Assessing the effects of socio – economic factors on agricultural land use in Malaysia

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ABSTRACT

A study is conducted to investigate the effects of socio economic factors on agricultural land use in Malaysia. Relevant socio – economic variables (from 1965 to 2007) were aggregated from the databases of various international and national agencies. These data include agricultural and non agricultural land uses, Gross Domestic Product (GDP) & Gross National Product (GNI); labour force, population age distribution, numbers of cars per 1000 people; road density. GDP/capita & GNI/capita, labour efficiencies ie (ha/worker in agricultural subsectors), percentage of male and female in the agricultural labour force and % change in outputs of major crops were derived from relevant data. Data were then subjected to multiple linear regression analysis using SPSS version 18. Findings indicated that, relevant socio – economic factors in agricultural land use in Malaysia are available workforce of the population, percentage of workers engaged in plantation farming, female workforce in agriculture, farm size and the workers condition of service in non - agricultural sector. This study has revealed that labour supply and their conditions of service are major factors in agricultural land use. This study further underscores the need for technology – driven - agricultural practices in the face of better posited industries competing for available labour.

Introduction

Malaysia is divided into three main regions: Peninsula Malaysia, Sabah and Sarawak. Fig1. The neighbouring countries are Thailand and Brunei on the north and Singapore and Indonesia on the South.

Fig. 1 Geographical location of Malaysia in relation to her Asian neighbours

Climatically, Malaysia, experiences heavy rainfall of about 2,540 to 5000mm per annum (Dale 1959; Andriesse l968). The average daily temperatures and relative humidity are 21 - 32°C and 85 percent respectively (Nieuwolt et al. 1982). Anon (1992) found that the topography of Peninsular Malaysia is characterized by the central mountain ranges running from north to south.

Malaysian soils are acidic and highly weathered ultisols and oxisols (IBSRAM 1985) of characteristically low pH (3.0 - 4.5); low base saturation; low Nitrogen, Sulphur, Molybdenum and Boron, Copper and Zinc (Nieuwolt et al. 1982). Malaysia has a land area of 32.98 million ha with approximately 15.56 million ha (47 percent) of the land being arable. Of this arable land, Peninsula Malaysia has 8.10 million ha, Sarawak has 5.31 million ha while Sabah has 2.15 million ha (Figures 2a & 2b).
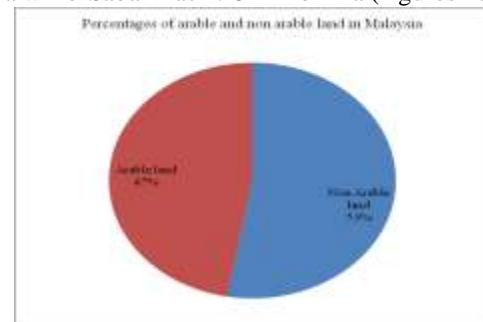

Figure 2a: showing percentages of arable and non – arable lands in Malaysia
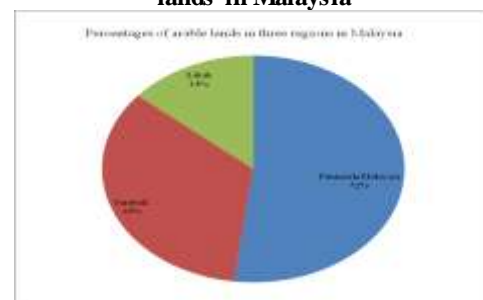

Figure 2b: showing percentages of arable and non – arable lands in Malaysia

Malaysian agricultural sector has contributed significantly to the economic development of the country. For instance before the country's independence in 1957, it is the major source of

