The Effect of Information and Market Access on Adopters' Income Level

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Abstract

This paper is aimed at relating income fluctuation with adoptable innovations, adopter category and their access to some variables than those explained in the neoclassical economics principle of labor market demand and supply equilibrium. Using a quantitative and qualitative case study of some farmers in two States, we considered whether respondents are earning enough income and what constraints they face. The von Hipple's lead user concept and decision model of risk aversion under uncertainty were used to explain causes of variability.

Notably, farmers with enough steady income have access to market, various information and are less risk averse.

Key words: Variability, Information, Income, Adoption, Market.

1. Introduction

The causes of income fluctuation and inequality among individuals of the same locality, different or same occupation have since attracted the interest of economic scholars. The theory of factor market reveals that the demand and supply for labor determines how high or low workers earn. By implication, more productive workers receive higher income than less productive workers. The assumption has resulted in categorizing individuals into possessing certain abilities or qualities that distinguish them from others viz: hard or lazy worker, smart or dull, strong or weak, outgoing or awkward and other personal characteristics. One assumption is that so long as the individual's marginal contribution to the economy is positive, his(er) income remains stable. Arguably therefore, hard and diligent work attracts better reward than the contrary.

Farm households also experience income fluctuations and inequality even to a larger degree compared with salaried workers as their business entails more risk and uncertainty. The rate of fluctuation varies between farmers in developed and developing countries regardless the numbers of hours they spend on the farm, how smart or dull they are, how strong or weak as well as effort expanded. A holistic understanding of this trend do not rest wholly on the concept of hard and lazy worker, smart and dull worker concept, nor can it find explanation only in policies that promote the provision of technical innovations, subsidies or insurance policy against climatic risk. Even when governments initiate some policy framework to solve the problem of

income variability, rather than resolve the situation, some of such policies have shown evidence of exacerbating the variability more than imaginable (Ahmed and Bernard, 1998, Walker et al. 1983). Moreover, persuading farmers especially in developing countries to buy insurance premium against climatic or other production and market risk is quite a complex and herculean task. This is because farmers do not trust insurance companies to deliver on their promises. Information asymmetry is high among farmers, insurance agents and the government, thereby presenting institutional flaws.

Mankiw (2002) added yet another twist to the debate of attribute-effect on income fluctuation by arguing that certain physical qualities such as looks and appearances play a correlating role. He brought to bear the case of movie actors, advertisers, sport stars, etc, and noted that actors with good looks, appearances and more humorous, tend to earn higher income than their colleagues in the same profession. By extension, if they neglect to maintain such qualities, they may cease to be a target for big producers. Similarly when talented sports stars neglect to train and keep fit; their income level during that period will fluctuate. This argument can be sustained and accepted for the case Mankiw presented, but whether such can be applicable to farmers poses a rather difficult dilemma, except if we extend it to the market environment of the farmers.

Arguably, even among farmers of relatively comparable qualities such as very hard working and good looking, there still exists persistent income variability among them. Obviously, it is possible that productive-enhancing innovations can be available; however farmers need to be aware of its existence, and how it works technically and commercially. On the other hand, innovation awareness requires as next step, accepting and applying it. This is a risky decision but it can also be rewarding in the long and short run, all things being equal, because early adopters capture the initial gain, signaling income increase, decrease or stability. In developing countries, not all product quantity translates into income generation. Some may not get to the appropriate market in good condition or at the right time. This implicitly suggests the existence of other contributory factors being responsible for income fluctuation. The purpose of this paper is to empirically explore and identify such factors with the following questions: Do income levels over time depend on hard work alone? Does access to Information enable farmers overcome their problems and thus, have more stable income? If such is the case, how relevant are the information being received? Is there a connection between information and market access with income stability? What motivates farmers to accept information content? How does attribute contribute to income level especially for farmers?

Empirically, we noted that access to various forms of information relating to farming activities and marketing as well as physical market had an influence on income level. We also observed that income stabilization cannot be accomplished only through insurance policy framework against some insurable risk, especially in developing countries due to some missing links.

Consequently, farmers who are more willing and ready to try an innovation without necessarily first observing other farmers practice it (less risk averse) make more stable income than others. However, government policies in some instances played negative roles, worsening the situation.

2. Review of some Literature on Income Fluctuation and Inequality

The problem of income fluctuation and inequality has been a source of worry to economists in every dispensation. Labor, as a factor of production in the concept of marginal product theory, is believed to earn an income in proportion to its marginal contribution to total production. The understanding informed economists to distinguish individuals with certain capabilities,

