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Information Access and Relevance Affects Adoption Decision: Rethinking Adopter Categorization.

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Abstract: Adopters of innovations have been habitually classified into categories ranging from innovators to laggards. The term 'laggards' have often been used by extension agents to explain why farmers 'resist' change. But are these categorization justified merely because of individual adopter's risk perceptions or are there other exogenous variables relating to information access that play significant roles to determine adoption decision? This paper analyzed the effect of information access, cost, relevance and knowledge utilization on adoption decision using empirical data obtained from two geopolitical division of Nigeria. Results revealed that information access was a major constraint among the respondents. Only about eighteen percent had complete information access relating to diverse information needs, 47% had no relevant information access. Those who had information access were majorly the innovators/early adopters (84%), the laggards recorded the lowest complete information access (0.9%). Disseminated information was also perceived differently among the adopter groups. Only respondents who perceived disseminated information as relevant to current agricultural needs were more disposed to utilize it than the contrary. Results indicated that there was a strong correlation between adopter categories and information access, information relevance and information cost. Hence, it is unjustified to regard individual adopters as laggards or imply that farmers resist change except there is a justifiable evidence to prove that adopters possess similar level of information in comparable socioeconomic environment. Even at that it is still necessary to determine what might have influenced overt decision during the process of information management.

Key words: Imo & Edo States, Information relevance, Applicable knowledge, Adopter categories

INTRODUCTION

The information rejection is also a form of response just like information acceptance and utilization.

Over the last decades, agricultural sector especially in developing countries has witnessed unprecedented influx of locally-generated or adapted innovations. The establishment of national agricultural research institutions, universities of agriculture vis-à-vis research funding has also witnessed impressively steady boost [1, 2 & 3]. Nonetheless, the rates at which innovations are generated and disseminated are disproportionate with adoption rate. For instance, between 2003 and August, 2006, Oyo State Agricultural Development Program (ADP) disseminated around twenty-four innovation package to farmers, an average of 47% adoption rate was recorded [4]. Similar results were recorded in other states. The discrepancies observed in the adoption of technical innovations and dissemination rate have long been the concern of sociologists and economists. Rogers[5] carried out extensive studies and compiled previous works on adoption pathways of technical innovations. The outcome facilitated more understanding and distinction of individual adopters. Subsequent studies have focused attention on explaining attributes of adopters and innovations. The concern on why innovations fail has also warranted several ex ante research studies [6]. Information has been identified as vital ingredient in the adoption process [7, 8]. The way in which adopters perceive information sources and attributes of innovation, in addition to available resources determines overt action. Sequel to this ideological orientation, researchers began to focus attention on how risk perception affects adoption decision. The climax yielded a paradigm which presupposed that more risk-averse individuals are unwilling to adopt new innovations immediately than less risk-averse individuals. Although such categorization is unwarranted [9], still farmers are

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classified as adopters and non-adopters based on risk perception. Lionberger[10] however revealed that those referred to as early adopters possessed significantly more risk capital and invariably more willing to take risk. Noteworthly, this illustration appears quickly plausible. A farmer with vast land may be more willing to commit some portion to try new innovation than a farmer with sparse land, ceteris paribus. By stating that farmers constantly seek information regarding innovations and that awareness is the prelude to adoption, Rogers[7] demonstrated that information availability and accessibility is very relevant. Notably the role of information is significantly meant to reduce influences of risk and uncertainty-related factors. Depending on source, cost, availability, attitude of the communicator and so on [11, 12]. Is Rogers' categorization of adopters into groups based on the premise that all individuals possessed the same quantity and quality of information within analogous sociocultural institutional environment? If such is the case, then individual attributes and risk perception can distinguish adopter categories. However, most studies fall short of determining how information availability, accessibility, cost, ownership, source as well as extractable and applicable knowledge can play leading roles in distinguishing adopters into categories [13, 14]. Nevertheless, few studies have demonstrated exception on the influence of information variables on adoption decision [15, 16, 17, 18]. The domain of extractable and applicable knowledge of disseminated information still presents an area yet to be explored as well as what happens between the points of information reception to decision stage (knowledge management). Distinctively, Westermarck[11] noted three foremost dimensions of information interpretation and how these affects individual decision maker. A decision maker must not only pay attention, comprehend, believe and accept the information content as being true or authentic and capable of addressing predetermined expectation (PE) but must also be willing to take commensurate action. Information content ought to be complete and reliable before farmers can bequeath scarce resources to trial. Lack of complete and reliable information will tend to negate information application. This may suggest why some farmers destitute of complete information typically wait till they have observed others who possessed the capacity to comprehend information content to try it first. Conversely, complete and presumed reliable information can turn out to be unreliable due to contrary emerging information or based on the component of information package which was unrevealed a prior. Education has more effect on adoption decision of complex innovations which require technical knowledge to apply such as GMOs [19]. One of the attributes which adopters take into consideration before accepting an innovation is complexity and technicality. The acceptance, adoption or consumption of genetically modified organisms (GMOs) especially in developing countries is significantly affected by anti-GMO information from developed countries. Equally, it may appear irrational to suggest that an individual is a late adopter except if there are sufficient verifiable proofs that the same information content is available to all in a similar sociocultural environment. Notwithstanding, it may be difficult to measure what may have informed overt action during the process of knowledge management and decision making. The objective of this article therefore is to determine whether information access significantly differs among adopter categories.