income, employment and foreign exchange earner basically in the production of rubber, timber, rice , cocoa and later oil palm. (Tables 1, 2 Fig 3a & 3b). But from 1970 till date the contribution of agriculture to the economic development of the country dropped significantly. For instance, Murad, et al. 2008 found that the contribution of agriculture to the national GDP dropped in the 1980 – 1990 from 22.9% to 18.7% and later to 13.6% in 1995. Also the contributions of agriculture to employment fall from 39.7% in 1980 to 27.8% in 1990. Comparatively, agricultural contribution to the GDP decreased from 8.8% in 2000 to 8.2% in 2005. Currently, agriculture is the third engine of growth next to manufacturing and service sectors Table 2 & Fig 3b.
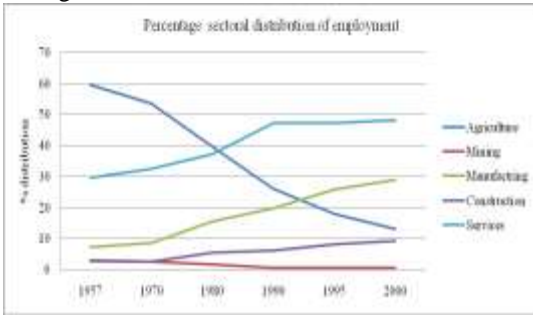

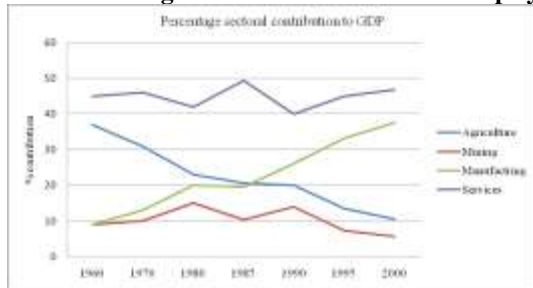**Figure 3a: Perentage sectoral distribution of employment**

Figure 3b: Perentage sectoral contribution to GDP

Murad et al, 2008 found that during the 9th Malaysian Plan (2006 – 2010), Malaysian agricultural sector achieved higher rate of growth than targeted and contributed to the economic growth and export earnings. In fact Malaysian agricultural sector had been helpful in national development by creating employment, alleviating rural poverty and reducing export deficit.

However, since 1991, there has been inter - crops and inter - sectoral competition for land use meaning there have been changing land use between different crops and sectors of the economy to the extent that the future food security of the country is becoming threatened (Lim and Chan 1993; Department of Agriculture DoA 2003).   For, instance, projection of the land use change by the DoA 2003 for 1985 to 2010, as shown in Table 3 and Fig 4, indicated that the land use by rubber, cocoa, coconut and paddy has been reducing while the corresponding land use by vegetables and fruits have been increasing. These land use change have been motivated by change in the population's taste, income and improved standard of living (DoA 2003).

Land use LU is a result of the complex interaction between human and biophysical driving forces that acted over the spatio temporal scales (Verburg, et al. 1999). While it is easy to measure LU at a given site and relating this to their spatio - temporal drivers, it is however, difficult to aggregate these changes at a regional or global scales because aggregated assessments obscure the variability of geographical situation and

lead to underestimation of the effects of LU for certain region and groups of populations (Verburg, et al. 1999).
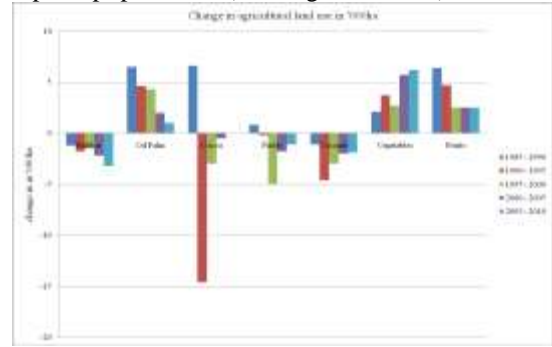

Figure 4: Agricultural land use change in Malaysia from 1985 - 2010

Land use and cover changes cannot take place independently but have certain linkages with the human activities that drives them (e.g., climate change). Understanding the dynamics of land use change has increasingly been recognised as one of the key research imperatives in global environmental studies (Lambin et al. 1999; Geist et al. 2001) for monitoring of the process of land use change (Lambin et al. 2000; Serneel et al. 2001; Wu et al. 2001). This task could be achieved by a statistical modelling, 'Panel analysis', which links the changes in dependent variables (land use changes) during a certain interval of time with the changes in independent variables (human activities) in the corresponding interval of time across a large number of localities (Lambin 1994; Kok and Veldkamp 2000; Wright and Samaniego 2008). This analysis postulates a linear relationship between the dependent and independent variables. This relationship can be expressed mathematically as follows (Kleinbaum et al. 1976 and 1998; Lambin 1994):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \dots\dots\dots\dots\dots 1$$

where:

Y is the dependent variable,

$X_1 \dots\dots X_n$ are the independent variables,

β_0 is a constant

βn are regression coefficients and

ε is the random error component.