experience, training, and possession of other inherent characteristics, to earn more income than others who possesses less of the recognized factors. Informed by such realization, government policies in some cases advocate human capital development through improved education and other vocational facilities (Huffman, 2001, Schultz, 1984, Sundrum, 1992). The marginal product of labor theory has received wide criticisms (Blaug, 1997, Ehrenberg and Smith 1996). Mankiw, (2002) as well as Ehrenberg and Smith took a critical look at the opportunity cost of acquiring further education and the effect it has on income variability[1]. Mankiw (2002) opined that based on incentives and how an individual react to risk, the long run benefit of acquiring additional education may be substituted for an immediate high income and prestige desire. While Sundrum (1992) reasoned that the sources of income variability especially in developing countries are correlated to their educational attainment. Huffman, (2001) was of the contrary view. He noted especially with respect to agricultural productivity, that education may be productive or unproductive depending on economic conditions prevalent in such a society. However, Walker et al. (1983) in their research observed that education is responsible for income variability only on instance that farmers take up additional employment especially during low productivity and adverse environmental condition. Agrawal et al. (1970) also noted that education or some form of training such as the ability to handle some agricultural machinery constitutes a source of income variability. Several analyses of income variability are basically hinged on equilibrium model of labor market, which entails that income should adjust to balance labor demand and supply (Binswanger, 1980, Ehrenberg and Smith, 1997, Sundrum, 1992). But this is not always the case (Mankiw, 2002). Cruces and Sticerd (2005), Ahmed and Bernard (1989) and Walker et al. (1983) demonstrate some deviation. While Fortman (1997) cautioned that not paying attention to cultural, legal, political and other factors is capable of misrepresenting reality in the quest too explain income inequality and stabilization mechanism. In this paper, we intend to explore the 'other factors' which can impact on adopters' income level. Income in agricultural business, among other factors, depends on the availability, affordability and adoptability of technical innovations. The use of such technical innovation can lead to income variability among farmers because early adoption signals improved income for the first users all things being equal. Subsequently, wide spread of its usage is capable of leading to price reduction of the ensuing product. Against this backdrop, Binswanger (1980) pointed out that the green revolution created some inequalities both on income and access among farmers. This is because not all farmers adopt an innovation at the same time and speed irrespective of their level of education or some other pronounced abilities. Occasionally, less educated farmers adopt innovation faster and become innovators (Tchawa et al. 2001)[2]. Despite the potential of agricultural innovations and its promise to abate income variability to adopters, there are still some elements of uncertainty (Tidd et al. 2003). Also despite several policy measures implemented in some developing countries, income variability is still a big problem. For this purpose, it is imperative to question why such trend has persisted.

2.1. Income Fluctuation: Why has it Persisted?

Income variability among farmers especially in the developing countries have persisted in spite of several policy measures that have been implemented. The trend sometimes assumes a kind of

[1] The term income variability and income fluctuation are used interchangeably in this paper, in several instances, income variability is preferred because it encompasses both inequality and fluctuation and both problem are addressed in this paper.

[2] In this work, Paul Tchawa and his team reported of a farmer who was formerly a taxi driver-turned innovator.

cobweb circle. Why has such phenomenon continued? Obviously it is not the case of farmers in developing countries being lazy, majority of them especially in Nigeria work very hard, spending about ten hours man labor per day on their farm, in contrast, they earn less income. Also, government has introduced certain policy measures aimed at reducing income fluctuation especially among rural low-income farmers through price policy, introduction of new innovations or some form of restriction. In developed countries, income stabilization can also take the form of insurance policies to compensate farmers against all insurable risks that causes fluctuation. However, Walter-Jorgensen (1987) counseled that correcting income variability in agriculture through price policy is only beneficial to efficient farmers with large production capacities and as such, will still increase income variability. This line of argument is also shared by Binswanger (1980). The failure of the green revolution era especially in some developing countries was because it targeted the wrong people, and was a cluster innovation which required other inputs to succeed. The desired lessons for correcting income variability occasionally seem elusive because some of the intended policy measures tend to worsen the situation as is evident below.

2.2. The 'Grow Cassava' Initiative to Correct income Variability

As part of her effort to improve income stability among rural farmers, the Nigerian Government disbursed N50 Billion (about $420 Million) in 2006 through the Special Program on Food Security (SPFS) (now metamorphosed into National Program on Food Security). Because emphasis then was on cassava production due to its industrial usage and export potentials, cassava varieties with high yielding and industrial usage were introduced to farmers. As the case may be, farmers were motivated by profit maximization and increased income. Hence, several of them obtained the loan (which was administered with about 10% interest rate) and embarked on large scale cassava production (for those who have more land). During the harvest peak season, cassava traded for approximately N40, 000 per Pick-up load [3](about $336). As more harvest poured into the market without appropriate mechanism to absorb or manage the surge, the economic principle of demand and supply set in to determine price. The resultant effect was that cassava price particularly in Oyo state fluctuated till it dropped by 55% within the same harvest season. Although the price of a Pick-up load of cassava remained almost stable in other states such as Imo state (also varied within Oyo state), several cassava farmers in Oyo state could not repay their loans, they were also forced to sell their product at the going market rate, essentially to meet food need of their family and other household commitments. Majority of them were coerced to repay the loan, or hide when they noticed the SPFS officers coming[4]. This incident informed us, among other deductions:

a. That in some cases, farmers do not intentionally wish to default loan repayment.
b. Sometimes, some policies aimed at correcting income variability actually amplify it.
c. Income stabilization modules should not focus entirely on increased production or insurance against climatic risk.
d. Encouraging farmers to increase production do not essentially correct income fluctuation and inequality without other mechanisms in place, this statement may appear plausible.

