



Causes, Effects and Way Forward to Food Insecurity

¹I.R. Ilaboya, ²E. Atikpo, ³F.E Omofuma, ⁴F.F. Asekhame and ⁵L. Umukoro

¹Department of Civil Engineering, Faculty of Engineering,
University of Benin, PMB 1154, Benin City, Nigeria

²Department of Civil Engineering

³Department of Petroleum Engineering

⁴Department of Mechanical Engineering

⁵Department of Civil Engineering, General Abdulalami A. Abubakar
College of Engineering, Igbinedion University Okada, PMB 0006, Nigeria

(Received: June 17, 2011; Accepted: December 18, 2011)

Abstract: This paper examines some important causes and challenges of the global food crisis on human and economic development. The main focus is on analysis of the causes and impact of food insecurity coupled with the measures to achieve adequate food security. Attempt was made to give an overview of the fundamental threat pose by insecurity of food on the people; these include: a moral and humanitarian threat, developmental threat and strategic threat. Issues on the role of biofuels on food insecurity were also discussed. Data on grain production and consumption were collated, in which the surplus/deficit values were computed. The data were then subjected to statistical testing using the step wise regression model to ascertain the real effects of utilization of grains in biofuels production on the overall security of food. Result of the model shows significant effects of biofuels on food security. A mathematical model was also used to analyse the impact of food insecurity on the terms of trade of nations, data generated were also subjected to statistical analysis using the step wise regression model to ascertain the real effects of food insecurity on the terms of trade. Results also show a very high significant effect. Finally, the way forward in ensuring adequate security of food were critically analysed to include among others: Increasing agricultural production, enhancement of science and technology, facilitating market access, rural off farm opportunities and capacity building

Key words: Food security ; Food insecurity ; Sustainability ; Good governance ; Renewable energy programmes

INTRODUCTION

The global food and energy crisis is hitting with alarming speed and force, challenging both developed and developing economies prompting public/private agencies coupled with other international organization to respond with strategic and long term approaches [1]. The World Bank reports that global food prices rose 83% over the last three years and the FAO (2007) cites a 45% increase in their world food price index during just the past nine months [2]. The Economist's comparable index

stands at its highest point since it was originally formulated in 1845. As of March 2008, average world wheat prices were 130% above their level a year earlier, soya prices were 87% higher, rice had climbed 74% and maize was up by 31% [3].

The global food security crisis jeopardizes the lives of millions of people in vulnerable communities, particularly in Africa where poverty, malnutrition and death from hunger are rife [4]. The combined effect of spiraling food prices and a lack of health care could be catastrophic for the poor. The crisis could delay the

attainment of several health-related Millennium Development Goals [5]. In the developing countries, an estimated 13 to 18 million people, mostly children, die from hunger, malnutrition and poverty-related causes each year [6]. That is about 40,000 people a day or 1,700 people an hour. One billion people - 20 per cent of the global population - live in households too poor to obtain the Food necessary for sustaining normal work [7]. Half-a-billion live in households too poor to obtain the food needed for healthy growth of children and minimal activity of adults [8]. As the Bellagio Declaration on Overcoming Hunger in the 1990s states: In a world of potential food plenty, we have collectively failed more than one billion of our people [9].

Achieving food security in its totality continues to be a challenge not only for the developing nations, but also for the developed world [10]. The difference lies in the magnitude of the problem in terms of its severity and proportion of the population affected. In developed nations the problem is alleviated by providing targeted food security interventions, including food aid in the form of direct food relief, food stamps, or indirectly through subsidized food production [3]. These efforts have significantly reduced food insecurity in these regions. Similar approaches are employed in developing countries but with less success [11].

Fundamental Threats Posed by Food Crisis

Moral and Humanitarian Threat: Hunger, poverty and disease are interlinked and are direct result of lack of sustainable food supply / availability. Hunger reduces the natural defences against most diseases and is the main risk factor for illness worldwide. People living in poverty often cannot produce or buy enough food to eat and so are more susceptible to disease. Sick people are less able to work or produce food. The UN Standing Committee on Nutrition concluded that nutrition is an essential foundation for poverty alleviation and also for meeting MDGs related to improved education, gender equality, child mortality, maternal health and disease. Hunger is a major constraint to a country's immediate and long term economic, social and political development. The search for sustainable food has thrown man into acute deforestation which has resulted to serious environmental, climatic and health problems [3].