The adjusted coefficient of determination is a measure of the amount of variation in land use type that can be explained by the independent variable (driving factors). The coefficient of the individual variables indicates the relative importance of the variable in explaining the percentage of a land use type relative to the other variables.

To date, few studies have been conducted on land use and its potential driving forces in Malaysia (Othman et al. 2009; Kamaruzaman 2009). The existing works were carried out on small study area thereby making the generalization of their findings for entire Malaysia unacceptable. This study is, therefore, conducted to take a country - wide look at the socio - economic variables affecting agricultural land-use in Malaysia in order to gain a better understanding of the factors and thus provide essential knowledge for taking appropriate policy actions in achieving sustainable agricultural land use and thus food security in the study area.

Land use change

The studies of land use dynamics make important research in the academic and political circles. For instance, the study of

implication of agricultural land use (ALU) change is very crucial in that, if the amount of land to be converted to non agricultural uses under the expected economic and population growth is too high, a threat to food security may occur. (Brown 1995; Xiangzheng et al. 2009).

Human use of land for cropping, forestry and residential purposes affect the structure, functioning and the interactions between ecosystems components and is capable of causing global environmental change and threats to global food security (Vitousek et al. 1992; Brown 1995; Turner et al. 1994). Modeling of the land use change taking cognizance of the socio-economic drivers provides opportunity for exploring the extent and location of land use and its effects (Verburg et al. 1999).

Drivers of land use change

Several literatures exist on the proximate and underlying drivers of land use and land use change processes (Cunha da Costa R 2004; Xie et al. 2005; Wassenaar et al. 2007; Busch 2006; Lambin et al. 2001; Burgi et al. 2004; Farrow and Winograd 2001). Five major types of driving forces that influence landscape development have been identified by (Hesperger and Burgi 2007; Verburg et al. 2004; Geist and Lambin 2002) as follows: - natural: soil characteristics and drainage conditions; - socio-cultural: demography, lifestyle and historical events; - economic: market structure, accessibilities and consumer demands; - political: policies e.g. nature conservation and infrastructure development; - technological: mechanization,

Population Growth

Population distribution and associated demographic are considered important factors affecting land use distribution. Population growth has been cited severally as one of the underlying factors of land use and land cover changes (Turner et al. 1993; Heilig 1994; Bilsborrow and Okoth - Ogondo 2005) because of the need to supply food, provide infrastructures and housing for the teaming population. This will lead to the development of new townships in fallow land around the existing cities (Mahapatra and Kant 2005) thus causing cropland encroachment on forestland and related natural resource degradation (Yin and Li 2001). Population parameters are commonly expressed by sex, age structure and distribution, location and activities distribution, literacy level, mortality and fertility rate and dependency ratio etc.

Agricultural Growth

Growth in agricultural production in developing countries is either accomplished by expansion of the agricultural areas or intensification. Barraclough and Ghimire 1995; DoA 2003; Wunder 2000; have identified commercial agriculture, farm settlement schemes, cattle ranching and shifting cultivation as the major drivers of agricultural land use in Malaysia. (Firman 199; Seto and Kaufmann 2003). This variable is captured by specifying the amount of land use per agricultural activities relative to non – agricultural uses, the physico – chemical characteristics of the sites and investment in agricultural activities.

Economic Growth

Theories have been postulated that economic growth is capable of having either positive or negative influence on natural resources degradation. For instance, if the economy is stagnating, people tend to explore land resources wantonly for immediate survival (Limey 1997; Myrdal 1957 and Brundtland 1987) In other cases, economic growth may create land intensive activities whereby increase in income will reduce human

pressure on land use (Angelson 1999; Rudel and Roper 1997) or otherwise, increasing income can increase the demand for agricultural and forest products vegetables and fruits because of change in taste (Kant and Redntz 1997). This will lead to the expansion of the agricultural land (Mahapatra and Kant 2005). So it is difficult to predict precisely the effect of increasing income on agricultural land use except a study of a particular situation is conducted so as to be able to explain the effect of growing or stagnating economy on agricultural land use and land use change. The effects of economic growth on land use analysis is usually expressed by the use of variables such as GDP or GNI per capita and the percentage change of GDP and GNI per capita over time, budgetary allocation to agriculture, contribution of agriculture to national economy.