Theoretical Model: Information Access and Effect on Adoption Decision: Supposedly, factors relating to information access affect the probability of individual's adoption decision. The following assumptions which are supported by previous literature are made here to support a model proposition.

1. Adopters constantly seek information about new innovations capable of alleviating constraints which limit optimum production and income.
2. Information obtained are processed rationally through evaluative thinking apparatus [20]
3. The objective decision function of adopters is profit maximization and risk reduction.
4. Information regarding new innovation is accepted if and only if new innovation's benefits exceed effort expanded.
5. Adopters are open to receive further information capable of improving knowledge base of previously acquired information.
6. Adopters have a predetermined expectation or evaluation (PE) of what the information content ought to address.
7. If information content does not adequately and reliably address PE, adopters can discontinue from information reception or adopt selective listening [7].

The model adopts similar approaches utilized by Kurkalova *et al.*[21] and Nguyen[22] however particular reference is made with Feder and Slade[23]. The model presented here includes influence of stakeholders in the process of knowledge management by potential adopters. The first part of the model covers information being disseminated about innovation attributes which potential adopters consider before venturing into trial.

$$nAi = \frac{\Delta Q_{py}}{\Delta Q_{px}} * p_o \gg 1 \ldots\ldots\ldots\ldots\ldots\ldots 1$$

$$nAi = \frac{dQ_{py}}{dQ_{px}} * p_o \geq 1 \ldots\ldots\ldots\ldots\ldots 2$$

$$nAi \equiv PE_n \approx f[\rho Ai + \varphi Ai \ldots\ldots\ldots\ldots 3$$

$$\therefore PE_n = f\left\{\sum_{i=1}^{n} \rho Ai \pm \sum_{z=1}^{n} \varphi Ai\right\} \neq \max_{lim} \Delta Q_{px} \ldots\ldots\ldots\ldots 4$$

Where nAi = attribute of the new innovation, ΔQ_{py} = change in production quantity of new innovation, po = product price, ΔQ_{px} = change in quantity produced by old innovation PE_n = predetermined expectation or evaluation of what the new innovation ought to address, ρAi = ranked attributes of new innovation in order of priority/preference, φAi = ranked order of risk premium of new innovation, $\max_{lim} \Delta Q_{px}$ = maximum limit realizable by the old innovation, $\sum$ = summation sign.

But $\rho Ai = \bar{Cm} + {}^{n}_{1}Ypr + \pi O_t \ldots\ldots\ldots\ldots 5$

Where $\check{C}m$ = compatibility index of new innovation, it is measured by its conformity with certain parameters found in adoption theory. Such that

$$\bar{Cm} \propto \langle V_s, M_o, T_i, F_e \rangle \ldots\ldots\ldots\ldots 6$$

$$\therefore \bar{Cm} = k\langle V_s, M_o, T_i, F_e \rangle \ldots\ldots\ldots\ldots 7$$

V_s = value system, M_o = management objective & capabilities, T_i = level of technology and the extent to which the adopter can comprehend it, F_e = the stage of farm enterprise, K = constant of proportionality.

πO_t = objective attributes of innovation set by proponents.

${}^{n}_{1}Ypr$ = ranked solution preference in the adopter's own perspective, where 1 is the lowest rank 5 is the highest rank. n = five possible options identified by respondents which included:

1. Ability to market the innovation's product and make more money
2. To produce more than current production level
3. To overcome major problems the old practice could not solve
4. Ability to manage the innovation and its product
5. Availability and affordability of new innovation over time.

