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FACTORS ASSOCIATED WITH THE ACCEPTANCE AND REJECTION  
OF THE "PICKING KNIFE" AS AN APPROPRIATE OIL PALM  
HARVESTING DEVICE IN RIVERS STATE, NIGERIA

presented by

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has been accepted towards fulfillment  
of the requirements for

Ph.D. degree in Agr'l & Ext. Educ.

A handwritten signature in black ink, reading "O. Donald Meaders".

O. DONALD MEADERS

Major professor

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**FACTORS ASSOCIATED WITH THE ACCEPTANCE AND REJECTION  
OF THE "PICKING KNIFE" AS AN APPROPRIATE OIL PALM  
HARVESTING DEVICE IN RIVERS STATE, NIGERIA**

**By**

**Alexander Johnson Akor**

**A DISSERTATION**

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## **ABSTRACT**

### **FACTORS ASSOCIATED WITH THE ACCEPTANCE AND REJECTION OF THE "PICKING KNIFE" AS AN APPROPRIATE OIL PALM HARVESTING DEVICE IN RIVERS STATE, NIGERIA**

By

Alexander Johnson Akor

Previous studies about oil palm harvesting especially in Rivers State, Nigeria, have been focused almost exclusively towards the development of mechanical devices, genetic height reduction and attributes of the first bunch. These past studies have been directed at solving the problems of health hazards to the pickers and increasing the productivity of the farms. This study was directed toward the factors associated with adoption and rejection of the picking knife for harvesting oil palm.

The picking knife seemed to have all the desirable qualities for an oil palm harvesting device in the Rivers State situation, but had not been accepted to a high degree by the oil palm operators. The problem, therefore, was to identify those factors that were associated with the adoption of the picking knife as an appropriate oil palm harvesting device.

The identification and analysis of the factors associated with the adoption of the knife in the Rivers State was done by using the innovation-decision and social theory (a case study). Data were collected through personal

Alexander Johnson Akor

interviews with operators, some of whom had never used the knife, as well as users and ex-users. An intensive description of the operators and their social institutions in the Rivers State was prepared along with the analysis and interpretation of the responses.

The factors identified were categorized into attributes of knife, individual characteristics of operators (e.g., age, education, experience), and situation.

The interrelationship between the social system, the operators' occupational biases, the historical heritage of the operators and the geographical influence on the adoption of the knife were discussed. A comparison between the Rivers State situation with that of Nigerian Institute for Oil Palm Research (NIFOR) and Malaysia showed some similarities but major differences in the interrelationship of factors and the social and historical setting. Most of the factors identified were more serious in the Rivers State than in NIFOR.

Finally, conclusions were drawn and recommendations made based on the conclusions in a way that the findings could be incorporated in programs aimed at adoption of the knife and for further research work in this area.

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### LIST OF NOMENCLATURE

A	Area under consideration in the histogram.
c	Number of columns.
C	Column frequency total.
E	The number of cases expected in a cell.
L	Distance of center of area from reference point.
Ma	Area moment of difference.
N <sub>1</sub>	Total number of Rivers State participants.
N <sub>2</sub>	Total number of NIFOR participants.
NIFOR	Nigerian Institute for Oil Palm Research
O	The number of cases observed in a cell.
Ø	Phi statistic.
r	Number of Rows.
R	Row frequency total.
T	Total frequency for each comparison.
x <sup>2</sup>	The chi-square statistic.

## **CHAPTER I**

### **INTRODUCTION THE RESEARCH PROBLEM**

#### **Background of Problem**

The oil palm tree is an important cash crop in the Rivers State, Nigeria because its two main products (palm oil and kernel) constitute the bulk of the state agricultural export products, and a large portion of these products are consumed internally. Oil palm production in the Rivers State has steadily declined over the years since the end of the Nigerian Civil War at the same time that most of the operators of the oil palm harvesters migrated to the cities. As a result, the production of palm oil and palm kernel is now mainly on plantations. The plantations which produce the palm products exclusively from cultured plants seem to be experiencing serious harvest labor problems. Experiences in other countries like Malaysia and Indonesia have shown that in similar situations, the adoption of the oil palm bunch picking knife provided an effective solution to the labor problem in harvesting. There has been no reported death due to oil palm bunch harvesting in these countries since the adoption of the picking knife method. The picking knife has a better safety record than any of the other harvesting methods.