Labour Dynamics

Urbanization can be perceived as a break from Malthusian dependence on natural resources to a less dependence on natural ecosystem and the start of modern economic growth (Lucas, 2000). This further entails a variety of structural changes, such as rising productivity, sectoral shifts in employment, output, expenditure, and demographic transition to aging population, decreasing mortality and fertility (Kuznets 1973; Williamson 1988). Economic growth initiates urbanization which further results to the release of worker from farm activities to non-farm activities and thus have great implication for agricultural land use. Therefore, in land use analysis labour related variables are capture in form of the ratio of labour engaged in, the return per unit labour, in farm and non - farm activities.

Road Development

Road development has been considered as an important factor in land use and land cover change and therefore lead to the acquisition and usage of land areas along the fringes of the roads which might hitherto undeveloped before the road was constructed (Schneider 1995). The opening of new roads results to increased accessibility, reduction in transportation cost and land speculation. Road density (km road per km^2 land mass) is variable commonly used to capture the effect of this variable in a land use analysis.

Methodology

The methodology adopted in the research is shown graphically involve the use of linear regression analysis in SPSS version 18 to identify the main drivers of land use change in the study area. The country-level discrete land use data were collected and applied as dependent variables while .Studies on land use and land cover changes have applied land use data as either quantitative (absolute land area under different uses – discrete variable) and qualitative variable (as a percentage of every land use type over total landmass - continous) source. In this study, land use data were taken applied as a continous variable by determining the percentage change in the land use types over time (1965 -2007). The reason for this is to make comparison between different land use types over time. Data on various land use types in Malaysia were obtained from the database of the FAO Statistics Division (FAOSTAT 2004), the Global Forest Assessment database (FAOSTAT 2001) and the Global Land Cover Facility (GLCF 2002). Percentages change of land use for permanent crops (oil palm, cocoa, coffee, rubber, fruits), permanent pasture, arable crops (rice, tobacco) were calculated from their respective land use data. The socio – economic data were obtained from the Malaysian Department of Statistics from 1965 to 2007. The percentage changes in the respective socio-economic data (Table 4) were computed and

were applied as independents variables. The list of socio – economic data employed in this study is shown in Table 4.

In empirical land use analysis, spatial autocorrelation (Anselin 2002; Munroe et al. 2002) due to land tenure structure, imitation among farmers (Verburg et al. 2004) and multicolinearity between drivers of land use will be minimized by applying stepwise regression analysis to select the most relevant variables from a set of hypothetically relevant variables and any variable that shows signs of multicolinearity were removed from the regression equation (Kok and Veldkamp 2000).

First, the most important land use drivers (independent variables) for different land use types (dependent variables) are selected from a set of hypothetically important variables by means of stepwise regression. The selected significant variables are then used to construct multiple regression models.

Multiple regression models were built to interactively minimize collinearity among the independent variables in the final model. Independent variables with the least significant regression coefficients (largest P-values) were then successively removed. Collinearity was evaluated when all remaining regression coefficients were significant. If collinearity was present, multiple regression models was compared for all possible combinations of the collinear independent variables and selected the final model to minimize collinearity (all condition indices < 15) and maintain the adjusted squared multiple R. Of these models, the adjusted coefficient of determination is a measure for the amount of variation in the agricultural land use type that can be explained by the respective independent variable. The standardized betas of the independent variables indicate the relative importance of the variable in the explanation of the land use type relative to the other variables (table 5).

Results and Discussion

The results of the multiple linear regression of the dependent variables (ALU) on the independent variables (SEF) are presented in the Table 5. The result clearly indicated that there is very high correlation between respective (ALU) and their SEF. For all the (ALUT) considered, the adjusted R^2 is between 0.691 and 1.000 indicating that the SEF considered adequately explained the dependent variables.

