THE APPLICATION OF DESIGN SCIENCE RESEARCH METHODOLOGY IN ISLAMIC BANKING AND FINANCE RESEARCH

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ABSTRACT
The paper describes a new methodology for Islamic Banking and Finance (IBF) research, adapted from the information science field so-called Design Science Research Methodology (DSRM), to solve the problem related to technology and product application in the IBF institutions. DSRM will be helpful since it has a role as a linkage between academics and practitioners, which enables them to produce application or product development as a scientific output jointly. It is realized that there are likely to be lags between practical work and scientific research in IBF. Currently, The IBF industry is in a rush to develop products that are complied with *al-maqoshid as-sharia* and simultaneously meet the requirement of all stakeholders of IBF to compete with conventional banks. Unfortunately, many outputs that have been produced that are not yet reported as a scientific paper. Therefore, there is a dire need for comprehensive research methodology usage so that IBF could offer more innovative products that successfully become the focal point of competition in the banking industry without leaving the opportunity to publish a scientific report. This new methodology is a technology-oriented solution, guiding both academics and practitioners to have scientific frameworks in developing new products so that it is believed to become more critical in the future to accelerate the growth of several IBF research.

Keywords: Research Methodology, Design Science Research Methodology, artefact, Islamic Banking, and Finance.

INTRODUCTION
Over the past decade, the number of papers in Islamic Economics literature has been growing tremendously. However, the scope of research in Islamic Banking and Finance (IBF) has focused primarily on substantive or fundamental issues such as investigating something complied or not complied with *shari'a*. The studies may have focused less on issues relating to product advancement and product innovation, which solve the problem being experienced by creating or developing the technology-based application.

For instance, researches conducted are mostly intended to understand some aspects of the natural phenomenon in the Islamic economic activities that allow researchers to analyze and predict the behaviour of Islamic man or institution result in new knowledge or new theory. Nevertheless, there are a lot of created phenomenon available such as technological products as opposed to natural phenomenon in IBF that are intentionally developed as part of practical efforts in order to compete with a conventional bank and financial institution.

Unfortunately, the created phenomenon has not yet been analyzed and valued by IBF researchers, which should potentially be published to the research community in the form of research papers or patents. What the field has lacked until now, however, is a standardized and rigour methodology that provides a

methodological framework, unifying the knowledge of shari'a, product innovation, and technical skill in technology.

Design Science Research Methodology (DSRM) fills the current gap between sharia scholars, bankers, management practitioners, and engineers, combining their forces to collaborate in doing research to broaden up the horizon of Islamic banking and finance knowledge. The Islamic banking and finance industry has a lot of information and communication technology (ICT) based projects that are developed to solve the problem being experienced. Unfortunately, the current research methodology used so-called behavioural science-based research is not well supported to enable the project being reported scientifically. By using the DSRM, Islamic economics literature can get benefit from hundreds of projects created in the IBF industry, which would be able to be scientifically published.

This paper presents an example of research in Islamic banking and finance area using the design science research methodology. Hopefully, the case can provoke professional and academicians to collaborate in doing research hand in hand, combining both points of view: a practical and theoretical perspective.

THE NEEDS OF DSRM IN IBF RESEARCH AREA

Scientific publications in IBF give very little attention to which methods may the most appropriate to be used in this field considering the latest need. Monowar (2008) is questioning the condition in his paper, which, unfortunately, does not come with a conclusion. Instead of mentioning a particular name as the most appropriate research methodology, the author makes a general conclusion that research in Islamic banking and finance could use the same method as researcher used in conventional banking and finance as long as it is excluded from non-sharia compliant items and research tools such as pork, alcohol, and riba.

Nowadays, the challenges facing Islamic banking and finance is on how to develop products which are complied with *al-maqoshid as-sharia* or the goals of sharia and simultaneously meet the requirement of all stakeholders of Islamic banking and finance. However, researchers in the field of IBF give little attention to designing and innovating IBF's products, especially in processing and providing solutions to financial service problems (Ullah and Patel, 2011). From a different point of view, Al-Salem (2009) mentions that Islamic banking and finance were mostly successful in promoting the importance of applying the Sharia principle in the economic and financial spheres. Unfortunately, this success is not followed by the innovative product development, as addressed by Tahir (2004) that there is a dire need for comprehensive review so that Islamic banks could offer a more innovative product, especially in the following of specific areas: Deposit mobilization, financing, liquidity management, and regulation and control of Islamic banks.