The operator uses the knife to harvest the bunches while standing at ground level and so the question of falling off the tree is eliminated.

Traditionally, the oil palm bunch is harvested using the cutlass almost exclusively. The operator climbs the tall trees using a ladder or a locally woven rope while holding the cutlass with one hand or between one shoulder and the head (Figures 1.1 and 1.2). The cutlass is not a handy implement for harvesting oil palm bunches (Hartley, 1977), however, and climbing the tree with a ladder or the rope is slow and sometimes dangerous. The ladder or rope has to be carried from one place (tree position) to another, placed in the operating position and then the operator propels his body up to his reach of the bunch, and cuts off the bunch along with green leaves. This is a time consuming exercise. Once on the top of the tree close to the bunch, the operator is exposed to all sorts of dangers: snakes and/or wasps inhabiting the tree top; inadvertently cutting off the rope; falling off due to ladder instability or weakness. Operators are known to have been maimed by falling off the rope or ladder, and in some cases death has resulted. These are the problems that plague the traditional harvesting methods and the operators in Rivers State.

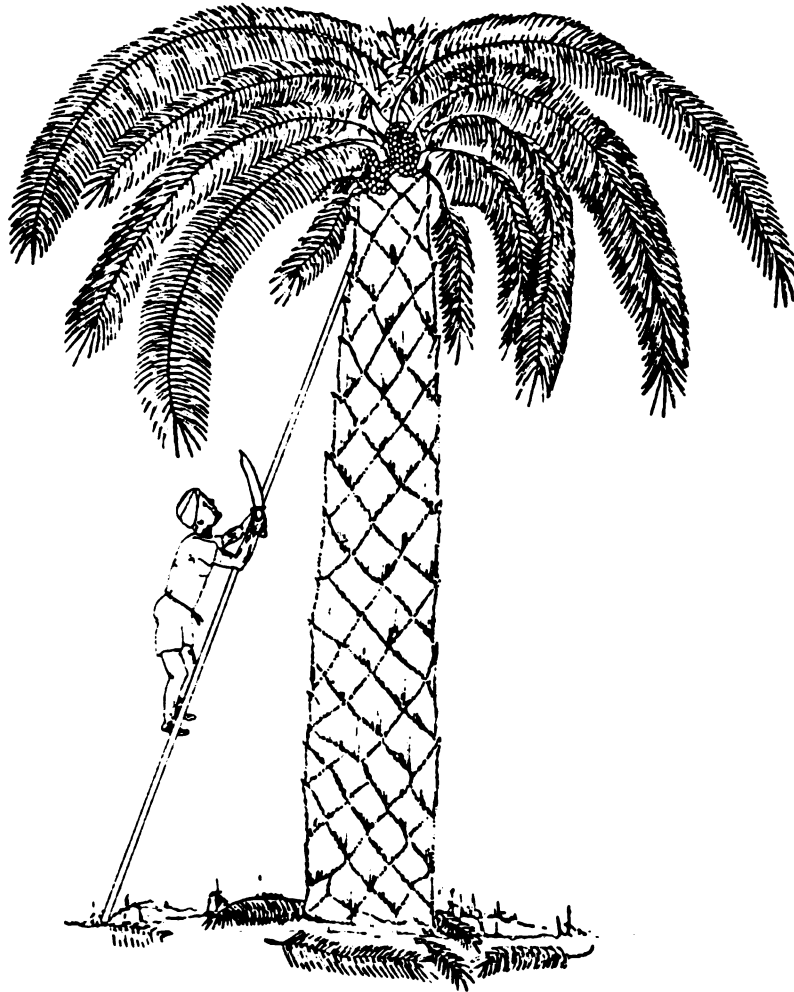


Figure 1.1 Ladder Method of Harvesting Oil Palm  
Bunch in Rivers State

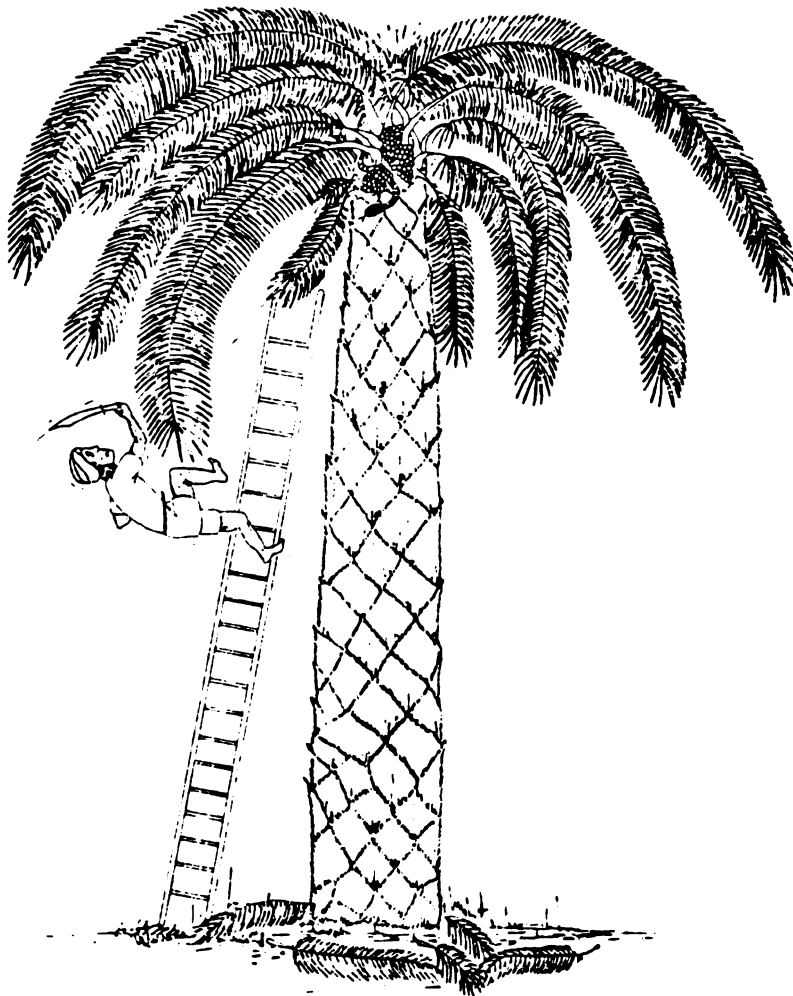


Figure 1.2 The operator falls off his tree because of a poisonous snake on the top

