Artificial Neural Networks to Measure The Rural Development: A Case Study of Malaysia

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ABSTRACT

Development has contributed the main role to encounter the economic crisis in world , so each nation intent to expand all aspects of development . This is a case study of Malaysia to assess the basic factors of community development in Malaysia villages . The Artificial Neural Networks is a statistical tool to measure the rural development. Results showed the impact of five basic factors which can solve the economic crisis , unemployment and inflation . Obviously, The economic development will improve the living conditions of community and lead to the more welfare of individuals . These results are useful for the policymakers and the relevant developers who concern the various aspects of building the community.

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Introduction

Human beings have known and learned the development of livelihood since they were born on the earth. As many evidences discovered so far, there have been the evolution of tools, constructions, weapons, clothes, vehicles, etc. Furthermore, much beliefs and teachings of Roman, Greek, Arabic, Chinese, Indian philosophers have been accepted and spread worldwide. So that "Development" has become a science and been adapted into many areas of study. Development has been a key to solve economic crisis such as inflation, economic recession, and unemployment. The Community Development Department of Malaysia was established in 1962 under the Ministry of Interior to coordinate with all governors, CDD workers, community leaders and people for collecting community data in rural areas, then analyzing data, reporting useful information and making policies for community development. Community planners and developers have been persistently concerned with building the good community (Grant, 2006). There are 2 types of Malaysian rural community database; BMN (Basic Minimum Needs), household-levelled information, and NRD-2C (Basic Village Information), village-levelled information. BMN covers approximately 8 million rural households and is updated every year, and NRD-2C covers 69,763 villages in rural area of Malaysia and will be updated every 2 years (Community Development Department, 2007). In this study, only NRD-2C was used to measure the amount of impact of each factor.

Table 1:A Summary of Factor Prioritization Affecting Malaysian Rural Development using Statistical Frequency Distribution Analysis (All Categories)

Total Villages Which Failed (Villages)	**Factor**	**Rank**
40,601	Learning by A Community	1
36,033	Sports	2
20,849	Soil Quality	3
16,312	Access of A Community's Financial Capital	4
15,547	Being Educated	5
10,758	Products from Other Agriculture	6
8,502	Water for Agriculture	7
7,885	Getting A Job	8
7,450	Products from Farms	9
5,847	Land Possession	10
4,605	Products from Rice	11
4,561	Water Quality	12
4,453	Social Protection	13
3,958	Further Studying beyond Limitation (Grade 9)	14
3,459	Environment Management	15
3,048	People Assembly	16
2,972	Community Participation	17
2,817	Road	18
2,593	Communication Technology Access (TV, Radio, Internet)	19
2,593	Water for Drinking	20
2,341	Household Industry	21
1,949	Working in Establishment	22
1,851	Educational Level	23
1,815	Water for Consumption	24
1,642	Benefits from Tourist Attraction	25
995	Electricity Access	26
982	Work Safety	27
849	Afforesting	28
829	Contagious Disease Prevention	29
279	Free from Addictive Drug	30
2	Land Utilization	31

But in term of impact evaluation, it is not necessary that the impact factor which most number of villages fail in has the most influence on Malaysian rural village development. On the other hand, the impact factor which has the most influence on Malaysian rural village development might have fewer number of failing villages. Moreover, all raw data in NRD-2C database were recorded as nominal data type

(passed or failed), and the data of village development level were as ordinal data type (level 1, 2, and 3). By Technically, Correlation Analysis and Regression Analysis cannot be used to measure the amount of relationship or weight of impact. Previous studies done by West, Brockett, and Golden (1997); Thieme, Song, and Calantone (2000); Song and Zhao (2004) showed that Artificial Neural Networks (ANN) approach was well suited to complex relationships analysis and well dealt with all data types. It was found that ANN was used to evaluate general relationship quality (Bejou, Wray, and Ingram, 1996). So in this study, ANN was applied to measure the weight of impact for each factor.

Artificial Neural Networks (ANN)

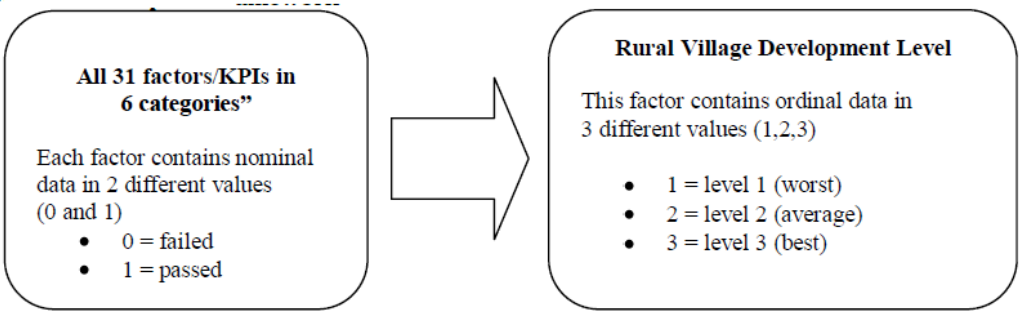
ANN was applied in two stages: learning and testing. In the learning stage, a set of connection weights was calculated for a given set of input and output values. For back-propagation method, the output set contained previously known values. An algorithm called the delta-learning rule was used to adjust the weights at the end of iterations until the output was more similar to the pre-defined output. Learning was complete when the network had learned the relationship between the inputs and outputs. During the learning, setting the number and the size of the hidden neurons was difficult. Hidden layers represented non-linearity or interactions between variables. The more complex interactions, the more hidden neurons were required. In the testing stage, weights calculated during the learning stage were engaged to estimate a new set of output for a given set of input values (Yesilyaprak, 2004) for measuring the estimated accuracy of the analysis. Basically, a generic neuron j, with a threshold θj, received n input signals $x = [x1, x2, \ldots, xn]$ from the units to which it was connected in the previous layer. Each signal was attached with an importance weight $\boldsymbol{w}j = [w1j, w2j, \ldots, wnj]$. The combination function is usually linear; hence the potential was a weighted sum of the input values multiplied by the weights of the respective connections. This sum was compared with the value of the