Comprehensively, Al-Salem (2009) explains the need for innovation imperative in order to meet customer needs and desires by offering competitive services. Research which focuses on developing new ICT based product which is built systematically with a rapid process is increasingly a focal point of competition in the banking industry. Firms that get to market faster and more efficiently with products that are well-matched to the needs and expectations of target customers create a significant competitive advantage (Salem, 2009). Ullah and Patel (2011) highlighted Al-Salem (2009) explanation by suggesting that the growth of IBF industry requests more innovative financial services that are capable of fulfilling the needs of emerging geographical regions, sectors and service portfolios, yet remains complying with the fundamental values and economic objectives of the Islamic law.

D, Cruz (1992) in Ambastha and Momaya (2004) defines competitiveness of the firm as the innovative ability to design, produce, and or market products superior to those offered by competitors, considering

the price and non-price qualities. Further, information technology as a mean of innovation is one of the essential assets in order to compete by providing more excellent value and satisfaction to the customers. Through the utilization of technology, the firm will be able to operate efficiently, cost-effectively, and quality consciously (Johnson, 1992). For the case of the IBF industry, Mokhtar et al. (2008) examined the competitiveness of Islamic banking in Malaysia compared to conventional banking using the input and output approach. They found that Islamic bank was less efficient in doing business in which it brings a lower level of Islamic bank's competitiveness compared to its counterpart. The lack of development of new technology as a mean of innovation is one of the root problems causing inefficiency, whereas Islamic banks are lack behind in investing money in the ICT based product. Furthermore, the authors found evidence that conventional bank which opens Islamic windows are more superior as they usually have advanced technology and skills; sophisticated services and broader international networks.

DSRM FRAMEWORK FOR IBF RESEARCH

DSRM approach can be utilized to answer the highly competitive condition. This approach uses artefacts such as concepts, models, methods, and instantiations as the main component to solve comprehensively the problem being experienced. The justification and theorification, however, are developed throughout the explanation of motivation of research and its significant contribution building the knowledge in Islamic banking and finance.

According to our literature review, there is only Ullah and Patel (2011), who has utilized DSRM in IBF research. The authors used DSRM in proposing two ideas, which are: (1) A construction of service designation for the new context of the IBF industry. (2) A definition of adaptation constructs based on the information system approach for the IBF industry.

The DSRM utilization in IBF is explained through the following consecutive sections of the report (Geerts, 2011): (1) Problem identification and motivation. In this section, the researcher is required to define the problem clearly. A clear problem statement can be created by understanding the theory, which is relevant to the phenomena or facts, and then describes the limitation of the solutions that have been worked out in order to realize what theory says. It is necessary because the researcher must develop justification of the value of solutions proposed, as conceptual and theoretical framing activities. (2) Definition of the objectives of the solution. Further, the researcher is required to define as clearly as possible the goals of the solution as it is proposed in the previous section. The question which should be answered well is "*how the problem should be solved?*"

The knowledge as a base in this substructure is the theoretical framework of what is feasible and what is possible by exploring the utilization of new methods, new technologies and theories derived from the different field which is relevance with the solutions proposed. (1) Design and development. (2) Demonstration. (3). Evaluation. (4) Communication. In the last section, the researcher should communicate three following items: 1. The problems of artefact creation; 2. The solution resulted from the utilization of the artefacts; 3. The novelty and the effectiveness of the solutions that are needed to achieve research's general and specific objectives.

EXPERIENCE OF DSRM USAGE IN IBF RESEARCH

According to the design science research methodology, the research will be performed in the following steps: (A) Problem identification and motivation. (B) Definition of the objectives of the solution. (C) Design and development. (D) Demonstration and Evaluation. (E) Communication. The following is the example of DSRM utilization in the case of Islamic Banking and Finance.

Problem Identification: The Function of ICT Application and Decision Making of IBF's Depositors

It is known very well that depositor's money plays a crucial role in running the bank's business. As a financial intermediary, the bank borrows money from the depositor and then sends it over as a credit to another party in order to generate profit. The conventional bank (interest-based bank) gives the reward so-called deposit interest to satisfy the depositor's profit motive. The interest rate is pre-determined and fix along the deposit period and should be regularly paid by the bank as an obligation, no matter what, whether it is profitable or not.