[3] A Pick-up load of cassava is approximately 1.5 Tons, the measurement is not standardized, the cassava tubers are packed into the pickup till it is "over-flowing", an expert loader can load more tubers than non-expert, therefore due to the unstandardized measurement, farmers' may not get the actual price of the worth of their product depending on the loading.

[4] One of the Oyo ADP officers that worked with us was in charge of the SPFS program. For those who had repaid their loans, they were willing to meet with us, while the contrary is the case for others who had not. In some instances, his presence either acted as incentive or disincentive.

The relationship between innovations, adoption, adopter categories and income fluctuation is depicted on the diagram below. The income line is a curve in nature (originating from adoption of innovation by adopter categories), indicating that in many cases, government efforts to reduce income fluctuation actually increases it and sometimes the trends are repetitive, therefore the arc could form a complete cycle depending on policy framework.

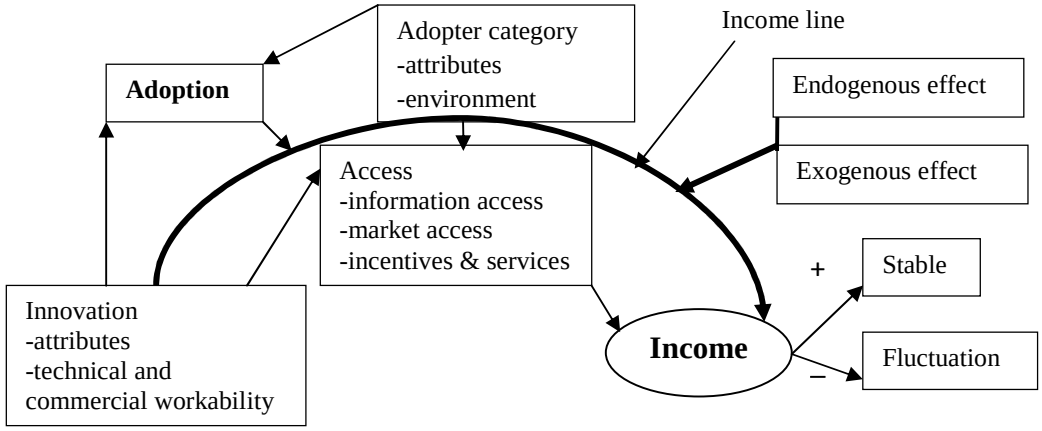

Figure.1 Adoptable Innovation[5] and Income fluctuation-cause link

The adoption of innovations can result to income increase or decrease to the adopter; therefore innovation's attributes are very significant to determine adoption rate. However, even when innovation attributes are compatible to the felt needs of the user community (Röling, 1988), the actual decision to adopt is still complex and in practice, not all farmers adopt at the same time and rate, showing differences in adopter categories (Rogers and Burdge, 1972). In the instance where an individual's motive to adopt an innovation is economic reason, access to market and market information is very crucial. Income fluctuation therefore is affected by other endogenous and exogenous variables. The endogenous variables are those variables which concern the adopter, such as formal and informal training, perceptions and reactions, personal attributes and dispositions, skills and production capabilities (Albach, 1994, Mankiw, 2002, Rogers, 1983). While the exogenous factors are those that are outside the control of the adopter, such as externalities, social factors, climatic, environmental, institutional, access to information, finance, market and other facilities, political and policy environment and production techniques (Binswanger, 1980, Roumasset et al. 1979 , Walker et al. 1983).

2.3. How Discrimination and Politics Play roles in income Variability

Theoretically, effort and ability play vital role in income stability. The probability for hard working, innovative farmers to earn higher and more stable income than others is an acceptable dogma. Notably, chance can play a role as well as attitude of government institutions. However, the ideology of how discrimination or ethnicity constitutes income variability in agriculture poses a serious debate. For employed labor, Mankiw (2002) noted that factors such as discrimination, gender, ethnicity, political inclination, etc. all affect income. He however

[5] Adoptable innovation represent those innovation that possesses both the subjective and objective attributes, in order words, they are user friendly. Such innovation attributes can only be realizable through participatory approach in innovation development and dissemination.

cautioned that these factors do not say it all. As controversial and debatable this issue tends to portray, it overtly impact on income variability, take for instance the case of fertiliser.