Plate 1.1 shows a 24-year old cultured oil palm tree for which the knife is used. The cultured trees have approximately 30 years of economic life. Plate 1.2 shows a wild oil palm tree, too tall for the use of the picking knife. The wild trees are not popular because the yield from them is low and it requires more time and energy to harvest them.

Elsewhere in the world, the traditional methods have largely given way to the picking knife, a method developed in the Far East (Hartley, 1977, p. 459). However, the picking knife has received only a token acceptance from the Rivers State operators. It is not popular as an oil palm bunch harvesting tool, in spite of the fact that a similar device is native to the State for harvesting plantain and banana.

The need to study the adoption of the picking knife as an oil palm bunch harvesting device in the Rivers State arises from the fact that there is a genuine concern about the safety of the operators and reducing the injury resulting from fall-off accidents.

A similar situation necessitated the introduction of the Malayan Knife into the Nigerian Institute for Oil Palm Research, Benin, in 1960. According to Hartley (1977), the introduction of the knife into NIFOR reduced the number of accidents at harvest and improved productivity per operator

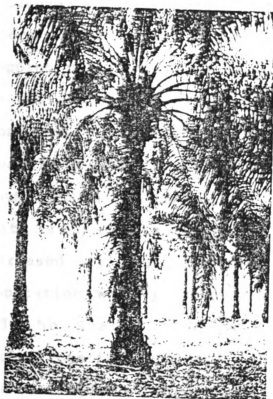


Plate 1.1. Cultured 24 Years  
Old Oil Palm Tree  
15 M to the bunch



Plate 1.2. Wild Oil Palm Tree  
About 27 Years  
42 M to the bunch



in that plantation. Thus, in this study, the current situation in the adoption of the knife in NIFOR is included to serve as base for comparing the case in the Rivers State. This is important because the picking knife was introduced into the Rivers from NIFOR.