From Table 5, ALU is found to be negatively correlated with workers on rubber plantation. This implies that as rubber plantation increases, workforce for other ALU decreases and this equation suggest that labour are being released from rubber plantation into other agricultural practices particularly now when the cultivation of rubber is no longer popular with Malaysian government. In order to underscore the importance of labour scarcity in plantation agriculture, report from DoA 1998 made a projection on the likely effects of labour scarcity in agricultural production in Malaysia. The report indicated that between 1998 - 2010 about 400,000 hectares of agricultural land were idle and about 300,000 hectares of rubber holdings were untapped and 30,000 hectares of oil palm were not fully harvested. The reason for this is not far deduced. The analysis of the returns of labour in manufacturing and agricultural sector under the same working hour indicated that a unit man-hour in the manufacturing sector has a higher return than in the agricultural sector. For instance, it had been documented that a man-hour labour productivity in agriculture is only about 60 per cent of the labour productivity in the manufacturing sector (DoA 1998). Moreso projection by the

NAP3 indicated that the total workforce in agriculture will decline from 1,524,000 workers in 1995 to 930,000 in 2010.

$$Y_1 = 8641.379 - 19.135 \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2) \ (0.933)$$

The regression estimate of oil palm plantation is positively correlated with the age strata of the population (above children category that is the working class category) implying that working class of the population is a crucial factor in oil palm land use.

$$Y_4 = -1.09E7 + 843.995 \ X_3 \ldots \ldots \ldots \ldots \ldots \ldots \ldots (5) \ (0.983)$$

Furthermore, the regression estimate of permanent crop shows that permanent crop is positively correlated with agricultural area. Indicating that the permanent crop will occupy 70.1% of every new agricultural area cultivated. There is the need to address this trend of growing permanent crops to the detriment of food crops. This trend has been identified as the cause of rising food import bill (DoA 1998). Though it has been found that it is economical for Malaysia to import food (rice) however, it will be dangerous for a country to over – depend on importation for her food supply particularly that the global supply is limited with competition among buyers and uses.

$$Y_2 = 239.542 + 0.701 \ X_2 \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3) \ (0.999)$$

The regression estimate of forestry shows that forestry is positively correlated with workers on rubber plantation. This is an indication of the successful practice of agro – forestry between rubber and forestry. For instance, Ahmad 2001 and Awang et al. 2010 found that the National Agricultural Policy 3 progamme by the government of Malaysia has as one of its main objectives the promotion of agro forestry between forest trees, rattan, bamboo and medicinal plants with cultivated crops such as rubber and oil palm. Moreso there is a consensus among the scientific communities that categorized some tree crops such as rubber oil palm as a forest crop.

$$Y_3 = 5417.212 + 9.968 \ X_1 \ldots \ldots \ldots \ldots \ldots \ldots \ldots (4) \ (0.786)$$

The regression estimate of oil palm shows that oil palm output is positively correlated with the age distribution of the population is an indication that most people in oil palm plantation are in the last category of age of age group in the population.

$$Y_8 = -7834528.7 + 194674.401X_3 \ldots \ldots \ldots \ldots \ldots \ldots (12) \ (0.993)$$

The economic activities of the present elderly cohort still mirror the past economic structure of Malaysia, in which agriculture was the major sector providing the greatest number of jobs and 62 per cent of older persons worked in the agricultural sector (1991 Census).

The regression estimate for cocoa plantation showed that cocoa cropping is positively correlated with workers on cocoa plantation an indication that labour force play a crucial role in cocoa farm land use. Although it is recognized that labour force participation generally declines as age increases. Yet, the economic activities of the present elderly still mirror the past, in which agriculture was the major sector providing the greatest number of jobs and 62 per cent of older persons worked in the agricultural sector (MDoS 1991).

$$Y_9 = 1508.251 + 6.699 \ X_6 \ldots \ldots \ldots \ldots \ldots \ldots \ldots (6) \ (0.963)$$

When all the selected socio – economic variables by stepwise regression analysis are imputed into the equation simultaneously as shown in the second column of Table 6, the result indicated that labour availability were identified a major factor in ALU in Malaysia as expressed in this relationship

$$Y_{17} = 0.181 + 0.002 \ X_{15} + 0.007 \ X_{16} - 0.409 \ X_{17} \ldots (13) \ (1.00)$$

The above result clearly indicates that ALU in Malaysia will continue to be a function of availability of labour but the return per every labour input in agricultural production