Farmers in developing countries majorly depend on fertiliser application for increased production. This can be due to soil fertility depletion or the fact that some improved varieties require high fertiliser application for optimum yield. Fertiliser availability, affordability, composition and distributional timing to the farmers are very important. In Nigeria, the popular fertiliser being distributed to farmers is the NPK 15:15:15 even though research has been shown that the best composition of NKP fertiliser for optimum crop yield for farmers in South Eastern Nigeria is the NPK 20:10:10 (Meyen et al. 1996), NPK 15:15:15 is still widely in use due to political reasons. Moreover, before the fertiliser and other planting materials can reach farmers, their appropriate use time may have elapsed. Some states receive planting materials on time while others do not, programs such as the Fadama users association, which targets dry season production, was started in the Northern Nigeria, although the message is presently being spread nationally. Moreover, majority of the farmers interviewed noted that inputs are not delivered to them at the appropriate time and quantity; this is linked to politics, bureaucracy and corruption.

3. Empirical Data

The empirical data for this paper was collected in Oyo and Imo states in the Southern part of Nigeria as part of a six-state case study research work, covering the six geo-political division of the country. The practical aim of the study is to determine what factors will affect sustainable adoption of biotechnology innovation in developing countries especially Nigeria. Farmers' utility, food security, and income depend on availability, affordability, usability and manageability of agricultural innovation, vis-à-vis the marketability of its product. Data were collected, in collaboration with the state ADPs, through structured questionnaire, personal interviews and participant observation during meetings with farmers and other stakeholders.

The data used in this analysis are from 640 farmers made up of 40 farmers each from 2 villages in 4 Local Government Areas for each state (LGAs). The data was designed to ascertain whether respondents make enough income, their source of livelihood, constraints to stable income, what will motivate them to adopt a new innovation. Ostensibly also to determine if they have access to market and necessary information for overcoming farming constraints, attitude to risk (Albach, 1994, Clark and Akinbode, 1968), and to determine the so-called lead users, (von Hippel, 1988).

3.1. Income variability Measurement

From some empirical work, the most widely used measures of income variability are the Gini coefficient (Thompson and von Witzke, 1986, Sundrum, 1992), Coefficient of variation (Binswanger, 1980), Variance, (Carlino and Sill, 2000, Walker et al. 1983), Welfare function or Welfare approach (Kingma and Oskam 1986, Sundrum, 1992), some uses a combination of measures (Sundrum, 1992). Cruces and Sticerd (2005) employed ex-ante and ex-post concept of risk aversion under uncertainty developed by Atkinson (1970), to explain how choice under uncertainty in a social setting can cause inequality. Atkinson argued that both the Gini coefficient, the variance or the relative mean deviation measurement for income inequality are misleading. Boussard (1976) altered the expectation and variance (E.V) model of Markowitz. Notable point in his transformation is that the risk aversion coefficient depends on the character

(attributes) and mood (probably together with the environment) of the decision maker. Preferring one measurement over the other is a matter of choice and orientation[6]

3.2. Environment and Income Variability

The figures below illustrate some typical environment where most farmers in developing countries transact their business as well as generate their source of income.

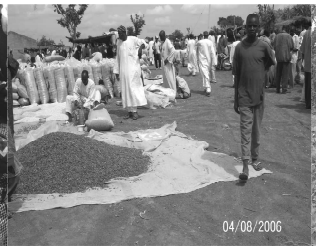

Fig.2 Market situation Fig.3 Fig.4 Fig.5 production environment

Figures 2-4 represents a typical local market, figures 2, 3 and 4 are groundnut, cassava and pepper respectively, displayed for customers to buy. The products are spread on the dusty and dirty floor, with people walking by, therefore the tendency of quality and grade reduction are not unlikely. Moreover, since the markets operate in open space with little or no stalls, incomes during extreme weather conditions is affected due to wastage. In some instances, the market locations are in remote places with no access road, farmers transport their produce with Pick-up trucks or Lorries. Such market environment will obviously affect the mood of the farmers, making them more aggressive. Also the price will be affected because of product quality, while lack of information regarding the market situation will increase risk and uncertainty (Feder and Slade, 1984). Fig.5 is a dry season vegetable production with no clean water irrigation, with the farmers using hoes and cutlass as production implement. Although they spend an average of ten hours daily in their farms, production is low, income is low. The crucial question then is how to stabilize income given the kind of production and market environment observed above and the preceding constraints in table 1. Although some authors advocate for insurance modules against risks that causes fluctuation (Burgaz, 2000), such system can work only where there is relatively perfect agricultural market, information sharing between government institutions, insurance companies and farmers, institutional environment that enforces the rule of the game and sustainable policy framework. Such are not the case in many developing countries. Receiving insurance claims are very ambiguous; there are questionable trust between farmers and insurance companies due to information asymmetry. Some of the major constraints facing the farmers and information relevance regarding their solution are shown below.

