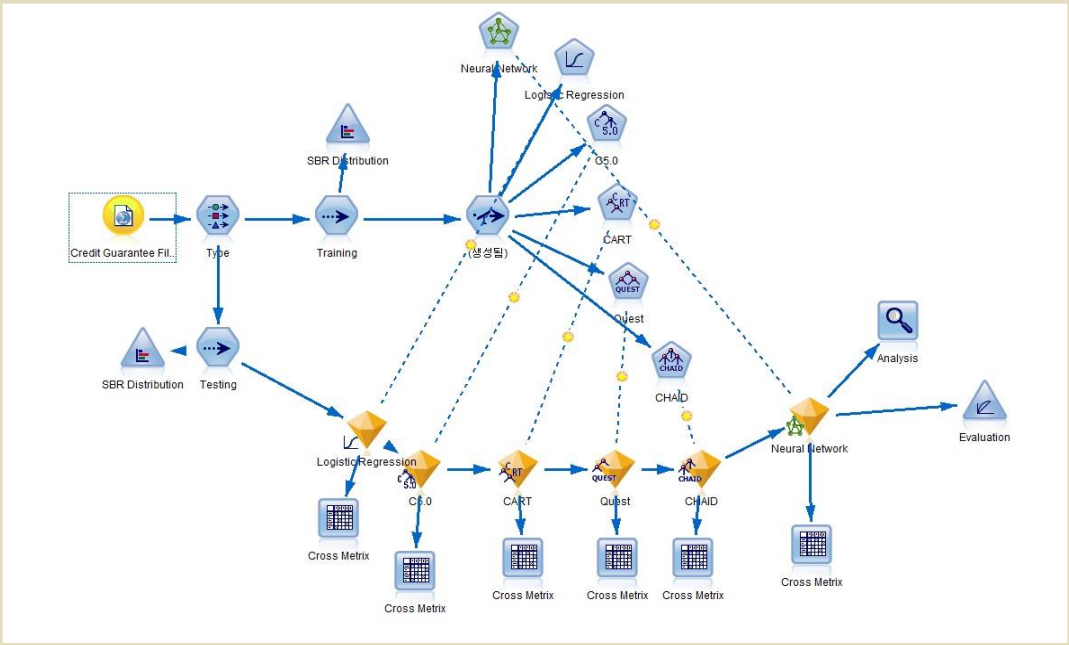


Figure 1. Study Model [8]

3.3. Analysis Methodology

This study is to suggest data necessary for sophistication of evaluation model for Micro enterprisers with prediction accuracy and predictor importance for each of analysis methods, in case credit ratings calculated by the evaluation model for Micro evaluators predict subrogated performance. As analysis method used for this study, logistic regression analysis, decision tree's C5.0, CRT, Quest, CHAID and neural networks analysis method were used.

Logistic regression analysis is the form to expand dependent variable (Y) of the existing linear regression analysis to categorical type and can be divided into binary logistic type and multinomial logistic type and in this study, subrogated performance was binary logistic type and it was measured with being dividing into occurrence of subrogated performance and being normal.

With decision tree decision rule is tabulated and groups of concern is classified into several small groups or predicted and it can choose categorical and continuous variables as dependent variables. If dependent variable is categorical, analysis is carried out with classification tree, and if dependent variable is continuous, analysis is carried out with regression tree. In this study, like for logistic regression analysis, subrogated performance is binary logistic type and it was measured using classification tree, and for the method of measurement C5.0, CART, Quest, CHAID were used.

The neural networks model is the imitation of neural network activity of brain that human learns from experience and finds patterns through repeated process of learning of data retained and it is the technique to predict by generalizing such patterns. However, the demerit is that intermediate process between the input and output cannot be known and it is used not much compared to decision tree.

4. Proof Analysis

4.1. Result of Analysis of Importance of Predictor by Modeler

With subrogated performance condition as dependent variable, and with individual CB grade, model grade for which added points are not applied, model grade for which added points are applied, combination grade for which added points are not applied, and combination grade (final grade) for which added points are applied as independent variables, model to predict subrogated performance was to be found. As a result of analysis, prediction accuracy for each of models appeared to be minimum 65.2% to 67.7%, like the Table 2, and out of decision tree CHAID was 67.7 % and it shows the highest model prediction accuracy. Such a fact shows that CHAID is the optimum model for prediction of subrogated performance out of the decision tree.