Invariably, before an adopter can utilize information content, it must certify certain principles. This is given by the following equation

$$\omega U_i = PE_n + f\left[\sum Is \pm Ek \pm Ak\right] + \sum(\beta Ps) + \sum(\beta Ms) + g(Kt) + \underset{Km}{\leftrightarrow} \pm \delta R_i + \varepsilon \ldots\ldots 8$$

ωU_i = information utilization by potential adopters, PEn has been defined in equation four above, Is signifies possession or dispossession of information by potential adopters, Ek implies understandability of the message being communicated (extractable knowledge). This depends on the attributes of the extension agent, approach and socioeconomic environment, Ak entails applicable knowledge, the capacity of the adopter to implement acquired information content without further external assistance. βPs Denotes aggregate personal attributes of adopters, this depends proportionally to the rate at which an individual implements information. βMs Represents level of market access available to adopters, including input and output market, $g(Kt)$ has been explained by Feder and Slade[23] as the general non-input-scientific impact of knowledge. $\underset{Km}{\leftrightarrow}$ signifies knowledge management as set of events which can influence potential adopters between the time of information acceptance, covert decision and at the point of overt action, this vector quantity can produce positive or negative effect. δRi Represent religious and other influences, this parameter is also a vector quantity. Its influence depends on time as explained in the broccoli instance. Incomplete information (information which does not reveal insitu motives and extension of the new innovation) is capable of resulting to termination of already commenced process. This is why an adopted innovation can be discontinued based on emerging information.

The probability of information utilization is given by:

$$P(U_i) = \frac{1}{1 + e^{-(b_0 + b_1\beta Is + b_2\beta Ek + b_3\beta Ak + b_4\beta Ps + b_5\beta s + b_6\beta gKt + \cdots + b_n X_{n+} \varepsilon)}} \ldots\ldots\ldots\ldots 9$$

Equation 9 takes the form of logistic regression where e = base of natural logarithms of a linear combination expressed in logistic regression analysis [24]. $P(U_i)$ = probability of information utilization, ε = error term, β = coefficients of measured variables.

MATERIAL AND METHODS

In the entire study which covered six geopolitical distribution of Nigeria, empirical data were collected quantitatively and qualitatively. The combination of both methods in collecting empirical data is not new in the domain of social scientific research [25]. In this article, only quantitative data from two geopolitical divisions are analyzed. A semi-structured questionnaire, 'Sustainable Biotechnology Adoption Questionnaire' (SBAQ) was used to obtain data from respondents. Data set represented here covered Edo State (South-South) and Imo State (South East) of Nigeria. In each State, four Local Government Areas (LGAs) were targeted for study. In each LGA, a random data was obtained from each village or sub-cells according to Agricultural Development Program (ADP) nomenclature with the assistance of extension agents (EAs). EAs served as interpreters especially for those not capable of communicating fluently in English language. They also served as guides to the villages because they were well acquainted with the areas and extensively familiar with real farmers. Realistically, they were also aware of adoption trend in the areas, having been involved in disseminating technical innovations to farmers. However, effort was implemented to ensure non-biased influence on respondents by the EAs while gender balance was also considered. Data collection was administered twice. The first phase was between July-October 2006 and second phase was between March-July 2007. In Imo State, A total of 40 respondents were interviewed in each of the randomly selected villages in the first phase while data was reduced to 30 respondents in the second phase. A total of 560 respondents were interviewed in the following Local Government Areas (LGAs): Ikeduru (Ikeduru&Iho), Ngor-Okpala (Umuneke&Umuowa), Owerri North (Awaka&Ubowala), and Owerri West (Ihiagwa&Orogwe). Edo State was not covered in phase one due to logistic constraints. Consequently, data collected from Edo State in the second phase was 60 respondents from each village, totaling 480 respondents. The following LGAs was targeted: Essan Central (Aduwa&Ihumudmu), Essan South-West (Ukpenu&Ikhirolo), Ikoba-Okha (Avbiama&Urhobo) and Ovia South-West (Iguobazuwa&Iguoriakhi) The combined data of Edo and Imo (1040 respondents) is analyzed here. Most of the questions were open and close-ended. Optional responses still incorporated provisions for comments, allowing respondents to express personal opinions. Similar responses were grouped together and formed the response options for entering result in the Grafstat software which was used in questionnaire design (See www.forschen-mit-grafstat.de). The baseline questionnaire was designed to elicit information on adopter categories, information sources, production constraints, type of crops and animals being produced, cost of information, cooperative membership and participation, motive for joining farmers' groups, nature of input and output market, information trust and speed of information utilization. Participant observation in farmers' field days, cooperative meetings and other activities enabled data verification and comparison.