The fall in the production of palm oil now has been particularly critical for Rivers State because it was the second major export of the State, and with the rapidly dropping price of petroleum (the primary export product of the State), the oil palm products assumed a new and higher prominence in the State's and Nation's economies. The production of palm oils in the country fell below the amount needed to satisfy local consumption and so companies that use them had to import from other countries. Increased oil palm production could reduce expenditure on importation and even earn foreign exchange for the Country and the State. The palm oils are used in making confectioneries, lotions, medicines, soaps, and as frying and cooking oil. They also are used raw with other food materials like potato, yam, cassava, plantain, and banana. The raw oils are a vital source of vitamins and carotene for the people of Rivers State.

The Rivers State had a population of 2,581,000 and occupied 2,185,000 hectares of the Niger delta of Nigeria (Figure 1.3). About 240,000 farmers in the Rivers State

FEDERAL REPUBLIC  
OF  
NIGERIA

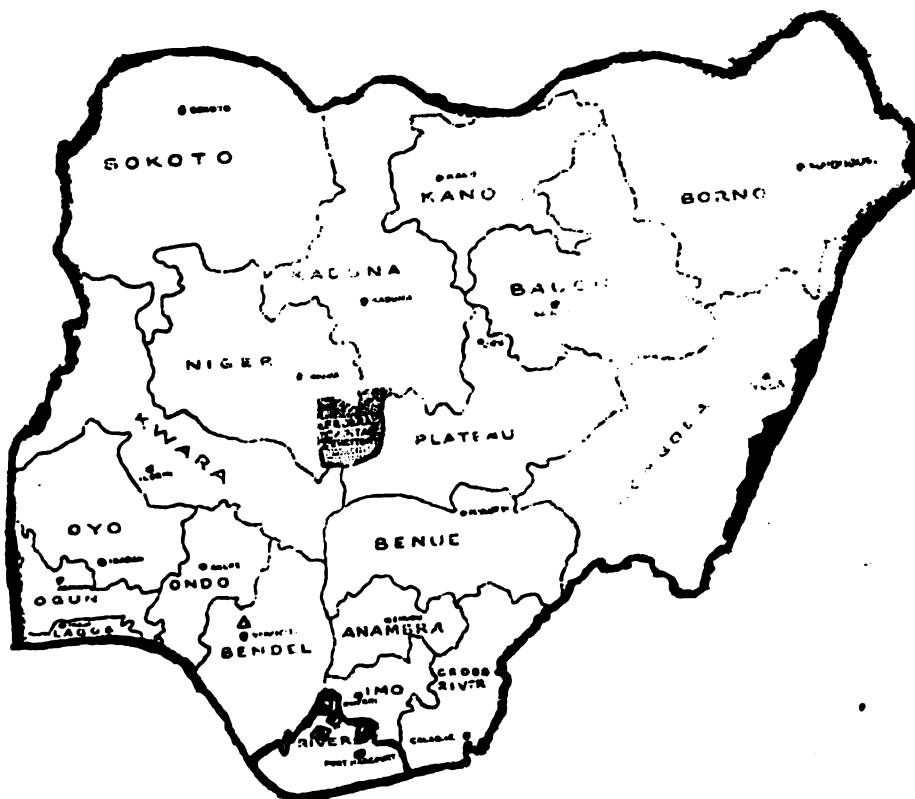


Plate 1.3. The Map of Nigeria Showing the Locations of the Rivers State, the Four Plantations, and NIFOR.

Key:

- Capitals of States
- Plantations in Rivers State
- △ NIFOR

operated oil palm bunch harvesters either on a part-time or full-time basis. One-third of the operators were professional operators.\* All of the operators were small scale farmers on other crops (yam, cassava, cocoyam, plantain, or banana). The professional operators had an average farm size of 0.8 hectares.\* The non-professional operators had other occupations such as weaving of baskets, chairs, hampers, etc. There were 86 employed operators in NIFOR and each had a garden of other crops behind his house.

With the production of palm oil and kernel now mainly in the plantations, and lack of interest in the oil palm harvest labor force in the State, the adoption of the picking knife seemed a reasonable alternative approach to solving the oil palm bunch harvest problem in the State and reducing the hazards to the people doing the harvesting.

#### Problem Statement

Over the years, the climbing methods for harvesting oil palm bunches has resulted in the loss of lives for many, and physical deformation for others. An alternative which reduces the risks as well as saves time of harvesting has received little or no attention from the operators. Obviously, no operator would want to die or be maimed harvesting the oil palm bunch. The problem, therefore, is

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\*Annual Abstract of Statistics 1981 Edition. Federal Office of Statistics, Lagos, Nigeria.

that the picking knife alternative had not been adopted to a high degree by the operators in Rivers State, in spite of the seeming positive attributes of the knife. There must be some factors that are responsible for this poor adoption of the knife.