Developmental Threat: This is erasing the economic gains of the past decades, while putting at risk the recent historic investments in public health and nutrition, improved education and community development in poor

countries. Without effective action to reverse these trends, developing countries could see a disabled generation, stunted both physically and mentally and chronically in need of assistance [4].

Strategic Threat: This is endangering the stability of developing countries due to rising food prices and fuel prices. The surge in prices has reduced the purchasing power of poor people and inhibited the ability of poor countries to import food for their hard pressed population.

Causes of Food Insecurity: These include unstable social and political environments that preclude sustainable economic growth, war and civil strife, macroeconomic imbalances in trade, natural resource constraints, poor human resource base, gender inequality, inadequate education, poor health, natural disasters, such as floods and locust infestation and the absence of good governance. All these factors contribute to either insufficient national food availability or insufficient access to food by households and individuals [2].

Insufficient Production: The major challenge to food security in Africa is its underdeveloped agricultural sector that is characterized by over-reliance on primary agriculture, low fertility soils, minimal use of external farm inputs, environmental degradation, significant food crop loss both pre- and post- harvest, minimal value addition and product differentiation and inadequate food storage and preservation that result in significant commodity price fluctuation [3]. Ninety five percent of the food in Sub-Saharan Africa is grown under rain fed agriculture. Hence food production is vulnerable to adverse weather conditions [4]. Fig 1 below reveal that the continent of Africa particularly the central and south still have a long way to go in-terms of fruits and vegetable production. The overall effect of these is perpetual rise in poverty level in the entire continent of Africa (Fig 2).

Lack of Adequate Storage Facilities: Lack of adequate storage facilities for food items such as cereals, yam, beans etc automatically leads to wastage thereby plugging the people into acute hunger. The bible registered that for the seven years of plenty, Joseph stored one fifth of the total produce yearly, thus ensuring security of food in the entire seven years of lack (Holy Bible).

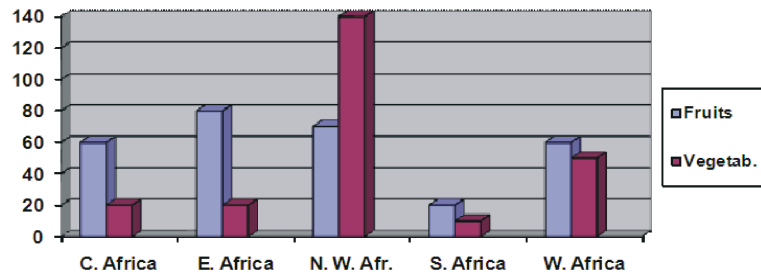


Fig. 1: Food Production in Africa-Primary Vitamin Sources

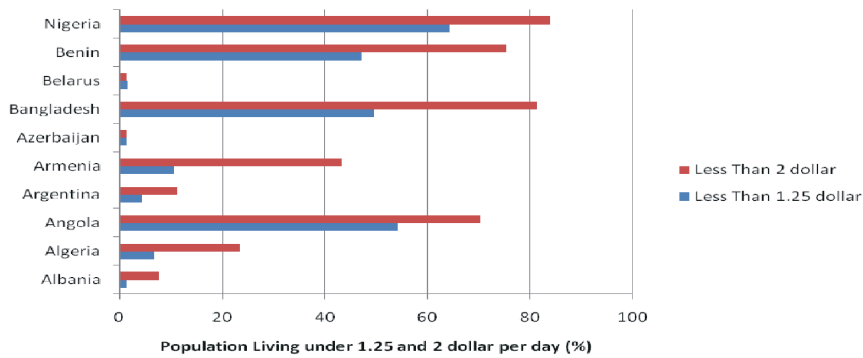


Fig. 2: List of Countries by percentage of population living in poverty: The table reveals that a very high proportion of Africa population are currently living below the national poverty line



Fig. 3: Food security needs adequate food processing technique to avoid wastage (Sources: New Benin market, Benin City; 2009)



Fig. 4: Land slide Affecting plants and people; (Source: Abandoned farm land in Benin City)