Determining Adopter Categories: Although the general aim of the study was to determine factors that are capable of promoting or hindering sustainable biotechnology adoption, the study did not focus on a particular GMO since there were no officially commercialized GMOs in the country. However, each state ADPs are involved in disseminating agricultural innovations to farmers which were developed by the international institute of tropical agriculture, Ibadan (IITA) or other research institutions such as the root and tuber research institute, Umudike. Such innovations were tested at the Moore plantation, Ibadan or other institutes and then distributed to the state ADPs who carry out on-farm or on-station evaluation. Moor plantation for instance coordinates the eight South Western states ADP namely: Osun, Edo, Lagos, Ogun, Ondo, Delta, Oyo and Ekiti. In each state, there are team leaders coordinating the affairs. Through this coordination, the research institutes develop new crop varieties, weed control measures, planting time, spacing, fertilizer application rates, processing technologies and so on. During the time of this survey, the state ADPs were still disseminating such innovations like Nerica1 (new rice for Africa), yam minisett technology, use of chemicals such as boost extra and agrolizer (some form of micro nutrient fertilizers). Respondents were asked to list some recently adopted innovations, its information source and when (time) they received such information. The determination of adopter categories were hence based on individual's first initial reaction when information regarding such new innovation was presented to them. Those who applied the information immediately were designated as innovators/early adopters, the early majority were those who first verified if the information was correct and relevant, those who waited till they received more information before adoption were considered as late majority and the laggards were those who waited till they observed other farmers adopted first. Adopter categories were diagnosed based on information access and other parameters.

Appropriate inferential and descriptive analytic tools such as Means, Percentages, Chi-Squared (χ^2), Cross-tabulation and correlations were used based on Field, [24] and Webster,[26]. A partial correlation analysis was used to determine the strength of correlation between variables of interest. Partial correlation is used when determining the relationship between two variables while the effect of a third variable is held constant.

RESULTS AND DISCUSSION

Demographic Characteristic of Respondents: Agriculture constitutes the major occupation and source of living for majority of Nigerian population. About 87% of Nigerian population is engaged mainly in subsistence farming. Industrial farming is still at very low level of development. Apart from crude oil revenue, agriculture accounts for a reasonable share of Nigeria's GDP earning. Across the regions, some states are more endowed with agricultural potentials than others due to availability of arable land. Results (Table 1) revealed that within the two states, agriculture constituted a little less than two-third of the people's occupation. The practicing of farming with other activities such as handiwork, commercial motorbike or taxi business, petty trading and so on was also rampant, this accounted for less than one-fifth of the respondents. Evidently, agriculture is the major occupation in Edo than Imo. Although Edo State possesses more land mass than Imo State, problems of land fragmentation, natural disaster such as erosion poor soil fertility are among the major handicaps for increased agricultural productivity in Imo also. However, the percentage of people who engaged in farming and civil servant in Imo was higher (14%) than in Edo (10%). Since agriculture constituted the principal occupation, intuitively farming represented more than three-quarters of people's source of living.

Only 14% of respondents depended not on agriculture as the primary source of living. The percentage of people who depended on farming as the major source of living in Edo (83%) was higher compared with results from Imo (74%). The relatively higher dependence on agriculture as major occupation and source of living among respondents in the two states suggested that information seeking regarding new innovations will be higher. This can be for the purpose of improving productivity and subsequently income or improving farming profession in order to attract and retain the younger generations. Although the number of respondents interviewed in Imo was higher, still the proportion of people who depended on farming was higher in Edo State.

Age and Gender of Adopters: In the adoption literature, age has been identified as having a correlation effect on adoption decision. The argument is that younger farmers are more apt to adopt new innovations than older ones as the former tend to adhere more to change than the later. Although this point can be controversial, notwithstanding, results (Table 1) indicated that only 0.3% of the respondents were below 20 years of age, 38% were an average of 35.5 years old, 12% were above 60 years, those who were an average of 45.5 years of age constituted 41% of the respondents. There was insignificant difference in the age of the respondents in the two states apart from the fact that no farmer in Edo was below 20 years. The results indicated that more than seventy-nine percent were in the range of 31-50 years of age. This age range is regarded as an active farming age. Similar results have been obtained elsewhere [27]. Result also revealed that female farmers constituted about forty-four percent of respondents. Women contributes a considerable proportion of agricultural labor force, notwithstanding, access to extension services and other facilities by women farmers are in several instances very poor. Women are sometimes discriminated while male farmers often have access to facilities due to representation. Although some of these constraints by female farmers are being overcome through cooperative formation, lack of extension access is capable of hindering adoption rate by female farmers.