(productivity per labour in terms of RM/labour) will still influence the readiness of labour to be engaged in agricultural production given the competing non – agricultural labour use. This issue of labour scarcity have been impacting Malaysian economy since the time of colonial rule till that and that explains the reason why the government of Malaysia under strict supervision allow reasonable importation of immigrant labour of various categories

The regression estimate of rice output shows that rice output is positively correlated with ratio of women work force in total available labour is an indication women labour dominates rice farming in Malaysia and future land use in rice cultivation is greatly depend on available women in the agricultural labour.

$$Y_{10} = -4982786.79 + 1.771E7 \; X_7 \ldots\ldots\ldots\ldots\ldots\ldots(9) \; (0.925)$$

The regression analysis of the change in oil palm land use is positively related to the male population labour force. This clearly indicates that the change in oil palm farm is affected by the work force ratio of the population as expressed in the relation below:

$$Y_{13} = 0.000 + 33.049 \; X_{10} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(15) \; (0.855)$$

The regression analysis shows a negative correlation between changes in ALU with dependent age category. This shows that as category in dependent age group increases, the ALU decreases as expressed in the relation below:

$$Y_{14} = 0.402 - 0.258 \; X_{11} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(16) \; (0.592)$$

In the past, during the colonial era, the colonial masters had to organized a massive inflow of immigrant labour in order to meet production schedules in mining and plantation agriculture (Bussink, 1980). For example the data made available by the Ministry of Home Affairs through MDoS indicated that the percentage of foreign workers in the Malaysian workforce increased from 4.64% to 17.80 between 1999 to 2006 and the percentage of the foreign workers engaged in agricultural activities in 2006 is about 5% of the total work force in Malaysia.

The regression estimate of coffee output shows that coffee output is positively correlated with improved condition of service by workers in the country. With more labour getting employment in the industrial sector due to better condition of service, this stimulates greater demand for coffee bye product. The increase demand for coffee will stimulate the cultivation of more areas for coffee production. This finding is in agreement with evidence provided by the International Coffee Organization (ICO), 2008 that the Malaysian culture of coffee consumption has increased

$$Y_7 = -4.767E7 + 194674.401X_4 \ldots\ldots\ldots\ldots\ldots(7) \; (0.871)$$

The regression estimate of rubber plantation shows that rubber cultivation is negatively correlated with improved standard of living of the populace. This is an indication that as far as other potential users/competitors for labour are ready to offer better working conditions, there will continue to be reduction of labour engaged in rubber cultivation and hence reduction in rubber plantation farm land use. DoA 1998, identified that labour productivity in agriculture is only about 60 per cent of the labour productivity in the manufacturing sector implying intense competition between agriculture and the manufacturing sectors for labour demand.

$$Y_5 = 1249.825 - 2.700X_4 \ldots\ldots\ldots\ldots\ldots\ldots\ldots(8) \; (0.993)$$

The regression estimate of coconut output shows that coconut output is negatively correlated with the size of arable farmland is an indication of competition between coconut farm and arable farming with forestry plantation.

$$Y_6 = 867589.767 - 551.914 \; X_5 \ldots\ldots\ldots\ldots\ldots(10) \; (0.920)$$

The regression estimate of tobacco cultivation shows that tobacco output is negatively correlated with the size of rubber plantation is an indication of competition between rubber farm and tobacco farming for farmland.

$$Y_{11} = 304686.6 - 33.819X_8 \ldots\ldots\ldots\ldots\ldots\ldots(11) \; (0.926)$$

The regression analyses of the change in rubber farm show an insignificant relationship with road density. Indicating that the change in rubber farm is not affected by the road density in the country.

$$Y_{12} = 67.875 - 0.001 \; X_9 \ldots\ldots\ldots\ldots\ldots\ldots\ldots(14) \; (0.782)$$

However, the increase in road density increment in a country is an indication of increased development and of course standard of living which from this study has no significant influence on rubber production. The implication of this is that the respective agricultural areas have been gazette based on the agroecology of the area and it is only a political/policy change that can influence the change of such area into another use.