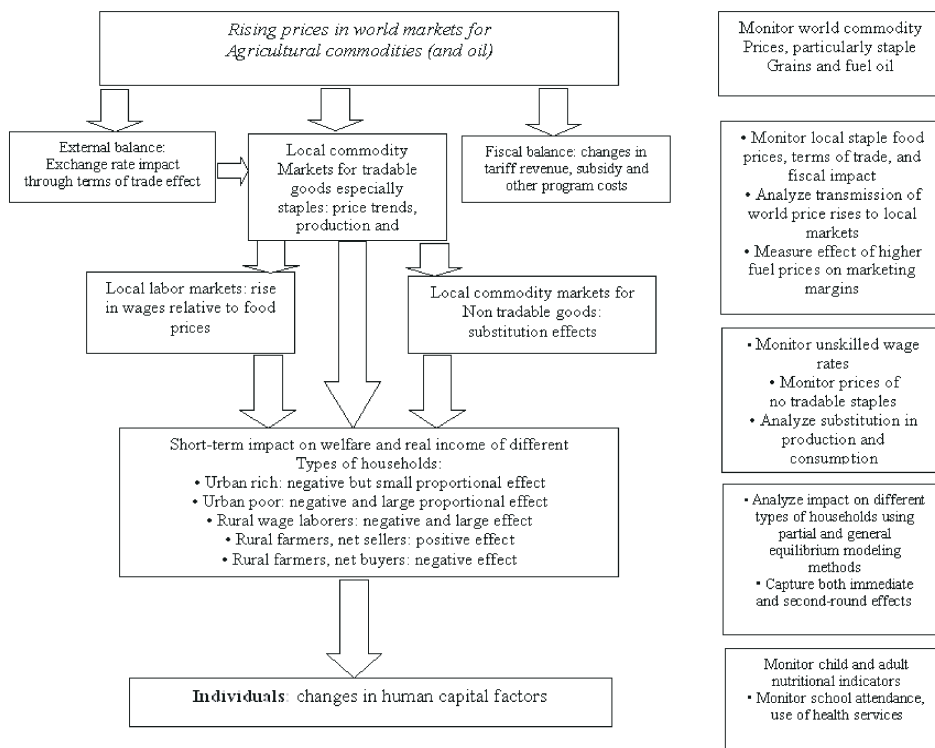


Fig. 5: Conceptual framework for understanding the welfare impact of food crises (Source: U.S. Department of Agriculture)

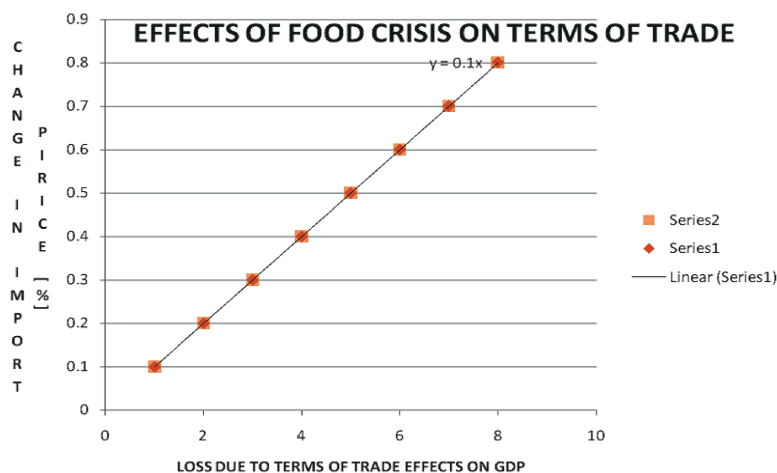


Fig. 6: Effects of Food Crisis on Terms of Trade

Inadequate Food Processing: This result in direct consumption of large portion of the harvest without taking into consideration what will happen in the near future. Processing refer to the transformation of agricultural produce such as citrus, pineapple, mangos and banana from their original form into another form for the purpose of consumption, sales or proper storage.

Processing prevents food that cannot be stored easily in their original form from wastage. It enables such food to be converted into another form that can easily be preserved. A very good example is the transformation or conversion of mangos, citrus and pineapple into fruit juice which can easily be preserved. Security of food requires that little or no wastage be allowed. Adequate processing

becomes very important if sustainable food security is to be achieved. Fig. 3 is a picture showing heaps of orange fruits in a particular market in Edo State, lack of adequate processing equipment will hinder the conversion of this fruits into fruit drinks which can easily be preserved and consumed when needed. The direct implications will be acute wastage and loss of value addedness.

