United Nations (UN 2006) and various documentations in Microsoft Encarta Encyclopaedia 2005 CDROM. The data set include national / regional aggregate agricultural resource use including agricultural land area, economically active population in agriculture, total fertilizer use, tractors in use, stock of livestock and agricultural area under irrigation, which were extracted from FAOSTAT.

Data on agricultural GDP, total GDP, import and export, gross capital formation, and government consumption, all in 1990 constant US$, were extracted from the national accounts main aggregate components of the UNSTATS. Information on per capital GDP, literacy level, life expectancy at birth and other indicators of socio-economic wellbeing were extracted from the United Nations-Millennium Development Goal Report 2006. Supplementary historical information on each country / region such as time of independence, colonial affiliation, forms of government in power at various times, incidences of war and political conflicts, among others, were extracted from documentations in Microsoft Encarta Encyclopaedia 2005. The complete data set could only be extracted for the period 1970 – 2004, and only these were used in subsequent analyses.

Methods of Data Analysis

The study data were analysed by a combination of descriptive and econometric techniques. Agricultural labour productivity (ALP) of each country in each year between 1970 and 2004, was computed as the real agricultural GDP in 1990 constant US$ divided by the economically active population in agriculture in that year. This provides the basis for the results of the descriptive analysis. The mean ALP of each country over the various decades between 1970 and dates were then computed and compared to establish the trends in ALP for each country, as well as compared with the average situation in other tropical sub-regions.

$$ALP = \frac{Real\ Agric.\ GDP}{Active\ Agric.\ Population}$$

The influence of various factors (capital accumulation, institutions and political) on ALP were then examined by specifying and estimating an ALP model, in which ALP was expressed as a function of a number of variables hypothesised in growth accounting literature (e.g. Majid, 2004) as driving labour productivity. The details of the variables and their measurement are summarised in Table 1. Two variants of the model were estimated. One was a full one-step regression model in which ALP was regressed against all the variables in Table 1. The second was a stepwise regression model, in which only significant variables were allowed to enter the model in a stepwise manner, in order to determine their relative importance in determining ALP in the West African sub-region.

RESULTS AND DISCUSSIONS

Patterns of Agricultural Labour Productivity

The central theme of this study has been to analyse the patterns and determinants of agricultural labour productivity and productivity growth in the West African sub-region, and compare their cases with what obtains elsewhere within the tropics. Table 2 presents the average agricultural GDP per economically active person employed in the agricultural sector in each decade between 1970 and 2004. It reveals that as much as eight of the 16 West African countries had average labour productivities that were lower during 2000-2004 period,

than the average they started with during the 1970s. These include Cote d'Ivoire, Gambia, Ghana, Guinea-Bissau, Liberia, Niger, Senegal and Togo. It therefore implies that an average farmer in these countries was poorer in 2000-2004 than they were during the 1970s. Similar evidence was also found in the case of an average country in the Central Africa sub-region and the Caribbean, while the case in Eastern Africa can only be described as stagnation.

Unlike the cases in the tropical sub-regions in Africa, results on Table 2 show that substantial growth in labour productivity was recorded by Malaysia in the South-east Asia, Brazil in South America and by an average country in Central America. Malaysia (representing the case in South-east Asia) consistently maintained the highest average agricultural labour productivity in the tropical region over the entire four decade, while Cote d'Ivoire, and much lately Cape Verde (2000-2004), maintained agricultural labour productivity leadership in West Africa.

Table 1: Variables in the labour productivity model

Variable	Explanation / Measurement
Dependent Variable	
ALP	Agricultural labour productivity measured as agricultural GDP per worker in 1990 US$
Explanatory Variables (a-priori sign)	
TRADE (+)	Degree of openness measures as aggregate exports plus imports expressed as a percentage of the GDP (%)
GOVCON (-)	Government consumption expressed as a percentage of the GDP (%)
SAVINGS (+)	Gross capital formation expressed as a percentage of the GDP
IRRIGATION (+)	Proportion of agricultural area under irrigation (%)
TRACTORS (+)	Number of tractors in use per thousand of economically active population in agriculture
FERTILIZER (+)	Fertilizer use per thousands of workers (tonnes)
MILITARY RULE (-)	Dummy variable for military interference in governance, 1 if year of military rule in the reference country, 0 if otherwise
ONEPARTY RULE (-)	Dummy variable for civilian dictatorship, 1 if country is a one party state in that year, 0 if otherwise
HIGH LITERACY (+)	Dummy variable for human capital, 1 if reference country had adult literacy rate higher than 50% in 2004, 0 if otherwise
WAR (-)	Dummy variable for incidence of war, 1 if the country was involved in civil war or major conflict in the reference years, 0 if otherwise
ARID (-)	Dummy variable for location of country predominantly within the arid region; 1 if arid region, 0 if otherwise
FRANCE (+/-)	Dummy variable for colonial affiliation, 1 if France, 0 if otherwise
PORTUGAL (+/-)	Dummy variable for colonial affiliation, 1 if Portugal, 0 if otherwise.
US (+/-)	Dummy variable for colonial affiliation, 1 if US, 0 if otherwise.