Table.1 respondent's source of livelihood, constraints and information access (n = 640)

Source of livelihood			Constraints (Con)/n (n multiple choices)								Info access solution		
Category	n	%	Con	n	%	%share	Con	n	%	%share	Category	n	%
Farming	362	56.6	A	338	52.8	9.2	F	451	70.5	12.3	Yes	94	14.7
C/servant	54	8.4	B	338	60.6	10.6	G	483	75.5	13.2	No	239	37.3

[6] In this analysis, we used Grafstat software for two variable analyses to determine relationships. More information on Grafstat can be found on www.forschen-mit-grafstat.de

F&C/S	107	16.7	C	461	72.0	12.6	H	398	62.2	10.9	Not as I	275	43.0
others	117	18.3	D	469	73.3	12.8	I	136	21.3	3.7	Do not	32	5.0
			E	205	32.0	5.6	J	338	52.8	9.2			
			Total possible nominations 3667										

Where: C/servant = Civil servant, F&C/S = farming and civil servant, A = Lack of fund or capital, B = Good quality chemicals, insecticides and vet drugs, C = Weed problem/Pests and diseases, D = Lack of improved seeds, high cost of animal feeds/improved seeds, E = Lack of modern equipment/high cost of hiring them, F = Fertilizer availability and affordability, G = Labor shortage/cost, Land depletion/access, good road, Marketing problems, H = Lack of processing/storage facilities, transportation problems, I = High mortality rate of animals, adulterated drugs, cost of drugs, knowledge of usage, J = Others (Water shortage, information access, drought, Health problem, food insecurity, flooding, Do Not = Do not know who to consult, Not as I = not as I wanted, %share = share of total Con.

Table 1 illustrates the source of livelihood, the constraints affecting the income level and the information being received for their solutions. Problems of weeds, pest and diseases are more prevalent among them as shown by the % share of total constraints. Regardless that farmers are not receiving enough information on how to overcome their farming constraints or the information is not as they wanted it, the relevance of such information are also questionable, this is depicted on the graph below.

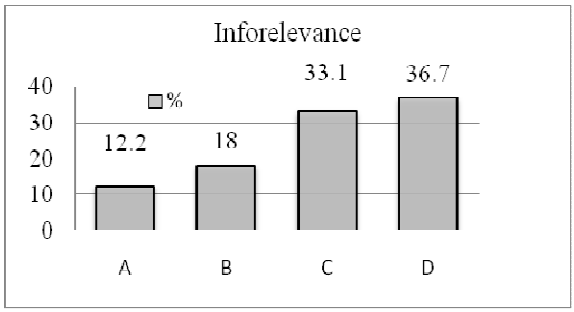

Fig.6 Information relevance relative to problem solution

The major sources of information available to farmers with respect to overcoming their constraints are extension agents, cooperative meetings, neighbors, NGOs, other government and non-government instructions. Farmers' cooperatives are relatively organised in the state (86.3 %) are members of cooperatives; some are structured into various commodity and activity group. About 44 % participated in cooperative activities often while 22.1 % participated very often. Information disseminated in their meetings[7] are appertaining to their farming and social needs. Surprisingly, the prerequisite that the Government set which farmers must fulfill in order to participate in the N50 Billion loan was that recipients must belong to a cooperative group. This reason may have accounted for the explanation why several of them became members. Notwithstanding, information trust index (IT-index)[8] farmers attached to cooperative activities are quite high. 52.7 % of the farmers showed willingness to accept and utilise the information content, however, 46.3 % noted that the information content are helpful but not adequate. Although several other underlying motives could account for membership and participation in

[7] We took part in several of such meetings. Whether the criteria set by the government before farmers could obtain the loan is efficient or turned the cooperatives into political environment is not the focus of this paper.

[8] IT-index is the level of trust in a scaled format; the farmers have on different information sources and on preferred ranking, who they will contact when faced with problems.

cooperative activities, the major part relate to information content being received from such meetings. Using a ranking method to determine why farmers join and participate in cooperative activities, the option; Organizational structure addresses farming needs ranked first with a mean of 1.48 (55.0 %), while the option; information disseminated are relevant to farming needs, ranked second with a mean of 1.61 (52.0 %).

Another method used in determining the IT-index of cooperative membership was to consider the category of stakeholders that farmers consult for their problem solution.

When farmers face problems constraining their production and income level, they consult others for solution. The quest for information on problem can be observed through the level and extent of consultation farmers undertake when faced with constraints. IT-index varies depending on past experience, farmers' attitude and the potential benefit of such information. Although farmers still consult with extension agents because they are presumed to have some training, they are skeptical about them as a result of previous failed government promises.

3.3. Market Information and Income variability

From part 3.2, we concentrated on IT-index on problem solution, cooperative and extension agent; our next discussion is the marketing aspect. In fig.2-4, we showed an illustration of some market environment where several farmers in developing countries earn their income. Noteworthly, the most remarkable driving force for innovation adoption by farmers are economic reasons. Economic reasons entail meeting their food requirements as well as sell the remaining to meet other needs. Such market environments are depicted in fig.2-4. Table 4 below illustrates the type of changes farmers would desire to be effected in the output market.