#### Purpose of the Study

It is the purpose of this study to examine all possible factors associated with the adoption of the knife, with a view to determining which of these factors are actually associated with the adoption of the knife in Rivers State, Nigeria.

The knowledge of these factors could be helpful in the design of programs to facilitate the adoption of the knife in the State and possibly with subsequent saving of lives and a reduction in medical bills of operators. (The government is not legally responsible for any injuries incurred during harvest.)

Specifically, the study was aimed at determining which of the:

1. attributes of the innovation were associated with the adoption of the knife;
2. "people differences" were associated with the adoption of the knife;
3. communication factors were associated with the adoption of the knife; and

4. the contributing factors resulted from the cultural geographical setting and historical background of the operators.

So, the problem, was to determine the reasons why operators in the Rivers State had not accepted and adopted the use of the picking knife as an appropriate oil palm bunch harvester. The picking knife, an individualized tool like the traditional cutlass, makes it possible for the operator to harvest the oil palm bunch while standing on the ground. The risk of falling off the tree is minimized. The picking knife is the only currently available oil palm harvesting alternative to the hazardous climbing methods in Rivers State.

#### Theoretical Basis for Study

This research was based on innovation decision and social change theory.

Rogers (1984) conceptualized five stages of the innovation-decision process. His model consists of the following stages: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation.

According to this model, knowledge of an innovation occurs when the individual is exposed to it as a need or to generate a need. Exposure of the individual to innovation occurs through communication (education). Then people perceive innovation according to their individual experiences (Rogers, 1984).

The steps in the persuasion phase include: motivation of potential adopters through the improvement of the attributes of the innovation and providing incentives and information about the improvements. Incentives create attitude formation towards the innovation (positive or negative). At this point, the individual seeks social reinforcement for adopting the innovation - social appropriateness, support system perception and social consequences (Fear, 1985). The individual may decide to try or abandon the innovation. If he decides to try the innovation and evaluate it from the trial (implementation stage), then he either decides to adopt or reject the innovation (Roger, 1984).

#### Theories of Innovation Diffusion and Social Change

This study was based on both existing theories of innovation diffusion and social change as proposed by Zaltman, Duncan and Holbeck (1973), Lin and Zaltman (1973), Zaltman and Duncan (1977), Rogers (1962, 1971, and 1983).

The theories of innovation diffusion provide the underlying explanations for the general behaviors of the oil palm harvest operators in the Rivers State towards the adoption of the picking knife.

The theories of innovation diffusion explain the tendencies of potential adopters of innovations to be a function of the perceived attributes of the innovation.

These attributes have been described by Zaltman and Duncan (1977) as: (1) relative advantage, (2) impact on social relationships, (3) divisibility, (4) reversibility, (5) complexity, (6) compatibility, (7) communicability, and (8) time dimension. Rogers (1983) summarized these as: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability. These characteristics have been found to be modified by age, experience, education, historical, cultural and geographical differences of the persons involved. More details of these attributes are given in Chapter II.

### Social Change

Major social change principles have been summarized by Davis (1973), and Davis and Salasin (1975), under a framework described by the acronym "A VICTORY" explained below:

- A = Ability; the resources and capabilities of the individual or organization to implement and subsequently evaluate the innovation; sanctions of decision makers to adopt the innovation.
- V = Values; the degree of accord with the individual's or organization's philosophy and operating style.
- I = Idea; the adequacy of knowledge about the innovative procedure and the proposed action steps.
- C = Circumstances; features of the individual's or organization's environment relevant to successful adoption.

- T = Timing; readiness to consider the innovation; the particular combination of events at a given time that might affect the likelihood of implementation.
- O = Obligation; the felt need to change from existing *modi operandi* - or at least to try the proposed change.
- R = Resistance; inhibiting factors - the organizational or individual disinclination to change, for whatever reasons.
- Y = Yield; the benefits or payoff from the innovation as perceived by potential adopters and by those who would be involved with implementation at the operating level.

These principles form a part of the basis for this study. The innovation decision theories are an integral part of the above principles.