Agricultural Innovations Disseminated to Farmers: Generally, agricultural innovations disseminated to farmers are first and foremost tried by state ADPs using small plots adoption techniques (SPAT) or on lead farmers' plots located on strategic places. The rationale is to enable potential adopters observe outcomes. Usually, results from demonstrations were discussed during farmers' field day. In such gathering, adopters illustrate the innovation, its sources, difficulties and outcomes. Other farmers were allowed to ask questions freely and responses were provided by lead users or the extension agents (EAs) and subject matter specialists (SMS). The medium of communication in such gathering is characteristically the local language. This creates an avenue where farmers communicate freely and ask pertinent questions. Those desiring to adopt the 'new' innovation could do so depending on the impression and conviction ascribed to the outcome and responses received from questions and issues addressed by subject matter specialists. However, whether farmers adopts the introduced innovation depends on several factors and what happens during the process of knowledge management. These factors have been discussed previously. Notably, adoption rate for some of the innovations were generally low. In some

Table 1: Demographic characteristic of the respondents

Variable		Imo & Edo	
Occupation	Percentage	Imo (n = 560)	Edo (n = 480)
Farming	65.2(678)	62.3(349)	68.5(329)
Civil servant	5.7(59)	8.6(48)	2.3(11)
Farming & Civil Servant	11.9(124)	13.8(77)	9.8(7)
Others	17.2(179)	15.4(86)	19.4(93)
Source of Living			
Not at all	13.8(143)	14.6(82)	12.7(61)
Partly	7.9(82)	11.1(62)	4.2(20)
Yes	78.4(815)	74.3(416)	83.1(399)
Age (Years)			
Below 20	.3(3)	.5(3)	0.0
21-30	8.5(8.5)	9.3(52)	7.5(36)
31-40	38.3(398)	37.9(212)	38.8(186)
41-50	40.9(425)	40.2(225)	41.7(200)
Above 60	12.1(126)	12.1(68)	12.1(58)
Gender			
Female	43.8(455)	45.5(225)	41.7(200)
Male	56.2(585)	54.5(305)	58.3(280)

instances, farmers continued with previous innovation due to conflicting information. During one of the farmers' field day in Imo state for instance, farmers noted that the reason for non-adoption of some particular innovations were attributed to conflicting information. Especially what they were told by the extension agents and what they heard from other media sources or researchers from institutes such as the Michael Okpara College of Agriculture Umuagwo, Imo State. For the purpose of correcting such conflicting information, farmers were encouraged to adhere mainly to information from the ADPs so that blames can be apportioned appropriately in case of failures. Nevertheless, such scenario and other instances were capable of separating some farmers into distinctive adopters.

Adopter Categories: Respondents listed some recently adopted innovations within the last three years, the source of such innovation and information awareness source. They also noted the initial reaction when such information was presented to them. The conventional method of identifying adopters according to Rogers, [7] nomenclature is innovators, early adopters, early majority, late majority and laggards. However, respondents noted four levels of action exhibited in the first instance of innovation awareness viz: 'adopted immediately', 'verified if the information was correct and relevant', 'waited till more information was received' and 'waited till others adopted first'. These four levels of action were used to designate respondents as innovators/early adopters, early majority, late majority and laggards respectively.

Part 'a' of figure 1 represents the ideal Rogers' [7] distinction of adopter categories. Part 'b' represents results obtained from respondents. The purpose of depicting Rogers' results was not for comparison, there was little or no foundation to do so. Nonetheless, the rationale behind it is for emphasis and further diagnosis of the reason for such deviation. Results revealed that more than one-third of respondents were laggards, one-sixth were innovators/early adopters while 18% represented early majority.

Ideally, the percentage of laggards ought to be in the neighborhood of 16% (from part 'a' of the graph). The percentage of early majority ought to be higher than 18%. As for the innovators/early adopters and late majority, the result is taken as given. A comparative analysis of Edo and Imo States revealed that the percentage of late majority was higher (32%) compared with Imo (28%). Nevertheless, the two states' results showed similar deviation from the ideal adopter categories in that the number of laggards was higher. Interestingly, the difference between early majority and late majority in Imo was not so high compared with Edo. In the ideal adopter categories, the early majority and the late majority accounted for 34% respectively, in Edo State however, the difference was doubled. The

following reasons bothering on information problems were elaborated by respondents to explain delayed innovation adoption and the exhibition of 'seeing-is-believing' attitude.