Source: Data obtained from FAOSTAT (2006) and UNSTATS (2006) databases.

Table 2: Trends in agricultural labour productivity in West-Africa and other tropical regions

Country / Region	Average Agricultural GDP per Worker (1990-US$)				
	1970s	1980s	1990s	2000-20004	1970-2004
Benin	233.98	361.19	540.57	710.42	417.62
Burkina Faso	281.67	297.37	316.54	365.33	306.39
Cape Verde	846.48	1,021.05	1,067.48	1,431.25	1,031.62
Côte d'Ivoire	1,409.19	1,274.10	1,212.40	1,219.16	1,289.22
Gambia	282.64	233.58	196.63	230.93	236.83
Ghana	937.75	750.86	707.46	764.56	794.67
Guinea-Bissau	286.67	214.70	279.69	273.61	261.91
Guinea	195.63	198.62	208.28	244.13	205.94
Liberia	807.02	645.44	248.65	453.27	553.65
Mali	300.48	279.20	331.65	352.68	309.53
Mauritania	496.61	475.18	555.91	577.35	517.25
Niger	327.54	356.29	297.03	292.69	322.92
Nigeria	625.25	571.61	721.18	868.07	666.25
Senegal	522.17	439.58	417.40	395.25	452.13
Sierra Leone	175.29	208.58	225.52	208.37	203.75
Togo	683.54	543.20	429.22	417.31	536.14
W. Afr. Average	525.74	491.91	484.72	536.52	506.61
Brazil	1,049.57	1,573.91	2,313.06	3,279.47	1,837.74
Caribbean	1,313.74	1,479.33	1,248.34	1,274.59	1,338.60
Central Africa	463.36	438.54	369.22	395.31	420.37
Central America	1,700.26	1,898.88	2,083.51	2,355.46	1,948.48
Eastern Africa	229.42	212.32	229.99	249.91	226.97
Malaysia	1,766.24	2,634.14	3,538.79	4,092.55	2,816.52

Source: Computed from data extracted from FAOSTAT database (2006) and UNSTATS database (2006)

Determinants of Agricultural Labour Productivity

Having established the pattern of agricultural labour productivity and productivity growth in West African sub-region, it becomes necessary to identify variables that enhance labour productivity and determine their relative contributions. This objective was achieved through the use of multiple regression analysis. The results are summarised on Table 3.

Examination of the diagnostic statistics reveals that the two variants of the multiple regression equations performed quite well. The F-statistics were significant at $p<0.01$, while the adjusted R^2 values show that explanatory variables of the model explained about 79 per cent of the variation in agricultural GDP per worker in the study area between 1970 and 2003. Eleven out of the 15 explanatory variables were also found to be statistically significant ($p<0.01$).

The results agree, in most parts, with evidence in growth accounting literatures (e.g. FAO, 2000; Gutierrez, 2003). High literacy rates, increased in shares of GDP saved/

invested, increased tractor and fertilizer use and increase in proportion of agricultural land irrigated were revealed to be associated with significant increases in agricultural labour productivity; while military intervention in governance and adoption of one party state (civilian dictatorship) were revealed to be significantly associated with lower labour productivity in agriculture. The results also show that colonial heritage / affiliation of the countries as well as shares of government consumption expenditure in the total GDP are also significant determinants of labour productivity in West African Agriculture. Countries that were former colonies of France and Portugal, such as Côte d'Ivoire, Senegal, and Niger, were revealed to be associated with significantly higher agricultural labour productivity than the average country in the sub-region just as higher government consumption as a percent of GDP was revealed as raising agricultural GDP per worker.

In terms of their relative importance, high literacy rates was found to be the most important factor driving increased labour productivity in West Africa. This was followed by greater capital formation as well as increased fertilizer and tractor use, while incidence of one-party rule (civilian dictatorship) was found to be the least important variable among the variables that entered the final estimating equation. Increased labour productivity from increased fertilizer and tractor use could probably be due to the efficiency and increased marginal productivities of these factors even when their use are kept constant.

