CHAPTER 1: THE PROBLEM

This research was dealing with predictions of economic crisis in indonesia. This section discusses about rationale, theoritical framework, conseptual framework/paradigm, statement of the problem, hypothesis, assumption, scope and delimitation, importance of the study.

1.1. Rationale

Indonesia experienced serious economic crisis in 1998. Economic crisis in Indonesia was caused by many reasons; one of them was the weakened of the value of rupias so that lead to high rates of inflation. This is because of economic crisis in Thailand in 1997. Because of the value of Thailands Bath was down and it impact to Indonesia rupias. Because of that, the investors did not trust their investment in Asia anymore including in Indonesia. High rates of inflation impact for our external debt. On that day, so many companies, especially private company was collapse because of they cannot pay their debt for foreign investor. The other reason was caused by political issue in Soeharto reign. Some economic experts claimed that at that time, Indonesia was free from the crisis; however, various factors affected the economic situation in Indonesia that it could not avoid the crisis.

The inflation was very high in 1998. The value of rupias was decresed drastically. It was from Rp. 2400 per US dollar to Rp. 16000 per US dollar. As a result, the rupias was unreliable anymore and investors turn to US dollars. They believed Indonesia could not survive from the crisis at that time.

The fact; however, Indonesia had survived from crisis; one possible caused was dissolution of Soeharto reign. The other reason was Indonesia had been helped by IMF to maintain the economic conditions so that our economic sector became strong in a short time.

In 2012 Standard Charted Bank of England publish a report titteled "The Super-Cycle Report". It reported Indonesia that in 2030 would be a strong economic country, and would be on 5th rank over the word. But in 2010, our Ministry of Energy was published a report about our oil production is running low until now; moreover our oil consumption was larger than oil production at that time. In addition, Indonesia only developed alternative energy around 5.3% in 2013. For developing country, as a result from reference [2] [8] is always been highly dependent on energy as their economy problem. Because of these reason, "The Super-Cycle Report" is not suitable in Indonesia as developing country.

The economic crisis is very complex and chaotic problems. If crisis will happen in Indonesia again some day, it could be has different reason from economic crisis in 1998. In Indonesia,

economic crisis prediction using Data Mining has been done [11], but for a short time. This research will try to predict economic crisis for a long term. This reaserch applies System Dynamic Model to create a model of economic conditions in Indonesia from 1971 until 2070 from 4 economic factors such as GDP (Gross Domestic Product), External Debt as factors to indicate monetary crisis and Energy Production, and Energy Use as factors to indicate energy crisis. The research refers to "The Limits to Growth" [7] which has created world model by using System Dynamic Model from 1900 until 2100. It applied behavior or trend of time series data from past and perdict the future. System Dynamic Model applied the value of coefficients dynamic to create a behavior data time series from historical data. When the value was obtained, the model was applied to make an Indonesian economic model for 100 years. The value of dynamic coefficients was obtained using Adaptive Genetic Algorithm, the adaptive behavior applied Fuzzy System [4] [13] [15]. The other name of this algorithm is Fuzzy Genetic Algorithm [4] [13] [15].

1.2. Theoretical Framework

This study attempts to develop model from economic conditions in Indonesia for a long term predictions. Because of economic crisis is the complex and chaotical problem, it can be happen from many reason and may different from economic crisis in 1998. From reference [2] [8] in 2011, Indonesia as one of developing country in Asia need energy as their economic movements. So that, if Indonesia have experience economic crisis again, it may come from monetary or energy crisis. From these reason, the model of economic condition in Indonesia is developed from 4 economic facrors, GDP and External Debt that reflect monetary conditions [5] and Energy Production and Energy Use that reflect energy conditions in Indonesia. These four factors are interrelated bi-directional [2] [8]. The values of dynamic coefficients are needed if one uses System Dynamic Model. Errors from actual historical data and trend from System Dynamic model will be calculated using MAPE (Mean Absolute Presentage Error). This algorithm is expeted to obtain optimal solution better than Standard Genetic Algorithm. Adaptive Genetic Algorithm applies Fuzzy System as its parameter controller. This method makes the parameter of Genetic Algorithm run adaptively. It can change while Genetic Algorithm is running. The result of this research is the model from System Dynamic Model of economic conditions of Indonesia using 4 factors for 100 years, from 1971 until 2070. The economic crisis will be predicted from this model. Based on "The Limits to Growth", the crisis will take place if the value of External dept is more than GDP and the value of Energy Use is more than Energy Production, and than reaches the peak of Energy Production.