On the contrary, Islamic banks cannot engage with interest since it is prohibited either in collecting or loaning money since, according to Islamic jurisprudence, the amount of received income should be based on the amount of work or the level of risk will be taken. Consequently, in order to accumulate funds, the Islamic bank offers a pre-determined profit and loss sharing ratio to the depositor that subsequently, the reward will be uncertain according to the bank's profitability.

Conventional bank depositors usually compare the interest rate quite often; as such, they do shop for their finance in order to find the highest rate. Interestingly, even though they already put the money in a particular bank that gives the best interest rate, they still keep their eye on to shop around finding another bank that might offer a better rate. Due to this motive, the depositor will hop from one bank to another in order to maximize profit. Interestingly, according to prior investigations conducted in Indonesia, Malaysia, Singapore, Sudan, and Turkey, it is empirically found that the type of motive which significantly influences depositor in dealing with the Islamic bank is the profit motive instead of the religious motive. For example, Kasri and Kassim (2009) reported that their behaviour in patronizing Islamic banks for the Indonesian case is quietly similar to the interest-based bank's depositor. They are hopping from one Islamic bank to another to find a better return as well. There is a tendency in which Islamic bank's depositors will withdraw their money and replace it to the interest-based bank if the latter offers a higher return. Accordingly, Anwar et al. (2010) suggested that the time deposit product of Islamic banks can be considered as an investment instrument.

The usage of profit and loss sharing principles in deposit products will bring the consequence that depositors will earn reward or loss from their deposited money depends on the Islamic bank's financial performance. Therefore, this condition raises the following problem: *"Depositors should take the correct decision before depositing their money into an Islamic bank. To do so, they need a particular support system which can provide them timely and accurate information regarding the future performance of Islamic banks, reflected in the deposit return"*.

Definition of the objectives of the solution
According to that problem, the research will answer what model can be applied to build the system in order to help depositors in predicting the future return of time deposit product as a proxy of Islamic bank's performance? This central question is then answered using the following objectives as follows: (1) Finding the variables which significantly affect the fluctuation of return of Islamic bank's time deposit product. (2) Examining the best prediction algorithm that could predict the return of the Islamic bank's time deposit product. (3) Developing the prototype application that is practically helpful and usable in delivering prediction information to depositors.

Design and development
The research follows three stages of examination as follows: 1. Sensitivity analysis. 2. Algorithm prediction analysis. 3. Prediction Algorithm selection.

Stage 1- Sensitivity Analysis

In this stage, the research intends to perform sensitivity analysis, selecting some variables from a set of independent variables that have a significant impact on influencing the dependent variable. The contribution of this part into Islamic bank and finance literature is to use different approaches modifying the previous investigation in selecting macroeconomic variables as determinants of Islamic bank's performance through two underlying channels, borrower and depositor. The borrower channel explains the volatility of specific macroeconomic variables affecting borrower's business, which subsequently affects Islamic bank's profit through two factors; the number of borrowers who end up in default because of failure to pay and the increasing or decreasing of shareable profit generated from good performing borrower.

Stage 2- Algorithm Prediction Analysis

In Stage 2, the research tries to select the prediction algorithm that will be employed in the proposed system as a prediction machine. This step is considered to be a new contribution to Islamic banking research literature by which confirming the predicting ability of widely used algorithms, generalized autoregressive conditional heteroskedastic (GARCH), and ANNs with support vector machines (SVMs) as the newest model in machine learning technique.

The Model

Each model has its own uniqueness, which is exciting to be explored. GARCH model, which is introduced by Engle, a Nobel laureate, exploits non-constant volatility features of financial time series data the so-called volatility clustering in which the data tends to exhibit the period of high and low volatility. Moreover, the ANNs model is a part of the machine learning technique which tries to simulate the way of learning of the human brain.