Table 3: Regression results on influence of various factors on labour productivity in West African Agriculture

	Full Regression		Step-wise Regression		
Variable	**B**	**T**	**B**	**T**	**Entry Order**
(Constant)	22.08	0.77	29.35	1.21	
TRADE	0.24	1.23			
GOVCON	2.77***	5.83	2.69***	5.87	7th
SAVINGS	4.59***	4.79	5.25***	6.38	2nd
IRRIGATION	14.43***	3.57	15.90***	4.09	5th
TRACTOR	193.54***	7.41	206.57***	8.42	4th
FERTILIZER	8.48***	6.44	8.16***	6.78	3rd
MILITARY RULE	-91.36***	-5.32	-91.08***	-5.41	8th
ONE PARTY RULE	-47.49***	-2.66	-48.20***	-2.78	11th
HIGH LITERACY	386.61***	18.00	386.77***	19.06	1st
WAR	26.45	0.62			
ARID	17.38	0.94			
FRANCE	143.05***	6.31	141.70***	7.86	6th
PORTUGAL	148.14***	3.83	140.16***	4.06	9th
US	-37.65	-1.21			
Trend	-2.28***	-3.08	-2.15***	-2.96	10th
F-value	140.28		191.92		
Adj. R2	0.79		0.79		

Source: Microsoft Encarta, 2005.
(p<0.01)

A few of the evidence in this study contradicts expectations in growth accounting literatures and/or evidence in some previous similar studies most especially Majid (2004)). According to him, theoretical and empirical evidence suggest that higher degree of openness, or open trade access, (proxied by the TRADE variable) is expected to be significantly and positively associated with higher productivity (Grossman and Helpman, 1991; Edward, 1998; Majid, 2004). This is because higher degree of openness is expected to allow smaller countries to absorb technology developed in advanced nations at a faster rate, and thus grows more rapidly (Gutierrez, 2003). Evidence on Table 3 shows however, that coefficient of TRADE variable (export plus import expressed as a proportion of the GDP), though positive was not significant. This is not unlikely to be a result of the type of commodities traded in, and the choice of trading partners. In Nigeria, for example, statistics in CBN (2004) shows that her export in 2004 was dominated by crude oil (96.4 per cent) while the nation's import in the same year consisted largely of consumer goods (46.2 per cent) and raw materials (29.7 per cent). Meanwhile, most of the nation's imports were from the industrialised countries (55.3 per cent) and the Asian Tigers (25.4 per cent), are based in the temperate regions. It is thus, not unlikely that commodities traded by most West African countries are not those that can benefit the farmers, either directly through access to foreign markets or indirectly through transfer of appropriate technologies.

Other important areas of departure of results in this study from evidence in previous studies relates to the influence of proportion of government consumption in the GDP and fertilizer use. While Majid (2004), against a-priori expectations, found coefficient associated with FERTILIZER to be negative, statistically significant, and thus difficult to interpret, results in Table 5 found significant role for increased access to fertilizer use in West African agriculture. Similarly, while coefficient of GOVCON (i.e. proportion of government consumption in the GDP) was found to be negative and insignificant in Majid (2004), results on Table 5 reveal the coefficient of GOVCON is positive and statistically significant. These results are in line with a-priori expectations, given that increased fertilizer use is expected to enhance yield and therefore, raise farm income and labour productivity. Governments fiscal operations, where appropriately focused, are also expected to raise labour productivity if it enables farmers to gain access to better infrastructure, better health services, and other institutional supports.

SUMMARY AND CONCLUSION

This study analyzed the pattern and determinants of agricultural labour productivity among countries in West African Sub-region. The main findings may be summarised as follows:

Eight of the sixteen West African countries had average labour productivities that were lower during 2000-2004 period, than the average they started with during the 1970s. These include Cote d'Ivoire, Gambia, Ghana, Guinea-Bissau, Liberia, Niger, Senegal and Togo.

Regression analyses reveals that labour productivity in West African agriculture is positively affected by higher degree of openness, increased in capital formation, increased tractor and fertilizer use, more irrigation, and

better educated workforce. However, military intervention in governance, adoption of one party state (civilian dictatorship) as well as incidence of war lowers labour productivity.

In terms of the relative importance of the labour productivity determinants, the study found that higher education was the most important factor, followed by higher capital formation and increased fertilizer and tractor use, while incidence of one-party rule was found to be the least important variable among the variables that entered the final estimating equation.

Against the above findings, the study concludes that substantial opportunities exist for increased labour productivity growth and income in West African agriculture. The following recommendations are proffered:

Governments in West Africa should intensify their efforts in providing basic education to their people. Adoption of free and compulsory education, at least up to secondary school level is particularly critical, while efforts at promoting adult education will be helpful.

Governments should provide support for increased private sector participation in the procurement and distribution of critical inputs like fertilizer, tractors services, etc. Provision of subsidy and possibly increased domestic production as against import, would also be helpful in the delivery of critical inputs to the farmers.

The present drive to promote peace and prompt conflict resolution by ECOWAS and African Union in the sub-region, as well as promotion of popular (multi-party) democracy, should also be intensified to ensure equality of opportunities and access to the nation's resources.

In order to achieve better productivity of labour in agricultural sectors of these countries, one should start looking for bottlenecks of productivity. The Governments should provide incentives or subsidies on fertilizer and tractors in order to encourage their use.

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