#### Questions to be Answered

The questions that will be answered by this study are as follows:

1. How do the operators perceive the attributes of the picking knife? Which factors among the attributes are associated with the adoption of the knife? How important are these factors?
2. Through what channels of information do the operators in Rivers State receive their learning about the picking knife? Is communication a factor in the adoption of the knife?
3. What individual factors such as health, age, experience, educational status, and employer policies of the operators are associated with the adoption or rejection of the knife?
4. How important are the factors in the user's and ex-user's decision to adopt or reject the use of the knife?



5. Which of these factors should be or could be changed to enhance the adoption of the picking knife in Rivers State?
6. What types of conditions would the operators perceive as appropriate for them in the adoption or continued use of the picking knife?
7. What social, cultural, historical, and geographical resistances are there on the adoption of the picking knife in the Rivers State?

### Research Hypotheses

These questions could be answered by posing the following hypotheses of independence:

- H<sub>01</sub> The adoption of the picking knife in the Rivers State is independent of the relative advantage of the knife over the ladder or the rope method. (Each of the subfactors under the relative advantage of the knife is tested for independence in this way.)
- H<sub>a1</sub> The adoption of the picking knife in the Rivers State depends on the relative advantage of the knife over the ladder or the rope methods.
- H<sub>02</sub> The adoption of the picking knife in the Rivers State is independent of the compatibility of the knife with social and individual orientations.
- H<sub>a2</sub> The adoption of the picking knife in the Rivers State depends on the compatibility of the knife with social and individual orientations.
- H<sub>03</sub> The adoption of the knife in the Rivers State is independent of the complexity of the knife.
- H<sub>a3</sub> The adoption of the picking knife in the Rivers State depends on the complexity of the knife.
- H<sub>04</sub> The adoption of the knife in the Rivers State is independent of the trialability of the knife.
- H<sub>a4</sub> The adoption of the picking knife in the Rivers State depends on the trialability of the knife.

- H<sub>0</sub>5 The adoption of the knife in the Rivers State is independent of the observability of the knife.
- H<sub>a</sub>5 The adoption of the picking knife in the Rivers State depends on the observability of the knife.
- H<sub>0</sub>6 The adoption of the picking knife in the Rivers State is independent of the experience of the operator.
- H<sub>a</sub>6 The adoption of the picking knife in the Rivers State depends on the experience of the operator.
- H<sub>0</sub>7 The adoption of the picking knife in the Rivers States is independent of the educational status of the operator.
- H<sub>a</sub>7 The adoption of the picking knife in the Rivers State depends on the educational status of the operator.
- H<sub>0</sub>8 The adoption of the picking knife in the Rivers State is independent of the age of the operator.
- H<sub>a</sub>8 The adoption of the picking knife in the Rivers State depends on the age of the operator.
- H<sub>0</sub>9 The adoption of the picking knife in the Rivers State is independent on the employer of the operator.
- H<sub>a</sub>9 The adoption of the picking knife in the Rivers State depends on the employer of the operator.
- H<sub>0</sub>10 The adoption of the picking knife in the Rivers State is independent of the reversibility of the picking knife.
- H<sub>a</sub>10 The adoption of the picking knife in the Rivers State depends on the reversibility of the knife.

These hypotheses were posed with the hope that the data collected will lead to the rejection of the null hypotheses in favor of the alternative hypotheses.

While these hypotheses were used to identify and characterize the factors associated with the adoption of the picking knife, conclusions drawn from the analysis of

the data and the observed modifying effect of the culture, history, and geography of the Rivers State operators were used to generate new hypotheses that would form the basis for further investigations in this area.

### Significance of the Study

The objective of this study was to identify those factors associated with the adoption of the picking knife in the Rivers State by analysis of responses to interview questions would provide these factors. The conclusions drawn from this study (which include the factors), would provide a resource base for planning programs to facilitate the adoption of the picking knife.

Based on the conclusions from this study, it will be possible to advise the government on policies towards oil palm harvesting; agencies and corporations engaged in the improvement of the productivity of the oil palm industry in Rivers State (e.g. The World Bank) on strategies for improving the safety record of oil palm harvesting by improving some of the attributes of innovation associated with the adoption, incentives for the operators and the information channels for the diffusion of oil palm harvesting innovations; and the research institutions on the direction of research works on oil palm harvesting in Rivers State.