Furthermore, the intention to develop SVMs model is to overcome the overfitting problem of the ANNs model. The model yields a linear model constructed in a higher dimensional input space, which represents the nonlinear decision boundary in the original space. In this step, the research determines the best-suited algorithm according to two parameters, as follows: (1) The accuracy rate performance (2) The stability of the accuracy performance. The prior means that the selection of the best algorithm is according to the accuracy performance in making a prediction at one point of time series. This selection uses selected variables as independent variables resulted from step 1.

Furthermore, the latter means that the best prediction algorithm is determined according to the ability to give an accurate prediction on points of time series as many as possible. Lastly, step 3 is to select the best-suited algorithm, which will be embedded in the system to perform real case prediction. The system is then employed to predict the time deposit product of the most prominent Islamic bank in Indonesia, namely Bank Syariah Mandiri. Further, in order to check the stability of the prediction algorithm that is used in this step, the research performs stability performance testing by performing predictions in three different scenarios of Indonesian economic condition.

The Data

This research initially collects eight macroeconomic variables as independent variables. The macroeconomic variables consist of the exchange rate of USD against Indonesian Rupiah (EXCH), Jakarta stock indices (STIN), money supply as measured by M1, inflation rate (INFR), average of one-month time deposit interest rate (INTR) of Indonesian conventional bank, central bank interest rate (BIRT), international gold price in USD per ounce based on London fix price (GOLD), and average prices of Brent crude oil and West Texas Intermediate crude oil in USD per barrel (OIL). These macroeconomic variables, except for GOLD and OIL, are collected from the Indonesian central bank. Meanwhile, the GOLD and OIL data are collected from the World Gold Council and US Energy Information and Administration. All data are collected from January 2000 until December 2008.

The Method of Algorithm Prediction Analysis

The second examination is to select the best model that will be used as a prediction algorithm in the DSS. This critical stage will be conducted by comparing the accuracy rate of prediction resulted by Generalized Auto-Regressive Conditional Heteroscedastic (GARCH), Artificial Neural Networks (ANNs), and Support Vector Machines (SVMs). Each model will predict the future rate of return of all Indonesian Islamic banks (RR-All).

The prediction uses selected macroeconomic variables resulted from the prior examination. The prediction task consists of two processes; (1) training process and (2) validation process. In the training process, the selected variables resulted from the first examination will be used from January 2000 to December 2008. Furthermore, the research will use out of sample data from January 2009 to April 2011 to validate the model as out of sample prediction.

The findings from stage 2 results in the suggestion about the best algorithm that will be used in the decision support system. Therefore, in this step, the research will perform the accuracy and stability performance of the selected algorithm in making predictions generated by a particular Islamic bank, namely PT. Bank Syariah Mandiri. As shown in figure 3.3, this step the following dependent variables; EXCH, STIN, M1, INFR, INTR, and BIRT, as resulted by the previous action. As can be seen in figure 3.3, the macroeconomic variables are incorporated in the model as the independent variables to predict the rate of return of an Islamic bank, namely Bank Syariah Mandiri. The independent variables of May 2011 are used to forecast the RR-BSM on the period of May (Y_t).

Moreover, in order to see the stability of the prediction algorithm, the research investigates stability performance checking. This investigation will examine how stable the accuracy performance resulted in the algorithm in predicting RR-BSM.

The first examination will be conducted under the expansion phase scenario. The economic stability is shown by a stable exchange rate, a smooth increase of GDP, and foreign capital inflow. In the sample, data testing will be performed from January 2000 until December 2006.

Additionally, out of sample testing will be conducted from January 2007 until December 2007. Finally, the one month ahead testing will be conducted for RR-BSM in January 2008. This one month ahead test is undertaken using training data from January 2000 until December 2007.

The second examination is then conducted under the contraction phase scenario. The impact of the global financial crisis is shown by the very high volatility of the exchange rate and the deep downturn of GDP. It is believed that the sharp decline in national income will obviously have a significant impact on the Islamic bank's financial performance. For this examination, the sample data testing will be performed from January 2000 until December 2008. Furthermore, out of sample testing will be conducted from January 2009 until December 2009. Finally, the one month ahead testing will be conducted for RR-BSM in January 2010. This one month ahead test is undertaken using training data from January 2000 until December 2009. Lastly, the third testing is conducted to see accuracy performance during the recovery phase. As shown in the figure, the year 2011 is the Indonesian economic recovery period after experiencing the impact of the global financial crisis. This condition is reflected in the significant rise in the number of foreign capital inflow, increasing the growth of GDP, and the strengthening of Indonesian currency (Rupiah) against the US dollar. For this examination, the sample data testing will be performed from January 2000 until December 2009.