The regression analysis of the change in non - ALU indicates a negative relationship with ALU This is an indication of a serious competition between agricultural and non – agricultural land uses as expressed in the relation below:

$$Y_{15} = 0.158 - 1.906 \; X_{12} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(17) \; (0.951)$$

The regression analysis of the change in ALU indicates a negative relation with non - ALU as expressed in the relation below:

$$Y_{16} = 0.121 - 0.509 \; X_{13} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(18) \; (0.952)$$

This result is in agreement with the findings of Murad et al. 2008 who observed that there had been competition between agriculture and industrial and urbanization for land uses. For instance in their finding they discovered that more agricultural land had been taken for industrial, infrastructural and housing purposes. Murad et al. 2008 also observed that the trade protection being enjoyed by the manufacturing sector while agricultural sector enjoy non make it easier for the manufacturing sector to obtain credit whereas agricultural sector find a bit more difficult. This privilege enjoyed by the manufacturing sector has resulted to the persistent outflow of resources from agricultural sector to the manufacturing sector. Coupled with the fact that the manufacturing sectors are able to offer better conditions of service than the agricultural sector. NAP3 document summary indicated that Rubber, paddy, coconut and cocoa holdings are going to be reduced by 494,000, 303,000, 73,400 and 30,700 hectares respectively and their reduction will be taken over by agro forestry, oil palm, fruits and vegetable cultivation.

Conclusions

The socio – economic factors SEF affecting agricultural land use ALU in Malaysia has been investigated with the use of regression analysis. The study underscores the importance of availability of labour in ALU in Malaysia and intensive cultivation of tree crops at the expense of food crops. The new approach for increased agricultural and food production in Malaysia is through intensification of production and application of science and technology. Moreso, efforts should be geared at increasing the productivities of the smallholders farmers by encouraging group farming.

Application of technology for the successful cultivation of marginal lands. The efforts at encouraging migrant labour from neighboring countries should be concretized and permanent food production zone should be identified and gazzetted while the

introduction of Agro-Technology Parks such as mechanized operations, precision control of inputs should be accelerated.

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Table 1: Percentage sectoral distribution of employment 1957 - 2000

	1957	1970	1980	1990	1995	2000
Agriculture	59.6	53.5	39.7	26.0	18.0	13.1
Mining	2.8	2.6	1.7	0.6	0.5	0.5
Manufacturing	7.4	8.7	15.7	19.9	25.9	28.9
Construction	3.2	2.7	5.6	6.3	8.3	9.3
Services	29.7	32.5	37.3	47.2	47.3	48.2

Source: Jomo 1990 and Bank Negara Malaysia Annual Report, various issues

Table 2: Percentage sectoral contribution to GDP 1960 - 2000

	1960	1970	1980	1985	1990	1995	2000
Agriculture	37	31	23	20.7	20	13.6	10.5
Mining	9	10	15	10.4	14	7.4	5.7
Manufacturing	9	13	20	19.6	26	33.1	37.5
Services	45	46	42	49.3	40	45	46.8
GDP	100	100	100	100	100	100	100

Source: Jomo 1990 and Bank Negara Malaysia Annual Report, various issues.

Table: 3 Change In Agricultural Land Use In Malaysia From 1985 – 2010 ('000ha)

Period	1985 - 1990	1990 – 1995	1995 - 2000	2000 - 2005	2005 - 2010
Rubber	-1.2	-1.8	-1.5	-2.2	-3.2
Oil Palm	6.5	4.6	4.3	2	1
Cocoa	6.6	-14.6	-3	-0.5	0
Paddy	0.8	-0.2	-5	-1.8	-1.1
Coconut	-1.1	-4.6	-3	-2	-1.9
Vegetables	2.1	3.7	2.7	5.7	6.2
Fruits	6.4	4.7	2.5	2.5	2.5

Source: Tunku M, Tunku YB. 2010.

Table 4: List of potential socio – economic factors affecting agricultural land use applied in the regression analysis.