1. Incomplete knowledge acquisition. For instance in the application of chemicals or animal medications. Farmers waited till they received more information or observed others apply it for learning purposes. The motivation was to avoid risking the entire investment.
2. Lack of adequate information (source, timeliness and availability) regarding innovation and market information to sell the product(s).
3. Irregular follow-up on given information. Extension to farmer ratio was very low. Extension agents experienced difficulties in reaching farmers at reasonable time and location.
4. Financial outlay to purchase innovations or other factors associated with it. Although some innovations were distributed freely to farmers, other direct or indirect costs were also involved.
5. Failed promises or previously introduced innovations from the government. Hence, farmers tended to be more skeptical in believing information content.
6. Study and observe results to determine if it is beneficial and need-based. This is often the case when innovations are designed without user's participation.

Information Access (IA) among Adopter Categories: Regarding adopters' information access to tackle identified constraints, three levels of access was identified: no complete information access, information was not as I wanted it and complete information access. Among respondents, results (Table 2) indicted that forty-seven percent lacked complete information access, 18% had complete information access. The highest complete information access was witnessed by innovators/early adopters (84%), the least was by the laggards. Intuitively, the proportion of early majority who noted that information access was not as desired was very high (71%), hence, they tend to learn faster from the innovators/early adopters. This was also the case with late majorities (54%).

Comparatively, the laggards recorded the highest degree (90%) lack of complete information possession. In the adoption process, the laggards adopt innovation last. They represented about 16% of the categories, [28]. Rogers correctly illustrated that information seeking and processing is the starting point of adoption. Tidd *et al.*[29] observed that lack of appropriate information hinders adoption. Adomi et al. (2003) [27] beforehand confirmed the lack of relevant information access by farmers. Their finding revealed that 71% among male and female respondents lacked access to information on fertilizer acquisition, 62% lacked information access on pests and disease control and seventy-five percent lacked information access on new innovations. This was indicative that farmers in Nigeria and conceivably other developing countries are deprived of relevant information access. Their results also revealed major constraints on information access as lack of contact with extension agents. Illiteracy was the least constraint among seven optional variables. As expected, results (Table 3) revealed a strong positive correlation between innovator/early adopters with information access and a strong negative correlation between information access and laggards. Without information availability, awareness would be unattainable. The results evidenced the fact that access to information is necessary for innovation awareness and it plays significant probabilistic role in distinguishing adopters into categories ($r = .67$, $p < 0.01$, 2-tailed). Results also showed a positive statistical significant correlation and a negative statistical significant correlation between information access and early majority and late majority respectively. Conversely, the strong negative statistically significant correlation ($r = -.56$, $p < 0.01$, 2-tailed) between laggards and information access suggests that it is impossible for farmers to adopt an innovation that they do not know the dynamics and reason why it works.

Extractable Knowledge among Adopter Categories: Extractable knowledge (EK) is meant to capture the capacity of an individual adopter to make out relevant meaning from the communicated information. Extractable knowledge is affected by language of communication, attitude and attributes of the communicator, innovation attributes, medium of communication, technicality and socioeconomic environment. Extension agents undertake their training in English language in most cases. In some instances, extension agents find it difficult to explain technical words or processes to farmers in the local dialect. In such scenario, they tend to substitute with the English version. Some innovations were not also adequately explained to farmers due to lack of resources. As envisaged, more than half of the respondents needed more information in order to understand information they were exposed to (Table 2) while 18% revealed full understanding of the information in an applicable form without further information or assistance. Among distinct adopter categories, innovators/early adopters exhibited higher capacity to have understood and comprehended information content (81%), laggards was the least in terms of information comprehensibility. In the absence of comprehending an information content

Table 2: descriptive statistic (cross tabulation)

Information access (IA)	Innovators/early adopters	Early majority	Late majority	Laggards	Total IA
No complete information access	2.5(5)	14.7(28)	43.28136)	90.0(316)	46.6(485)
Information not as I wanted it	12.8(23)	70.7(135)	54.3(171)	9.1(32)	35.0(3649
Complete information access	84.4(152)	14.7(28)	2.5(8)	0.9(39	18.4(191)
Extractable knowledge (EK)					Total EK
Do not understand completely	0.6(1)	12.6(23)	23.5(74)	50.7(178)	26.5(276)
Need more information to apply it	18.9(34)	79.1(151)	70.8(223)	48.1(169)	55.9(581)
Understand it perfectly	80.6(145)	8.9(17)	5.7(18)	1.1(4)	17.6(183)
Information relevance (IR)					Total IR
Not very satisfactory	6.1(11)	28.3(54)	67.3(212)	88.3(310)	56.6(589)
Not as I wanted it	18.3(33)	59.2(113)	28.9(91)	10.5(37)	26.5(276)
Very satisfactory	75.6(136)	12.6(24)	3.8(12)	1.1(4)	16.8(175)
Information cost (IC)					Total IC
Time and money	68.3(123)	74.9(143)	41.0(129)	43.0(151)	52.9(550)
Time, energy and effort	31.7(57)	25.1(48)	59.0(186)	57.0(200)	47.1(490)