Also, out of sample testing will be conducted from January 2010 until December 2010. Additionally, the one month ahead testing will be conducted for RR-BSM in January 2011. This one month ahead testing is conducted using training data from January 2000 until December 2010.

The research evaluates the three models using several performance measures, which are accuracy rate and accuracy performance stability. The accuracy rate is assessed on the basis of standard statistical criteria like percentage errors, as follows.

$$Error\ (i) = \frac{|\ Rate\ of\ Return\ Act\ (i) - Rate\ of\ Return\ Predict\ (i)\ |}{Rate\ of\ Return\ Actual\ (i)} \times 100\%$$

For i=1,2,...., n; where n is the number of testing data points. Finally, after calculating the forecast error, the forecasting accuracy will be calculated as follow.

Forecasting Accuracy = 100% - percentage of error in forecasting

Meanwhile, the performance of stability is investigated using r-squared (R^2), Mean Absolute Error (MAE), Normalized Mean Squared Error (NMSE), and visual method or graphic. The coefficient of determination or R^2 provides a measure of how well future outcomes are likely to be predicted by the model. Generally, Normalized Mean Square Error (NMSE) and Mean Absolute Error (MAE) are parameters used to evaluate the distance between prediction results and the eventual outcomes. Specifically, MAE is a parameter used to measure how close forecasts or predictions are to eventual outcomes, while NMSE is a parameter used to quantify the difference between an estimator and the true value of the quantity being estimated. Lastly, the real case is used to test the best model among the three models evaluated in the previous section. This investigation shows the implementation of the selected variable on the prototype predicting one month ahead of RR-BSM. The section proceeds by performing a stability testing that addresses the issues of validity and reliability, together with their impact on the interpretation of the study's results.

The Best Algorithm Prediction Model

As shown in figure 4.1, the research suggests that ANNs outperforms the GARCH and SVMs model since the predicted line of ANNs locates closer to the actual line. The graphs are based on actual against predicted RR, resulted from the training process for January 2000 until December 2008.

This finding is also supported by the accuracy rate calculation resulted from the training process in which ANNs achieve 97.23%, and SVMs reaches 91.75%. Furthermore, using statistical criteria, it supports the graph analysis finding that the performance of ANNs is better since the value of R^2 is higher than such value of SVMs. On the other hand, the value of MAE and NMSE of ANNs are lower than SVMs models. All conditions mentioned above demonstrate that ANN outperforms SVMs models empirically in case of learning ability and explaining RR volatility.
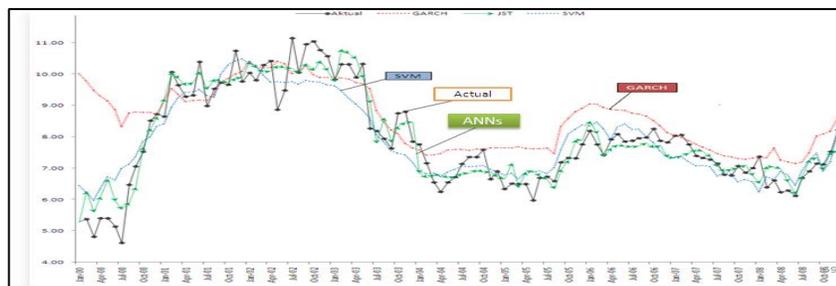

Figure 4.1. Performance comparison

Finally, the out of sample data prediction is then carried out. Table 4.1 suggested that ANNs perform more accurately than GARCH and SVMs in which the average accuracy rates are 84.62%, 83.06%, and 84.47%, respectively. The table shows that the ANNs model outperforms GARCH and SVMs model based on statistical and accuracy rate parameters for in sample data prediction.