Independent variables	Measured by
Agric area	% agric area of total land mass
Arable farm land use	% arable area of total agric area
Rubber, Forestry, Cocoa, Oil Palm, workers	
Rubber, Forestry, Cocoa, Oil Palm, efficiencies	
Cars per 1000 persons (condition of service)	
% change in agric land use	
% change in non agric land use	
% of forest land use	
% change in population of age group 0 -14 years old	
% change in population of age group 15 – 64 years old	
% change in fishery workers	
% change in non – agric workers	
% workers in primary industry	
% workers in secondary industry	
% workers in tertiary industry	
Age category	
Road density	
Population density	
Change in gross farm product per agric worker	
Change in gross farm product per unit farmland	
GDP	GDP/capita
GNI	GNI/Capita
Total Expenditure/year, Government expenditure/year, Private expenditure/year	

Table 5: Result of multivariate analysis of Socio – Economic Factors (SEF) of Agricultural Land Use (ALU) in Malaysia

Dependent variables	Final independent variables	Constant	Parameter Estimate	Std Error	Std coeff	df	F	Pr > F	Adj R²
Agric Land Use	Rubber workers	8641.379	-19.135	1.002	-0.97	1	364.637	0.000	0.933
Permanent crops	Agric area	239.542	0.701	0.01	1.000	1	4953.421	0.000	0.999
Forest (ha)	Rubber worker	5417.212	9.968	2.266	0.910	1	19.351	0.012	0.786
Oil palm (ha)	Age >/= 15yrs	-1.097E7	843.955	38.606	0.996	1	477.902	0.000	0.983
Rubber (ha)	Workers condition of service	1249.825	-2.700	0.101	-0.997	1	714.137	0.000	0.993
Coconut output	Arable farm land	867589.767	-551.914	106445.543	-0.965	1	54.739	0.002	0.920
Coffee output	Workers condition of service	-4.767E7	194674.401	32957	0.947	1	34.891	0.004	0.871
Oil palm output	Age above sixty five	-7834528.7	19511.8	803.7	0.997	1	589.363	0.000	0.990
Cocoa output	Cocoa area	1508.251	6.699	27255.470	0.985	1	132.693	0.000	0.963
Rice output	Female employed/labour force	-4982786.790	1.771E7	3423274.262	0.933	1	26.755	0.007	0.925
Tobacco output	Rubber farm land	30468.6	-33.819	1930.308	-0.974	1	74.952	0.001	0.926
Change in rubber farm	Road density in Malaysia*	67.875	-0.001	0.000*	-0.909	1	18.960	0.012	0.782
Change in oil palm farm	Male labour force	-	33.049	7.116	0.937	1	36.244	0.002	0.855
Change in agric land use	Change in pop of 0 - 14	0.402	-0.258	0.099	-0.821	1	8.252	0.045	0.592
%change in non- agric LU	% change in agric LU	0.158	-1.906	0.192	-0.985	1	98.644	0.002	0.951
% change in agric land use	% change in non agric area	0.121	-0.509	0.051	-0.985	1	98.644	0.002	0.952
Change in Agric Land Use including all the variables into the equation at once	% change in fishery workers	0.181	0.002						1.000
	% change in RM/workers		0.007						
	% change in non – agric workers		-0.409						

Table 6: Significant Socio – Economic Factors (SEF)) affecting Agricultural Land Use (ALU) in Malaysia

Dependent variables	Independent variables	Regression Method
Y_1 = Agricultural land use	X_1 = Rubber workers	stepwise
Y_2 = Permanent crops land use	X_2 = Agric area	"
Y_3 = Forest land use	X_1 = Rubber worker	"
Y_4 = Oil palm	X_3 = Age category	"
Y_5 = Rubber	X_4 = Cars per 1000 persons (condition of service)	"
Y_6 = Coconut output	X_5 = Arable farm land	"
Y_7 = Coffee output	X_4 = Cars per 1000 persons (condition of service)	"
Y_8 = Oil palm output	X_3 = Age category	"
Y_9 = Cocoa output	X_6 = Cocoa area	"
Y_{10} = Rice output	X_7=Female employed/labour force	"
Y_{11} = Tobacco output	X_8 = Rubber farm	"
Y_{12} = Change in rubber farm	X_9= Road density	"
Y_{13} = Change in oil palm farm	X_{10} = Male labour force	"
Y_{14} = Change in agric land use	X_{11} = Change in working population	"
Y_{15} = %change in non- agric area	X_{12}= % change in agric area	"
Y_{16} = % change in agric area	X_{13}= % change in non agric area	"
Y_{17} = Change in agric area	X_{15} = % change in fishery workers	enter
	X_{16} = % change in RM/workers	
	X_{17} = % change in non – agric workers	