Table 3: correlation between adopters and information access variables

Education = constant				
Imo & Edo	IA	EK	IR	IC
Innovators/early adopters	.67**	.63**	.66**	.14**
Early majority	.18**	.04n.s	.16*	.21**
Late majority	-.12**	-.09*	-.20**	-.16**
Laggards	-.56**	-.44**	-.45**	-.14**
Imo				
Innovators/early adopters	.69**	.65**	.64**	.14**
Early majority	.18**	.07n.s	.14**	.15**
Late majority	-.16**	-.08n.s	-.17**	-.18**
Laggards	-.57**	-.51**	.48**	-.09*
Edo				
Innovators/early adopters	.64**	.65**	.69**	.12*
Early majority	.19**	.01n.s	.18**	.28**
Late majority	-.04n.s	-.14*	-.24**	-.14*
Laggards	-.59**	-.36**	-.42**	-.19**

** Correlation is significant at .01 level (2-tailed), * Correlation is significant at .05 level (2-tailed), n.s. = Not significant

and for fear of risking investments, the ideal and rational decision choice for some farmers was to 'wait till other farmers had adopted the innovation'. Similar results by Meera *et al.*[30] indicated that 57% of farmers perceived disseminated information as inappropriate since they lacked the capacity to comprehend information relevance. This type of scenario results in low adoption rate[31,32,]. As envisaged (Table 3), a

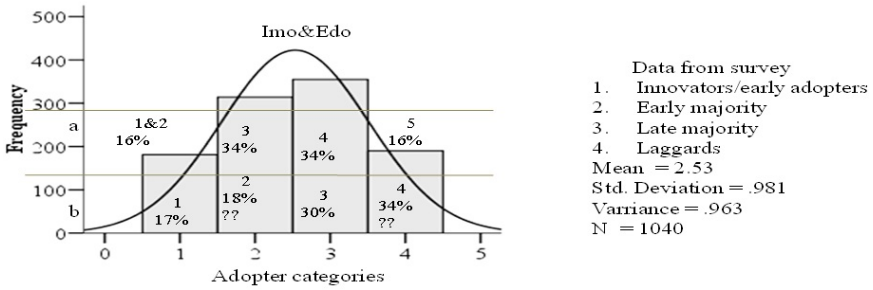

Fig. 1: Imo and Edo adopter categories

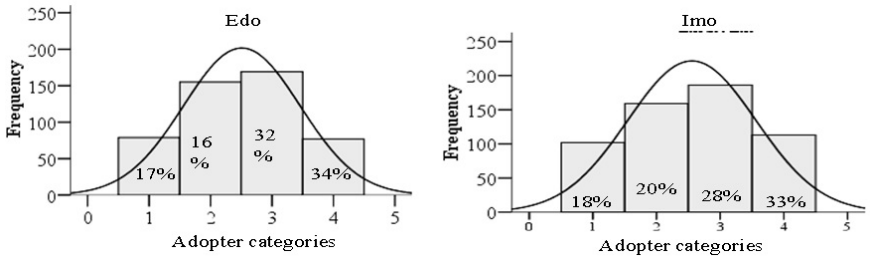

Fig. 2: adopter categories of Edo and Imo States

strong positive statistical significant correlation existed between extractable knowledge and innovators/early adopters (r = .63, $p < 0.01$, 2-tailed) while a strong negative statistical significant correlation existed between laggards and extractable knowledge (r = -.44, $p < 0.01$, 2-tailed). The more adopters understand 'why and how' an innovation works, the more they are in the position to apply the information while the reverse is the case. The early majority first verified the information content, therefore no correlation existed between them and extractable knowledge, the late majority waited till they received further information, hence the negative statistical significant non-correlation.