In/Out-of-sample	Parameter	GARCH	ANNs	SVMs
In sample data (Jan-00 until Dec -08)	MAE	0.94642	0.21915	0.64390
	NMSE	2.04150	0.03293	0.27360
	R-squared	0.84	0.88	0.85
	Accuracy rate	85.21%	97.23%	91.75%
Out-of-sample data (Jan-09 until Apr-10)	MAE	1.12468	1.03984	1.03627
	NMSE	4.04613	2.51300	4.06265
	Accuracy rate	83.06%	84.62%	84.47%

Table 4.1. The implementation results

The results confirm the theory of the ANNs model by which the empirical risk minimization principle has been successfully trained the network to make better in-sample prediction through the value of MAE and NMSE.

MAE reflects the distance between the predicted value and actual value omitting the positive or negative error. The value shows on average, the length of the predicted line generated by the ANNs model with the actual line is 0.2. Furthermore, NMSE reflects the error of predicted value concerning its positive or negative gap-related with how far the set of predicted values is spread out (variance). The NMSE value of the ANNs model shows that the gap between predicted value considering its positive or negative position along the actual line is very much close, and the variance of predicted value which spreads out along the predicted line is relatively small.

However, from the graph of out-of-sample data prediction (see figure 4.2), it is difficult to determine whether ANNs or SVMs is superior in making a prediction. This condition arose due to the predicted line of ANNs model is less accurate compared with SVMs model along the period of January 2009 until January 2010. However, it begins to outperform the SVMs model started from February 2010 until April 2011.

Therefore, it is necessary to check the statistical and accuracy rate parameters. From the table, it demonstrates the following conditions: ANNs model outperforms GARCH and SVMs in in-sample data testing reflected on all type of parameters., SVMs model outperforms ANNs notably in out-of-sample data testing reflected on MAE, but in the out-of-sample data testing, ANNs outperforms SVMs in term of NMSE.
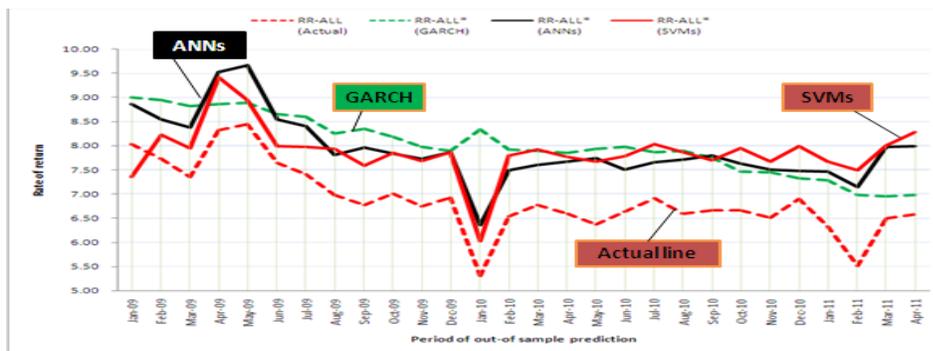
Figure 4.2. Graph of out-of-sample prediction

ANNs model works on plane (two) dimensions so that the model uses empirical risk minimization principle, which tries to find the smallest error empirically in terms of the smallest gap (MAE) and the minor variation of predicted value spread out along prediction time (NMSE). The principle is working on training set finding the best architecture for making predictions both in the training set (in-sample data) and testing set (out-of-sample data). Therefore, ANNs perform much better compared with GARCH and SVMs in in-sample data testing.

In out-of-sample testing, the SVMs model outperforms ANNs and GARCH in terms of MAE as the proxy of the average gap. Specifically, SVMs has lesser performance than ANNs in term of NMSE as the proxy of mean error considering the negative and positive error or the position of predicted value along the prediction period as we know that SVMs is developed to overcome overfitting problem of ANNs which perform very well in the training set but lower in the testing set. So, by using specific kernel function, it lifts the working space into the higher dimension and then uses the structural risk minimization principle to find the smallest error in terms of gap or structure. Therefore, SVMs achieve better MAE with smaller NMSE.

In conclusion, the accuracy rate, reflecting the ability of the model in generating accurate value along the predicted time, shows that the ANNs model outperforms SVMs and GARCH models. Therefore, the research found a clear suggestion that the ANNs model is considered as the best-suited algorithm, as reported by Anwar and Mikami (2011). Based on the evaluation results, this step recommends ANNs as prediction algorithm carrying prediction task in DSS.