Climate Change and Natural Disasters: Natural disasters and climate variability are major sources of vulnerability to food insecurity (Fig 4). They particularly affect those in countries that largely depend on rain fed farming and those highly dependent on agriculture. Examples of such natural disaster include drought and land slide. Poor people are also less able to cope with the impacts of climate shocks and variability. These events can result in massive crop losses, loss of stored food and damage to infrastructure and consequent increases in food prices. Degradation and declining productivity of agricultural soils are a serious threat to agriculture in many areas.

The Impact of Biofuels: Biofuels have forced global food prices up by 75% far more than previously estimated according to a confidential World Bank report obtained by the Guardian. Grain has been diverted away from food, to fuel; (Over a third of US corn is now used to produce ethanol; about half of vegetable oils in the EU goes towards the production of biodiesel); Farmers have been encouraged to set land aside for biofuel production; The rise in biofuels has sparked financial speculation in grains, driving prices up higher. The World Bank has also estimated that an additional 100 million more people have been driven into hunger because of the rising food prices. Another institute, the International Food Policy Research Institute (IFPRI) estimates that 30% of the increase in the prices of the major grains is due to biofuels. In other words, biofuels may be responsible for some 30-75 million additional people being driven into hunger (Guardian, July 2008.). Data on the production and utilization of grains for biofuels generation was collated as shown in Table 1 below:

According to Literature [6], turning food into fuel for car is a major mistake on many fronts. This is because the conversion of staple food grains, from corn to soya into fuel, so as to ensure continuity and stability of energy supplies to the world is resulting in unintended consequences.

Poor Policies and Uncontrolled Population: Poor policies have greatly affected food security in many countries and particularly Africa. The problem arises when the focus on policies, structures and institutions is put above that of the people themselves. When policies are not inclusive in their design they tend to handicap the exempted lot by providing barriers. When we fail to provide Safety nets for vulnerable groups, we doom them to destruction [6].

The Impact of Food Insecurity

Impact on Welfare: Agricultural and Food Markets Monitoring and Analysis

Terms-of-Trade Effects: One way to measure the terms-of-trade effect is to calculate the change in the value of net exports due to changing world price (assuming that the country maintains the same volume of imports and exports) as a proportion of the size of the economy. This effect can be calculated as follows [8]:

$$\frac{\sum x_i \left[\frac{\Delta P_i}{P_i} \right] - \sum m_i \left[\frac{\Delta P_i}{P_i} \right]}{GDP}$$

where :

x_i = The value of export commodity i

m_i = The value of import commodity i

$\left[\frac{\Delta P_i}{P_i} \right]$ = Change in the world price of import commodity i

GDP = Gross Domestic Product of the country

Consider a developing country with the following characteristics:

- Ⓒ Agricultural exports of US\$0.1 billion
- Ⓒ Agricultural imports of US\$1 billion
- Ⓒ GDP of US\$10 billion

As a simple example, if a country has agricultural exports of US\$0.1 billion, agricultural imports of US\$1 billion and a GDP of US\$10 billion, the terms of trade effect of a 50 percent increase in agricultural prices would be $(0.1 \times 0.50 - 1.0 \times 0.50)/10 = -0.45/10 = -4.5$ percent. Thus, the loss due to terms of trade effects is about 4.5 percent of GDP. Assuming 10, 20, 30, 40, 50, 60, 70 and 200% change in world price of import commodity due to

Table 1: World Grain Production and Consumption, 1991-2003 [million T]: Source: U.S. Department of Agriculture, Production, Supply & Distribution, Electronic Database, updated 9 April 2004.