Information Relevance (IR) and Adopter Groups: Rogers[28] reiterated elaborately that adopters can exhibit selective listening or expose themselves to information that addresses their socioeconomic needs [33]. Heim, [34] explained the tendency of farmers to receive information content but during implementation, refuse to apply it. Information received by adopters is processed through evaluative thinking which are in stages [20]. For information to complete its full cycle, the receiver should be in a position to believe the information content as true and relevant for his/her present needs and willing to utilize it. Sometimes, information can be true and relevant but may not be needed in the present time due to several circumstances [35]. Such information will not be utilized by farmers. Results (Table 2) revealed that the highest proportion (57%) of respondents perceived disseminated information as unsatisfactory and inapplicable to present needs. Surprisingly, a relatively small proportion of the respondents (one-sixth) regarded disseminated information as relevant and applicable to current needs. This result may provoke curiosity. However Oladele,[36] previously discovered a sharp decline in extension activities. The problem hinges more on lack of participation among stakeholders before new innovations are developed [37]. Such approach falls short in incorporating the subjective opinion of the users. The resultant effect is that adopters reject such innovation or regard it as 'ADP projects' [38]. Extension agents also noted that some innovations were not adopted by farmers because it was not perceived as relevant and necessary when it was first introduced. An example was the yam minisett technology which was introduced more than twelve years ago. In Imo and Nasarawa States for instance, adoption rates was very low in the last ten years because planting material (seed yam) was not difficult and expensive to procure. Only a small proportion of adopters perceived the innovation as relevant, thus adopted it. More than three-quarters (Table 2) of innovators/early adopters judged disseminated information as relevant and applicable to appropriate needs, 13% of early majority viewed it as relevant. Only 1% of laggards regarded disseminated information as relevant and applicable (applicable knowledge) to current needs. As was envisaged (Table 3), a statistical significant correlation existed between innovators/early adopters and information relevance (r = .66, $p < 0.01$, 2-tailed), a negative statistical significant correlation existed between information relevance and laggards (r

= -.45, $p < 0.01$, 2-tailed). This may appear quickly plausible. Only those who regard information content as relevant to the present need can apply it. As the early majority seeks more information, they tend to gain more knowledge about the working dynamics of the new innovation, hence the positive statistical significant correlation. Applicable knowledge is affected by: attributes of the receiver, objective attributes of new innovation, available resources, perception and socioeconomic environment.

Information Cost among Adopter Categories: The acquisition of information involves direct and indirect costs. This revelation was noted by respondents. Feeder and Slade (1984) previously illustrated the cost of active information seeking. Passive information can also be expensive judging by the opportunity cost of time utilized on information acquirement. Participation in cooperative activities or farmers' field day involves direct and indirect cost. A larger proportion of respondents (53%) spent time and money on information acquirement (Table 2). The highest expenditure on time and money for information acquisition was recorded among early majority (75%). Innovators/early adopters utilized 68% of their time and money but less time, energy and effort on information acquisition. Improved seeds in some cases were given to innovators/early adopters without financial obligation for trial purposes. Subsequently additional cost is involved and as the innovation spreads, farmers acquire from neighbors. Further comparative analysis revealed that laggards in Imo spent more time and money (52%) than Edo (33%) on information acquisition. Interestingly Edo early majority spent more time and money (77%) than Imo on information acquisition. This can explain why seventy-five percent of Edo early majority observed that information access was not as they wanted it to be compared with Imo. Consequently, the proportion of laggards in Imo who lacked information access was higher (94%) compared with Edo. However, more respondents among the laggards in Edo noted that information was not as they would have wanted it compared with Imo. Contrary to expectation (Table 3), there was a smaller positive statistical correlation between innovators/early adopters with information cost. The reason for this was attributed to the fact that improved seeds or chemicals were usually given to this category of adopters free of charge for trial purposes, subsequently, costs are involved. A higher positive statistical correlation existed between early majority and information cost. The positive statistical significant correlation existing between innovators/early adopters and early majority with information cost (r = .12, $p < 0.05$, r = .28, $p < 0.01$, 2-tailed respectively) and the negative statistical significant correlation existing between late majority and laggards with information cost (r = -.14, $p < 0.05$, r = -.19, $p < 0.01$, 2-tailed respectively) is an indication that the cost of information regarding technical innovations are capable of distinguishing individuals into adopter groups.

Conclusion: Intuitively, grouping individuals into adopter categories is ideal for the purpose of interpreting sociological behaviors in terms of acceptance or rejection of technical innovations. Notwithstanding, such categorization should not imply that farmers resist change nor reject new innovations due to risk perception alone; except there is verifiable evidence that each individual adopter possessed the same level of information, and understood it on the same frequency within similar socioeconomic environment. Even at that, emerging information is capable of affecting overt action of adopters during the process of knowledge management. It has been proved here that not only information access determine adopter categories, but also other variables such as applicable knowledge, information cost and extractable knowledge. It may be necessary also to carry out further research on the influence of input and output market access, cooperative membership and sources of information or level of trust adopters ascribe to such information. Such holistic analysis is capable of shading more light on the categorization of adopters into distinctive grouping or a rethinking of such terminology as 'laggards'.

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