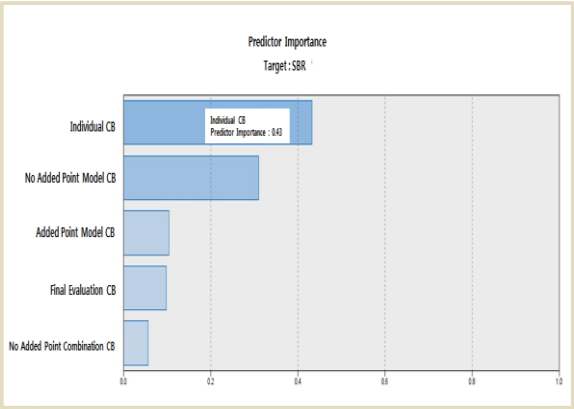
Table 2. Prediction Accuracy of Each of Models[8]

(Unit: %)

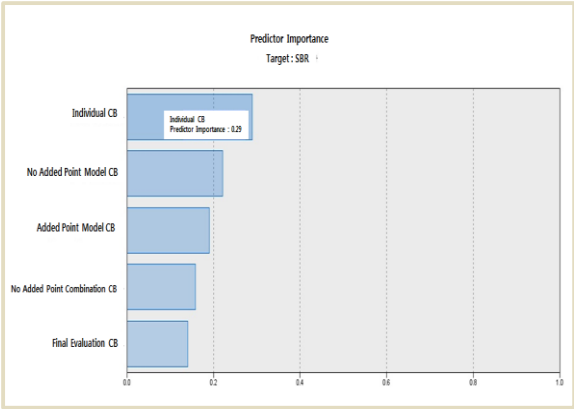
Classification	Logistic Regression	C5.0	CART	Quest	CHAID	Neural Network
Accurate	6.57	66.4	67.1	65.2	67.7	65.9
Wrong	34.3	33.6	32.8	34.8	32.3	34.1

The Figure 2, shows the prediction importance of the independent variables individual CB grade, model grade for which added points are not applied, model grade for which added points are applied, combination grade for which added points are not applied, combination grade(final grade) for which added points are applied, for each of analysis models. For logistic regression analysis and neural network, individual CB grades are 43% and 29% respectively, and they show the importance of predictor that predicts subrogated performance and for C5.0, CRT, Quest, CHAID of decision tree, the combination grades for which added points are not applied are 81%, 85%, 72%, and 79% respectively and they show the importance of predictor. Such a fact suggests that individual CB grade is the most important predictor in case the results of analysis with logistic regression analysis and neural network are suggested and that subrogated performance prediction using individual CB grade is accurate and suggests that for decision tree almost absolutely the combination grade for which added points are not applied is the optimum predictor and predicts subrogated performance. However, based on the result suggested in <Table 2> because the prediction accuracy of the model is the prediction of subrogated performance through CHAID model of the decision tree, the combination grade for which added points are not applied is the optimum predictor and it is desirable to predict subrogated performance with the combination grade and use the result of prediction for guarantee policy.

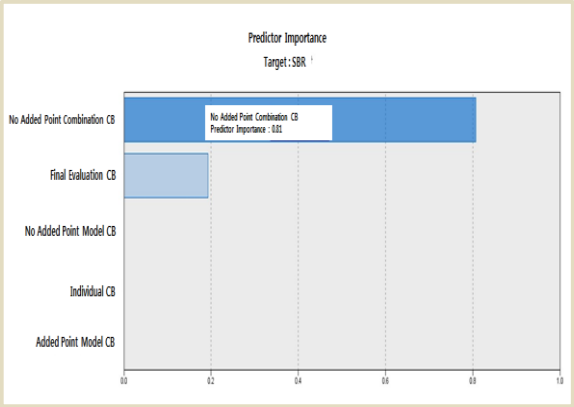
Predictor importance by logistics



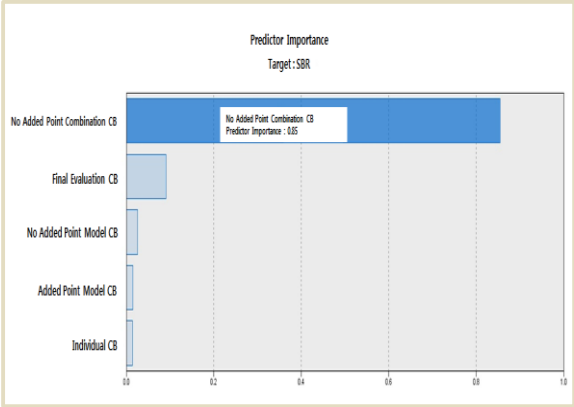
Predictor importance by neural network



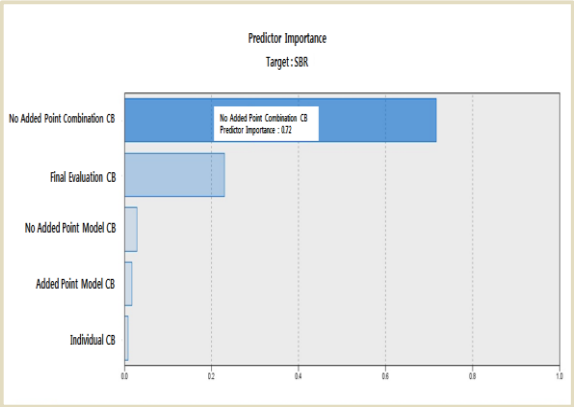
Predictor importance by C5.0 (decision tree)