Table 4 Output market change preference (n = 640)

Category	R.s	Ranking	%	Mean	Median
Pref. BP	371	1st	58.0	1.66	1
Pref. IPC	205	2nd	32.0	2.29	2
Pref. SPP	380	4th	59.4	3.22	4
Pref. AMP	247	3rd	38.6	2.83	3

Where R.s = response share of ranked preference priority, Pref. BP, IPC, SPP AMP = better price for product, better information about price changes, stable price for product and available market for product respectively

The output market is neither satisfactory, nor efficient and to the farmers' benefit. Farmers do not get appropriate price for their product due to market failures, lack of market information, lack of storage facilities especially when product prices are relatively low, poor road network to reach the appropriate market, poor grading and packaging facilities. For this and other reasons, there is need to institute changes as indicated in table 4. These constraints and others accounted for the variability in income which is demonstrated in the graph below.

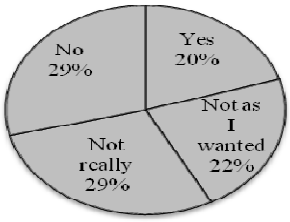

Fig. 7. Income variability

Enough income (EI) is represented by four categories of income level, those who are making enough (yes), those who are not making it as they wanted (not as I want), those who are not really making enough income (not really) and those with no enough income (No). As is evident from figure 7, the variability is somewhat evenly distributed, with 5% level difference between the upper and lower limit. These Enough Income levels are denoted by +1, +1/2, +1/3 and 0 respectively. (This can also be taken as higher, middle, lower and bottom levels in that order).
The highest constraints faced by majority of the farmers are presented in table 1 of page 6. 92.16% of them belonged to one cooperative group or the other for several motives. What then is accountable for differences in EI? This kind of scenario requires further elucidation.

4. Discussion: What are the Possible Causes for the Observed Variability?

Why does income variability persist in the same natural, institutional, technological and economic environment with some people having so to say 'equal opportunity'? Several works have been carried out on income variability; there has not been a one clear cut answer to the problem. More light is shed here for this phenomenon by comparing EI with other variables.

Table 5 Enough Income (EI) vs. Infoaccess (IA) (n = 640)

Infoaccess↓→ EI	Yes(1)%	Not as I wanted(1/2) %	Not really(1/3) %	No(0) %	IA%
Yes	63.1	6.4	1.6	0.0	14.7
No	0.8	6.4	44.3	79.5	37.3
Not as I would want it	35.4	85.0	47.6	11.9	43.0
Problem: who to consult	0.8	2.1	6.5	8.7	5.0
Total	100	100	100	100	100

In table 5, 14.7 % of those who had Infoaccess made enough stable income representing 63.1 % of the entire sample size. Only 0.8 % made enough stable income among the 37.3 % who did not have Infoaccess while among those in category +1/2 of EI, (35.4 %), 43.0 % did not have Infoaccess as they would have wanted it. Next, we compared market access (MA).
Access to market (also credit market, Ahmed and Bernard (1989) have covariate relationship to EI, the grow cassava campaign resulted in income variability due to MA problem, while the price of cassava was high in other states, both farmers and consumers were denied the economic benefit of increased cassava production due to lack of MA. Improving MA is a possible solution.
Table 6 Enough Income (EI) vs. Market Access (MA) (n = 640)

MA↓→ EI	Yes %	Not as I wanted %	Not really %	No %	MA%
Yes	90.0	17.9	1.6	0.5	22.8
No	0.0	2.9	21.1	80.0	29.8
Not completely	9.2	65.0	11.4	2.2	20.0
Once in a while	0.8	14.3	66.0	16.8	27.2
Other comments	0.0	0.0	0.0	0.5	0.2
Total	100	100	100	100	100

Table 6 is a representation of EI vs. MA. 22.8 % of the sample size had access to market, from this figure, 90.0 % fall into the first category of EI. Those who had market access once in a while only represent 0.8 % of +1 EI. 29.8% did not have MA; they occupied the 0 category of +1 EI. Similar analyses were conducted on Inforelevance (information relevance IR), suggestion for output market improvement and the reason for adopting a new innovation. For the Inforelevance, only 12.2 % were satisfied with the information being received, 56.9 % of this figure represented

the category +1 of EI. In essence, only those who regarded the information as being satisfactory, or not really as they would have wanted it to be, earned appreciable income. For improvement in the output market, better information about price changes ranked 2nd in order of priority, majority of those who constituted this ranking are among the +1EI level. This is also applicable with preference to available market for their product which ranked 3rd.

4.1. Enough Income (EI) Compared with Adopter Category and Risk Averse

So far, exogenous variables on EI have been compared. In this section, we make a connection between EI, rate of innovation adoption and risk averseness among individuals. Innovativeness in any field of business increases market share, new products are engine for capturing and retaining market shares, profitability and competitiveness. Many organizations channel much of their activities into this orientation. Conversely, not all organizations or societies innovate at the same time and rate. As with organizations, so it is also with individuals who make up such organization or society, some are more ready to take risk while others are not. However, those who take the risk tend to capture the initial profit as they are small to influence the market price (Rogers, 1983, Tidd et al. 2003 and Utterback, 1996). Moreover, when faced with relatively comparable alternatives, some individuals tend to choose the less risky alternative. The expectation and variance (E.V) model try to explain how individuals make alternative choice in the midst of uncertainty. The more risk averse an individual is, the less likely that he or she will choose an alternative whose probable outcome in terms of utility increase is less. This is depicted in the table below.