threshold. The potential of neuron *j* (*pj*) was defined by the following linear combination:

Methodology

In this paper, it was assumed that all factors were related to the level of village development. So that all 31 factors were selected as the independent variables and the level of village development as the dependent variable as shown in Figure 3. Then ANN was applied to measure the weight/amount of impact, called "importance", for each independent variable affecting the level of rural village development.

$$p_j = \sum_{i=0}^{n} (x_i w_{ij})$$



Back-propagation algorithm was selected as a main approach of ANN and it was set to run continually and re-process as looping until the expected accuracy was not less than 95%, and then the analysis process was stopped. Once the weights of impact for each independent variable were retrieved. Then prioritized all of the weights of impact in descending order. The highest weight/importance was ranked 1st, and the lowest weight/importance was 31st.

Results

Table 2:A Summary of Factor Prioritization Affecting Malaysian Rural Development by Artificial Neural Networks (All Categories)

Score of Impact	**Factor Name**	**Factor Ranked by Impact**
17.88	Land Possession	1
15.35	Electricity Access	2
14.02	Communication Technology Access (TV, Radio, Internet)	3
12.06	Educational Level	4
10.57	Household Industry	5
10.55	People Assembly	6
7.56	Soil Quality	7
7.14	Community Participation	8
6.17	Water for Drinking	9
5.68	Contagious Disease Prevention	10
5.68	Getting A Job	11
5.53	Work Safety	12
4.93	Learning by A Community	13
4.64	Being Educated	14
4.57	Road	15
4.50 4.09	Water for Consumption Sports	16 17
3.88	Access of A Community's Financial Capital	18
3.73	Water for Agriculture	19
1.76	Water Quality	20
1.40	Afforesting	21
1.30 1.21	Environment Management Free from Addictive Drug	22 23
1.15	Social Protection	24
1.06	Products from Farms	25
1.02	Products from Other Agriculture	26
0.95	Land Utilization	27
0.95	Products from Rice	27
0.88	Benefits from Tourist Attraction	29
0.69	Working in Establishment	30
0.58	Further Studying beyond Regulation (Over Grade 9)	31

Conclusion

Referring to Table 2, the factor which has the most impact to Malaysian rural village development is "Land Possession" (17.88%), the first runner-up is "Electricity" (15.35%), the second runner-up is "Communication" (14.02%), the third runner-up is "Educational Level" (12.06%), and the forth runner-up is "Household Industry" (10.57%). "Land Possession" has played the most important role in Malaysian rural development. This suggests that Malaysian government should keep on providing the title deeds or certificates of land ownership for agriculture to poor people in rural areas by Agricultural Land Reform Office (ALRO) established in 1975. Moreover ALRO has worked on this mission until present. Furthermore, when consider "Natural Resources and Environment Category", "Soil Quality" has significantly more impact to Malaysian rural development than others. This corresponds to "Land Possession", the 1st rank. It seems that the government should make policies for people to possess their land first. Because the findings show that it is more important than the quality of soil improvement and land utilization. The 2nd and 3rd impact factors, "Electricity Access" and "Communication Technology Access", which are related to information systems and technology, have slightly less impact. It seems likely that the information and communication technology (ICT) nowadays play a very important role in developing rural areas as well as urban areas. ICT helps provide useful information, news and knowledge to people which are the key capital of community development. So it seems very worth for the government to keep investing in ICT for covering all areas of Malaysia. The 5th, 6th, 8th and 11th impact factors, "Household Industry", "People Assembly", "Community Participation", and "Getting a Job", are classified into "Employment Category" mixed with "Community Strength Category". This finding could guide the government to promote grouping and participating of people and support them to make their household goods/products or jobs at the same time for earning their living. Owing to "Educational Level" is ranked 4th. So

the government should pay more attention to educational policies to continually support and gain people's opportunities and accesses into all supported educational systems. From the study, the findings show that 2 methods of prioritization referred in this study, either Statistical Frequency Distribution Analysis or ANN gives different results and different views. Statistical Frequency Distribution Analysis shows the number of villages which passed and failed. On the other hand, ANN shows how much impact of each factor. From now, the government or a policy maker should consider these results both in term of frequency and impact. Some problems might have been found in many villages (high frequency), but they have caused small impact to those villages. In contrast, some problems might have been rarely found (low frequency), but they have caused much impact to those villages.

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