Predictor importance by CART (decision tree)



Predictor importance by Quest (decision tree)



Predictor importance by CHAID (decision tree)

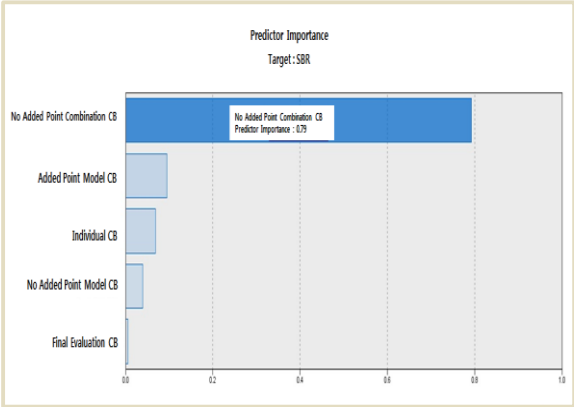


Figure 2. Predictor Importance for Each of Analysis Models

5. Conclusion

5.1. Summary of the Study Result and the Suggestion

Credit evaluation model is the core infra for approval of guarantee and risk management. Therefore, for smooth supply of funds to Micro enterprisers and alleviation of burden of guarantee fee rate while maintaining soundness of guarantee, sophistication of evaluation suitable for this is necessary. Accordingly, this study has the purpose to understand which variables are most importantly used for prediction of subrogated performance out of credit grades calculated from credit evaluation model for Micro enterprisers using data mining technique and to use the result for establishment of guarantee policy. Therefore, the result of progression of this study is like the following. Out of prediction accuracy for each of the models of this study result, CHAID was 67.7% which is the highest model prediction accuracy out of decision tree and it suggests that prediction of subrogated performance using CHAID model out of decision tree can bring good prediction result. In addition, in the CHAID model of decision tree the combination grade for which added points are not applied is 79% and shows predictor importance so it is necessary to use prediction result for guarantee policy by predicting subrogated performance with the combination grade for which added points are not applied as the optimum predictor.

Such study results provide basic data which reflect the result of prediction of occurrence of subrogated performance for guaranteed enterprise to the policy of guarantee supply to lower the rate of subrogated performance through the evaluation model for Micro enterprisers and which can make the tax of government be used efficiently. Therefore, suggested is the appropriateness that each local foundation can predict subrogated performance through credit evaluation model before supply of guarantee and use the result for adjustment of rate of guarantee and the Korean Federation of Credit Guarantee Foundations should decide whether or not of reflection of credit evaluation model for Micro enterprisers for evaluation of compensation through reguarantee. In addition, likewise credit scoring system (CSS) that is used for individual guarantee reflects the result of prediction of subrogated performance and should decide guarantee limit or whether or not of approval of guarantee. Therefore, as a method to reduce guarantee risk, the outcome of this study would have great significance [8].

5.2. The Limit of the Study and the Direction of Future Study

In spite of the suggestion that the result of this study can provide the information necessary for sophistication of credit evaluation model for Micro enterprisers necessary for local credit guarantee foundation to establish guarantee policy and carry out work, it has the limits like the following. First, as this predicts subrogated performance with only variables of the product from credit ratings of evaluation model for Micro enterprisers, it cannot suggest to what degree the other variables such as age, type of business and history of business predict subrogated performance. In the future the researcher needs to contribute to sophistication of evaluation model by finding the influence of such variables on subrogated performance. Second, it used only the material to calculate credit evaluation grade which reflected only the characteristics of Micro enterprisers to establish credit evaluation model for Micro enterprisers, and there was no consideration of credit evaluation model by mobile communication and psychological data. Afterward, the researcher needs to study the influence of the variables on the credit evaluation model. Third, because this study was carried out only with the result of carrying out credit evaluation model, it is necessary to progress studies by combining unevaluated materials.

Oliver [10] satisfaction that has influence on satisfaction/ dissatisfaction and proposes Expectation and Disconfirmation Model. Therefore, future study needs to examine Public Guarantee System with satisfaction of Citizen [9].

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