Year	Production	Consumption (Biofuels generation)	Surplus or Deficit
1991	1,707	1,712	-5
1992	1,788	1,738	50
1993	1,712	1,741	-29
1994	1,756	1,766	-10
1995	1,710	1,747	-37
1996	1,871	1,813	58
1997	1,879	1,825	54
1998	1,875	1,835	40
1999	1,871	1,854	18
2000	1,838	1,855	-16
2001	1,870	1,898	-27
2002	1,819	1,910	-91
2003	1,827	1,932	-105

Table 2: Import and Export Relationship, (Source: Todd Benson *et al.* [8])

S/No	[] P _i /P _i]	Xi [US\$] [billion]	Mi [US\$] [billion]	GDP [US\$] [billion]	$\frac{\sum x_i \left[\frac{\Delta P_i}{P_i} \right] - \sum m_i \left[\frac{\Delta P_i}{P_i} \right]}{\text{GDP}}$	Loss Due To Terms Of
						Trade Effects on GDP
1	0.1	0.1	1	10	-0.9%	0.09 billion
2	0.2	0.1	1	10	-0.18%	0.18 billion
3	0.3	0.1	1	10	-2.7%	0.27 billion
4	0.4	0.1	1	10	-3.6%	0.36 billion
5	0.5	0.1	1	10	-4.5%	0.45 billion
6	0.6	0.1	1	10	-5.4%	0.54 billion
7	0.7	0.1	1	10	-6.3%	0.63 billion
8	0.8	0.1	1	10	-18%	1.8 billion

some factors previously analyzed such as the effects of biofuels. The table below gives a break down of the overall terms of trade effects:

The graph shows that as the world prices of imported agricultural goods changes, it has a serious effect on the country's Gross Domestic Product. This case will be more injurious to developing nations that depend so much on imported goods especially African countries.

Statistical Analysis of Data

Effects of Biofuels on Food Insecurity: Data on grain production and consumption were collated, in which the surplus/deficit values were computed. The data were then subjected to statistical testing using the step wise regression model to ascertain the real effects of utilization of grains in biofuels production on the overall security of

food. The analysis was done using the statistical package for social sciences (SPSS) and the results are displayed below

Result of the model shows significant effects of biofuels on food insecurity. This effect can be seen from the very high significant value depicted by the F probability in the analysis of variance table. The perfect value of the coefficient of determination (r²) can also attest to the good fitness exhibited by the collated data and the accuracy of the model.

Impact of Food Insecurity on Terms of Trade: A mathematical model was also used to analyse the impact of food insecurity on the terms of trade of nations, data generated were also subjected to statistical analysis using the step wise regression model to ascertain the real effects

Descriptive Statistics

	Mean	Std. Deviation	N
Surplus/Deficit	-7.6923	52.09028	13
Grains Consumption	1817.3846	71.99136	13
Grains production	1809.4615	67.57171	13

Correlations

		Surplus/Deficit	Grains Consumption	Grains production
Pearson Correlation	Surplus/Deficit	1.000	-0.44	0.301
	Grains Consumption	-0.441	1.000	0.723
	Grains production	0.301	0.723	1.000
Sig. (1-tailed)	Surplus/Deficit	0	0.066	0.158
	Grains Consumption	0.066	0	0.003
	Grains production	0.158	0.003	0
N	Surplus/Deficit	13	13	13
	Grains Consumption	13	13	13
	Grains production	13	13	13

Model Summary (b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	1.000(a)	1.000	1.000	0.42929	1.000	88336.5	2	10	0.000

a: Predictors: (Constant), Grains production, Grains Consumption

b: Dependent Variable: Surplus/Deficit

ANOVA (b)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	32558.926	2	16279.463	88336.588	0.000(a)
	Residual	1.843	10	0.184		
	Total	32560.769	12			

a: Predictors: (Constant), Grains production, Grains Consumption

b: Dependent Variable: Surplus/Deficit

Residuals Statistics (a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-104.5888	58.3322	-7.6923	52.08881	13
Residual	-0.4112	0.67034	0	0.3918	13
Std. Predicted Value	-1.860	1.268	0	1.000	13
Std. Residual	-0.95	1.562	0	0.91	13

a: Dependent Variable: Surplus/Deficit

Variables Entered/Removed (a)

Model	Variables Entered	Variables Removed	Method
1	Terms of trade effects		Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a: Dependent Variable: Change in price of Import

Model Summary (b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					
					R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	0.832(a)	0.693	0.641	0.1467	0.693	13.521	1	6	0.010	1.094

a: Predictors: (Constant), Terms of trade effects

b: Dependent Variable: Change in price of Import

ANOVA (b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.291	1	0.291	13.52	0.01(a)
	Residual	0.129	6	0.022		
	Total	0.420	7			

a: Predictors: (Constant), Terms of trade effects

b: Dependent Variable: Change in price of Import

of food insecurity on the terms of trade. The analysis was done using the statistical package for social sciences (SPSS) and the results are displayed below:

Results also show a very high significant effect. From the ANOVA table, it is obvious that the very low significant value indicates the high effects of food insecurity on the terms of trade.