Finally, the data from this study may provide the basis for the formulation of hypotheses for more detailed investigation of the interrelations of the factors associated with the adoption of the picking knife as the oil palm bunch harvesting device in Rivers State.

#### Sources of Data

The participants for this study included selected current and former users of the oil palm bunch picking knife in Rivers State; a sample of the users in the Nigerian Institute for Oil Palm Research, Benin from where the picking knife was first introduced into Nigeria, and some operators who had never used the knife in the Rivers State. Thus, some conclusions from the study could apply in the Rivers State of Nigeria, as well as NIFOR.

#### Potential Beneficiaries

The stakeholders in this project were: the oil palm bunch operators, Rivers State Government, extension agents in Rivers State; and institutions engaged in oil palm harvesting research. However, because of the fact that some information about the adoption of the picking knife was drawn from the Malaysian experience (the world innovators), and because of some generalizations of the psychology and sociology of planned change as presented by Rogers (1984), and Zaltman and Duncan (1977), and the

similarities in the oil palm industry (Corley, et. al., 1973), Hartley (1977) and Durfrane and Vanderweyen (1954), there was little reason to believe that some aspects of the conclusions from this work could not apply elsewhere in the world. According to Rogers, Zaltman and Duncan, the general compelling forces in the innovation-decision process apply cross-culturally. Differences occur in the values, beliefs, attitudes or behaviors of the individual potential adopters, change agents and the socio-political systems.

Borrowing from Zaltman (1983, p. 312):

The particular concepts, principles and . . . propositions presented . . . here . . . are to be viewed as rules of thumb that change agents . . . should use with considerable poetic license.

### Definition of Terms

The following terms are defined in the context in which they are used in this study. Unless otherwise noted, the definitions are as presented by Rogers and Shoemaker (1971).

Acceptance: The act of approval (Webster).

Adoption: A decision to make full use of a new idea as the best course of action.

Adoption Levels: The four levels of adoption as delineated by Bouterse (1975).

Level 1- No action on the part of the person in relation to adopting the innovation.

Level 2- Awareness that the innovation is available.

Level 3- Information sought regarding the innovation.

Level 4- Action taken to implement the innovation.

Change Agents: The professionals who optimize the direction of social changes. They are catalytic in function.

Communication: The process by which messages containing ideas are transmitted from a source, through a medium to a receiver. The message is encoded by the transmitter and decoded by the receiver using past experiences. The message is transmitted to the receiver with a view to modifying his/her behavior.

Communication Channel: The means or medium by which the message gets from the source to the receiver, for instance:

--Mass Media communication channels--All those means of transmitting messages that involve a mass medium such as radio, television, movies, newspapers, magazines-- anything that enables a source of one or a number of individuals to reach an audience of many.

Impersonal communication channels: Those channels of communication that do not involve a face-to-face or voice exchange between two or more individuals. These are one-way communication channels. Most of the mass media (including the computer) are in this group.

Diffusion: A special type of communication concerned with the spread of messages that are new ideas. The main

elements of diffusion are the innovation which is communicated through certain channels over time among the members of a social system (like the Rivers State Operator). It is the element of time that distinguishes diffusion from other types of communication.

Harvester: Any device that is used to detach the oil palm bunch from the palm tree. Usually refers to mechanical devices. A harvester can be used to prune the palm tree. (Technical definition)

Innovation: The introduction of something new, modified from existing similar material or immaterial objects. In other words, innovation could be an idea or machine. (Technical definition)

Laggards: The last set of adopter categories. Late adopters as different from early adopters of innovations.

Loose Fruits: These are oil palm fruits detached from the bunch.

Operator: Artisan or workman who uses the harvester (Webster).

### Assumptions

The adoption pattern of the oil palm bunch picking knife has followed mainly the research and development model of social change in its introduction to Nigeria with elements of other models, as is evident from the publications of the Nigerian Institute for Oil Palm

Research (NIFOR).\*\* Thus, it is appropriate to assume in this study that:

1. There was a rational sequence in the application of the innovation. This sequence included: research, development and dissemination of the information to the potential adopters (Havelock and Havelock, 1970). This sequence was in the dissemination stage for the picking knife in the Rivers State.
2. The operator in this case was a passive but rational consumer of the technology. The operator did not develop the idea but would use it if he considered it useful.
3. The operator adopted or rejected the picking knife through the innovation-decision sequence of knowledge, persuasion, trial, decision, implementation and confirmation.
4. The operators accepted the innovation when offered in the right place at the right time and in the right form.
5. Self-applied innovation had the best chances for long-term survival.
6. The wide-spread adoption of the knife in the Rivers State would result in decreased hazards to the persons involved in harvesting the oil palm bunches.