Table 7 Adopter Category (AC) v. Enough Income (n = 640)

AC↓→ EI	Yes(1)%	Not as I wanted(1/2) %	Not really(1/3) %	No(0)%	AC%
Innovators	91.5	7.9	3.8	1.1	21.7
Late adopters	1.5	11.4	80.0	9.7	28.8
Laggards	1.5	2.1	11.4	87.6	29.4
Early adopters	5.4	78.6	4.9	1.6	20.2
Total	100	100	100	100	100

Categorization of adopter group in table 7 is for the purpose of linking it with theoretical concept of adoption. This corresponds to; started applying it immediately, waited till I received more information, waited till I observed other farmers adopt it and first verified if the information is correct and relevant respectively in our original data. Among the 21.7% who are adopters, 91.5 % represent category +1 of EI, 7.8 % for category EI +1/2, and 3.8 % for category +1/3 EI.

By analyzing also what motivated them into adopting some particular innovation, it was observed that for the category +1 EI level, the main reason is because it addressed their specific needs rather than conflict with belief or the risk involved, implying that they take risk if it meets their specific needs, they also consider future economic and environmental impact of innovation.

4.2. What does this Imply?

An individual's or organization's determination to constantly innovate increases market shares, the more the market share, the more apparent a stable EI level. However, not all farmers innovate at the same rate as evidenced in the theory of adoption. For adoption to take place, the farmers have to be aware of the innovation (information seeking), its technical and commercial workability as well as actual market access to sell the product. Even where these variables are available, the explicit decision to adopt varies from individual to individual. Such trend leads to

income variability among farmers. Even though some policies may address innovation availability, the actual decision to adopt is an exclusive right of the user. The ability to take appropriate-timely decision is vital and this may depend on some certain inherent attributes of the user too.

von Hippel (1988) introduced the concept of the lead users with the following characteristics:

a) They show familiarity with their conditions presently and also have accurate perception of future needs. (due to information seeking and processing)
b) Have real experiences which make it possible to project future market condition.
c) Have relatively high expectation of utility from problem solution.
d) Have tried on their own to solve the problem, they have an understanding of how and what to expect.
e) Can serve as need forecasters in the future market trend and market research.
f) Their risk aversion is relatively small due to their quest to higher return.

It may appear plausible to say that those with EI level of +1 and +1/2 have some special abilities evident in their capacity to be less risk averse, more apt to source for information on problem solution. Their consultation level for problem solution and quest for market access (MA) is high. Walker et al. (1983) indeed noted that risk aversion have covariate implication on income variability. However, the challenge of having the right information, enabling facilities such as storage, processing and MA at the appropriate time and place also posses another conceptual problem. Although hard work and training is also indispensable, farmers noted that their EI levels are affected because they lacked the knowledge to use certain innovations, some elements can be missing still. Again, government may embark of large scale introduction of 'appropriate innovation' in order to stabilize income, such policies have shown evidence of further contribution to making income variability cyclic, especially if adequate measure are not taking to provide relevant information and market access to the target farmers. Adoptable innovations result in high Enough Income for those adopting it. However, despite how user-friendly an innovation may be presumed, the actual decision to adopt is quite complex. Even when farmers show risk averseness, they may do so with previous experience. Previous disappointment can play a role, the grow cassava initiative can serve as an illustration.

4.3. Summary

Admittedly, causes of income variability posses a rather conceptual dilemma and the method of correcting it more problematic and inexhaustible. Without being polemic, we have nevertheless in this paper, endeavored to reduce the inexhaustible list of possible solutions. We have argued that abilities are relevant tools in determining income as well as education especially where it concerns the use of technical innovation and also like Walker et al. (1983) noted, where farmers take up alternative employment to enable them earn additional income. We have also argued that providing adoptable innovations can raise income level for rural farmers, however, we have warned that in some instances, such policy dimensions usually fail to address other fundamental problems of how to absorb the surge in increased production thereby making income variability a rather cyclic phenomenon. The grow cassava campaign by the Nigerian government being an example, as more farmers will tend to reduce cassava production during the next cropping season, the shortage in supply in the season will increase price and the trend will be repeated.

Invariably, we have shown that discrimination and political environment can cause income fluctuation, these have been demonstrated in the case of NKP fertiliser, availability and affordability of farming inputs. Farmers who get such inputs on time improve their production and hence possible income increase while those who get it late may suffer poor harvest and hence lower income in such farming season.