The Way Forward to Food Security: How then can the world achieve food security? The solution lies in increasing food availability, food access and food adequacy for all. The food insecurity in many countries and Africa in particular is directly correlated with poverty, it is necessary to not only alleviate poverty but also create wealth for the target population. The key lies in mutual honest intention from multi-stakeholders to ensure that all is done with the sole purpose of benefiting every person. The following master plan will be of great help.

- C Increasing Agricultural Production
- C Enhancement of Science and Technology
- C Facilitating market Access
- C Rural off Farm Opportunities
- C Capacity Building
- C Gender Sensitive Development
- C Adequate Storage Facilities
- C Production of Bio ethanol/diesel from other source outside grains and oil
- C Good Governance

The forces that produce persistent and widespread hunger are local, national and international. National governments bear the primary responsibility for creating an environment within which individuals and communities can effectively address hunger. But the steps needed to achieve food security cannot succeed if they are carried out in a top-down, technocratic manner [2]. Governments should forge partnerships with NGOs and business and industry and ensure that local governments and communities have the resources and authority they need to facilitate food security and good nutrition. Other actors also have critical roles to play. The governments of developed countries should end trade-distorting policies; put resources behind their repeated pledges to provide more aid, but with better focus on contributing to sustainable food security and poverty reduction; and relieve the unpayable debt of poor countries [9]. The government of developing nations must take it upon themselves to:

- C Encourage local engineer to produce/ fabricate equipments for small and medium scale food processing.
- C Go into partnership with international and donor organizations to subsidize the prices of processing equipments.
- C Reduce import tax on processing equipments so that private individuals will be encouraged to go into the business of food processing.
- C Encourage producer to produce so that surplus food can be stored or processed. The market situation must also be stabilized so as not to jeopardize the efforts of the producers.
- C Educate the people on the different methods of processing and storing food.

CONCLUSION

The world needs to recognize the right to food as a universal human right (IFPRI, 2006). This goes well beyond the mere endorsement of this right in principle, beyond the ringing denunciations of the use of food as a weapon, beyond the emerging idea that civilians in zones of armed conflict are entitled to food for survival and beyond humanitarian food supply measures to prevent famine. It requires continuous practical action at all levels - international and national, household and individual on the basic social responsibility to ensure that everyone is adequately fed under all circumstances [2]. It requires the adoption of concrete international goals such as reducing world hunger by half over the coming decade. Above all, it requires a true global compact, including North-South collaboration and the concerted efforts of all of us.

REFERENCES

1. United Nations Project, 2006. "Food Security in Developing Countries. A paper presented at the UN convention Towards a sustainable food security.
2. Angela Nwaniki, 2005. "Achieving food security in Africa." Challenges and Issues.
3. International Food Policy Research Institute. 2006. "Achieving Sustainable Food Security for All by 2020.
4. International Food Policy Research Institute. 2001. "Appropriate Technology for Sustainable food Security." Edited by per pinstrup-Andersen.
5. James Gustavo Speth. 1993. "Toward Sustainable Food security for All."

6. Rosegrant, M.W., 2005. "Looking Ahead. Long-Term prospects for Africa's Agricultural Development and Food Security". Washington D.C.: IFPRI
7. Pinstrip-Adereesen, P., 2002. "Food and Agricultural Policy for a Globalizing World: Preparing for the Future". American. J. Agricultural. Economics, 84: 1201-1214. American Agricultural Economists Association.
8. Todd Benson, Nicholas Minot, John Pender, Miguel Robles and Joachim von Braun, 2008. "Global Food Crises: Monitoring and Assessing Impact to Inform Policy Responses"
9. Kherallah, M., Delgado, C.L., Gabre-Madhin, E.Z., Minot, N., Johnson, M. 2002. "Reforming Agricultural Markets in Africa". IFPRI. The Johns Hopkins Food policy statements.
10. Oxfam. 2002. Rigged Rules and Double Standards. Trade, Globalization and the Fight against Poverty, Oxfam International.
11. Mwaniki, A., 2003. The Utilization of Locally Grown Plant Materials in the Production of an Intervention Formulation for Malnourished Children.