The Development of Decision Support System (DSS)
In order to build a robust DSS as an artefact, empirical examinations have been constructed. Based on those testing, the investigation process is then conducted upon the findings, theoretical, and evidence gathered from previous research to measure the robustness of the model. Furthermore, the prediction model will be built based on the chosen algorithm to predict the future rate of return of a particular Islamic bank as a test case. Finally, the research will propose a decision support system for the Islamic bank's depositor by adding an expert system that can suggest which Islamic bank will give a better return and then should be chosen as a place to deposit the money.

The web-based application comprises three features which are: simulation feature, comparison feature, and prediction feature. The simulation feature is a feature that provides a simulation for those who want to know how the Islamic bank generates a return and then rewards some of the return to depositors based on the pre-agreed profit- sharing ratio.

Demonstration and Evaluation

the research utilizes ANNs software that namely Tiberius version 5.5.0, to build predictive models for the rate of return. Finally, out-of-sample data forecasting will be performed by comparing the target values computed by the neural network with the target attribute values given in the training data. In other words, we query prediction of target variables from out of sample period, which will be tested using the actual rate of return of May 2011 to measure the model's accuracy. Actual macroeconomic data for the period of May 2011 are used to make a prediction. In figure 4.3, it can be found that the predicted rate of return resulted from the model is 5.98%, in which the actual rate of return that is published by PT. Bank Syariah Mandiri is 5.99%. It means that the system successfully predicts one month ahead of the rate of return of PT. Bank Syariah Mandiri for about 99.99%.
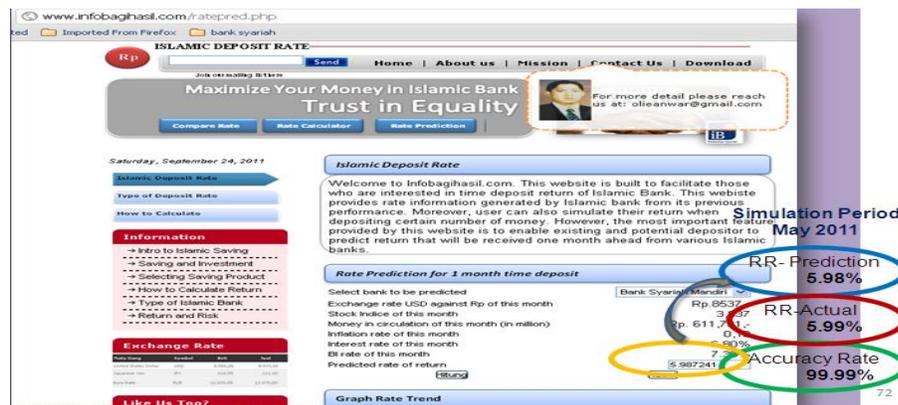

Figure 4.3. Prediction systems in DSS

Communication

Two empirical findings have been carried out, concluding the possibility of applying a decision support system in helping depositors for making a decision. The first investigation is initiating in both it's theoretical and practical as it is the first effort to point out the mudharabah time deposit as an investment instrument that should be facilitated with a specific decision support system. Furthermore, the latter is to emphasize the similarity pattern of time deposit return using a machine learning technique that is mimicking the volatility of interest rate in which this mimicking issue has been criticizing by many Islamic scholars.

Based on the empirical investigations that have been presented earlier, the prototype system using artificial neural networks (ANNs) is now fully assembled, providing a rate of return prediction. Furthermore, the empirical investigation, which results in the market interest rate as the most dominant variable in affecting the rate of return, gives a pure signal of the movement of the deposit return of Islamic banks. When the market interest rate is increasing, it provides a message that the deposit return will increase as well and otherwise. Later on, the more detail information regarding the percentage of return that will be increased or decreased, it can be found in the proposed decision support system.

CONCLUSIONS

IBF industry has been growing so tremendously due to the attractive new paradigm introduced to the financial sector. However, there is an important requirement to raise the competitive level since the current customers demand more products with higher-level value. Moreover, in order to attract new prospective customers, IBF must ensure that the quality of services and products may compete with its counterpart. In this regard, DSRM can be utilized to facilitate academicians and professionals in the IBF

field to hand in hand developing technology-based products and satisfying customers with more excellent value and satisfaction and simultaneously giving contribution in IBF research.

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