Most notably, we have systematically demonstrated that adoption of technical innovation presents a risky and uncertainty scenario and only those whose risk averseness is relatively low venture into it. Such individuals are the lead-users, they capture the initial profit and control the market till others join, hence may enjoy a stable income. Notwithstanding, we opined that the lead-users also depend on available information for new innovations as well as available market to sell their product. Diverse information for farming activities is incentives to knowledge increase, thus reducing risk and uncertainty which invariable have a bearing on income stability.

Access to adoptable innovations, market, information and personal attributes of the adopter impacts on income stabilization. The following suggestions are some measures that could reduce income fluctuation especially in developing countries.

a. Any policy framework to increase production should take cognisance of the product market, where such market is lacking; effort should be made to initiate one.
b. Provision of processing and storage facilities to take care of excess production. Farmers in developing countries loss much of their production due to lack of processing and storage facilities, this is one major causes of income fluctuation.
c. Provide access to market information, problem solution information and other possible relevant information to farmers. Information flow increases knowledge and relevant knowledge regarding farming activities reduces risk.
d. Reduce risk and uncertainty in agriculture by providing adoptable innovations. Innovations that are user specific and environmental specific as well as their timing of availability have a positive effect on income stabilization.

Annex

Following the example of Adams, Jr. and He (1995) on a different approach, we therefore suggests that EI is a function of access to adoptable innovations, access to information, market, ability of the adopter, less constraint and other institutional factors. This is called the AIIMA function (Adoptable innovation, Information, Market and other Access)

$$\text{EI} \quad \alpha \quad \sum_{a=1}^{z}(\partial \text{Ina}) + \sum(\partial \text{Ifa}) + \sum(\partial \text{Ifr}) + \sum(\partial \text{Mka}) + \sum(\partial \text{Ac}) + \sum(\partial \text{At}) - \sum_{c=1}^{\infty}(\bar{C}f - \bar{C}n_f) - \beta \quad (1)$$

$$EI = k\left(\frac{\sum_{a=1}^{z}(\partial Ina) + \sum(\partial Ifa) + \sum(\partial Ifr) + \sum(\partial Mka) + \sum(\partial Ac) + \sum(\partial At) - \sum_{c=1}^{\infty}(\bar{C}f - \bar{C}nf) - \beta}{N = (f - n_f)}\right) \quad (2)$$

Where: ∂ = partial change in

Ina = innovation access (from 1 to z innovation), Ifa = information access, Ifr = information relevance, Mka = market access, Ac = Adopter category, At = Attributes (personal attributes of adopters, risk and others), $\bar{C}f$ = mean constraints by farmers, $\bar{C}nf$ = mean constraints by non farmers, β = number of observable constraints, N = $(f - n_f)$ = total number of farmers and non farmers.

To calculate $EI.I_1$, we consider three different innovations introduced by the Oyo ADP from 2003 to 2006 with its adoption rate given below.

Table 8 Agric innovations disseminated to farmers from 2003 to August 2006

no	innovation	% adoption	Share sample[x]
1	Use of dry poultry manure for vegetable production	90	288
2	Row planting of leafy vegetable for better management	30	96
2	Use of sweet potato as cover crop for soil conservation	20	64

Source: Oyo ADP, [x] Own estimation based on sample size

For EI level for first innovation, we consider adoption by farmers and those who practice farming with other occupation. We compute the partial difference in Infoaccess, Inforelevance, market access, attributes, adopter category, and constraints. This was done by comparing occupation with these variables mentioned above using Grafstat.

$EI.I_1$ for three category occupation =

$Ina\,(288 - 28) + Ifa\,(149.5 - 67) + Ifr\,(106.16 - 90) + Mka\,(155.83 - 36) + Ac\,(130.49 - 74) + At\,(218) - \overline{Cf}\,(163.9) - \beta\,(30) = 559.52$

$N = \left(f - n_f\right) = 292$

$EI.I_1 = \frac{559.52}{292} = 1.91$

$EI.I_2$ enough income for the second innovation I_2

Adoption share for $I_2 = 96$,

$EI.I_2 = \frac{560.98 - 193.9}{292} = 1.26$

$P\,(EI.I_1) = 1 - EI.I_1 = |1 - 1.91| = 0.91$, $P\,(EI.I_2) = 0.26$, $P\,(EI.I_3) = 0.15$

Where $P\,(EI.I_1)$ = probability function

The higher the EI Level, the lower the variability

For farmers alone

$EI.I_1 = \frac{762.32 - 414.9}{179} = 1.94 \quad EI.I_2 = \frac{570.32 - 414.9}{179} = 0.87 \quad EI.I_3 = \frac{538.32 - 414.9}{179} = 0.69$

$P\,(EI.I_1)$ farmers alone $= |1 - 1.94| = .94$, $P\,(EI.I_2) = -0.13$, $P\,(EI.I_3) = -0.31$

In calculating EI level for the introduced innovation, other variables are held constant here, in reality, these variables changes in the course of adoption process due to the approach employed by the resource community to disseminate the innovation, a lower P(EI) results in more variability. This calculation is repeated with adoption rate from other states and we observed similar trend depending on adoption rate.

5. Reference

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