1.3. Conceptual Framework/Paradigm

The variables that influence the result of this research are:

1. Parameters of Genetic Algorithm such as populations, generations, motation probability and cross over probability.

2. Fuzzy rules are builded from the behavior of Genetic Algorithm.

3. The differences of historical data models before Susilo Bambang Yudhoyono reign and after Susilo Bambang Yudhoyono reign.

1.4. Statement of the Problem

The main problem of this reaserch is to create Indonesian economic conditions model from 1971 until 2070 using System Dynamic Model optimized by Adaptive Genetic Algorithm using 4 economic factors which are GDP, External Debt, Energy Production, and Energy Use. This model was used to make a prediction of economic crisis in Indonesia for long term predictions. "The Limits to Growth" became the main reference of this research and Adaptive Genetic Algorithm would find the best value of dynamic coefficients from historical data time series.

1.5. Hypothesis

Adaptive Genetic Algorithm is expected to find optimal solution better than Standard Genetic Algorithm. Standard Genetic Algorithm only applies its parameters from the beginning before the algorithm is running [6] [12] [13] [14]. However; Adaptive Genetic Algorithm can change the value of these parameters while Genetic Algorithm is running [4] [13] [15]. This adaptive algorithm is created by Fuzzy System. This system applies to change the GA parameters while GA running. From all of GA parameters, probability of mutation is the most important value in GA [6], because this parameter can cause GA to exploration or exploitation in searching area [6]. This parameter can produce more individual variates. This reaserch using real value as gen of chromosome, it is bounded by 0.1 until -0.1 for each gene. It is limited but the searching area is unlimited because there are unlimited value between 0.1 and -0.1. This is the other reason why the variates of individual needed, more of individual created, it means the algorithm will close to the solution. From this large searching area, Adaptive Genetic Algorithm is expected to obtain an optimal solution.

Model from System Dynamic model [7][10] is expected to describe the Indonesian economic conditions from 4 economic factors such as GDP, External Debt, Energy Production, and Energy Use and has the result refers to "The Limits to Growth" [7].

1.6. Assumption

This research has the following assumptions:

1. The time series data are including policy, politics, and other factors implicitly.

2. The result is the model from historical data behavior and it can predict the trend from time series data.

1.7. Scope and Delimitation

The limitations of this research are:

1. The analysis is only from behavior or trend data of System Dynamic Model using 4 parameters or economic factors, they are GDP, External Debt, Energy Production, and Energy Use as used in Data Mining method.
2. The models are developed based on historical data from 1971 – 2070 (100 years). The data is from www.worldbank.org and accessed in 5 juny 2013.
3. The numerical experiments of research only apply the different value of mutation probability (Pm). It started from 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1, and the other parameters such as GA and Fuzzy parameters only set once in the beginning of the trial.
4. The Fuzzy rules are produced by the help of GA expert and from continuous study.
5. The economic crisis caused by many reasons, so that this research attempt to predict monetary crisis and energy crisis as warning indicators for economic crisis in Indonesia.

1.8. Importance of the Study

This research will contribute to the field of Data Mining to solve the economic problems; one of them is economic crisis. This prediction can be used by Government to make policies in order to avoid crisis in Indonesia.

The contribution on this study is to predict monetary crisis and energy crisis as earlier warning in quantitative measurements.