These assumptions served as the basis for gathering the data for this work.

### Limitations

The findings from this study will only apply to a limited extent beyond the Rivers State and the Nigerian Institute for Oil Palm Research from where the data were

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\*\* Journal of Nigerian Institute for Oil Palm Research (1960, 1961, 1964, 1965).



collected because of cultural, geographical, and socio-political differences as stated earlier.

The data were collected by interview only, because most of the participants could not read or write the English language or their own languages, and the questions had to be translated into their native language (Ogba, Eche, Ekpeya and Ikwerr). There are, therefore, chances for misinterpretation or misconception of words or sentences.

A major limitation was imposed by the total number of participants - defined as current users and discontinued users. In the Rivers State, the total number of participants was 71 (21 users, 25 ex-users, and 25 operators who had never used the knife). In Rivers State, the latest census information (1981) indicated the total population to be 2,581,000. The population in the rural areas, where the oil palm was grown, was reported as 1,720,667. The scope of this study was confined to the areas where the four major plantations were located and to the population which provided the source of persons who did the harvesting on those plantations. In NIFOR, a two-thirds sample size was 57 (38 current users and 19 ex-users). The total sample size of 103<sup>\*\*\*</sup> with so many

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<sup>\*\*\*</sup>The 25 operators who had never used the knife were not included in the statistical analysis because of the unanimity in their responses.

variables did not allow for accurate detailed analysis beyond the general identification of the factors.

The empathy on the part of the interviewer and the homophily between interviewer and participants determined the extent to which the participant was able to answer interview questions and the extent of understanding between them. Even when the study participants were able and willing to describe their experience and feelings about the picking knife, it was not known to what extent they revealed what there was to disclose about their decision to adopt or reject the innovation. Thus, the amount and authenticity of information gathered depended on the participants' cooperation and capability.

Qualitative studies using interviews to gather data are subject to concerns about both reliability and validity. Reliability could be managed by using a single interviewer (the researcher) and following the pre-established areas of inquiry. The question of reliability and validity could be enhanced by careful documentation of all aspects of each interview session, recapitulation, confirmation and correction of the description given by the study participants. This is easier to achieve if all of the interview sessions are recorded on a tape. However, replication is not expected nor consistent with the open-

ended interview approach that is appropriate for a case study methodology.

Finally, the focus of this study is not on individual farmer-operators, but on operators in general.

#### Organization of the Remainder of this Study

Chapter II of this dissertation contains a review of the literature with the intent of supporting the assumptions made in this study and providing background information about the adoption of the picking knife in the Rivers State and elsewhere. Chapter III describes the theoretical basis for research design and the exact procedures followed in the study. Chapter IV presents an analysis and a discussion of the major findings. Chapter V offers conclusions of this study, implications and recommendations for further study.

## **CHAPTER II**

### **REVIEW OF LITERATURE**

The purpose of this chapter is to identify those factors that may be associated with the adoption of the picking knife as an appropriate oil palm harvesting device in the Rivers State. This chapter, therefore, presents and discusses the literature relevant to theories and assumptions on which the study is based. Together, the literature of social changes and innovation-decision factors and processes fulfill the intent of this review. The two kinds of literature also provided a basis for discussing the relevance of the findings of this study and for suggesting their implications.

Finally, because of the peculiarity of oil palm harvesting, the available literature in this area was reviewed and related to the theories for the sake of clarity and support.

#### **Innovation-Diffusion Research**

Most of the early published work in innovation-diffusion was in the field of agriculture, and focused on the farmer adopting progressive farm practices or newly developed field crops. Included in the study of adoption processes were the innovation characteristics, the role and effectiveness of extension services, and the reactions of the clients.

Since the early 40's, when a pioneer study of the diffusion and adoption of hybrid corn was made (Ryan and Gross, 1943), diffusion researchers have repeatedly observed that adoption occurs as "a process composed of learning, deciding and acting over a period of time" (Wilkening, 1953). The adoption of an innovation is an evolutionary process that results from a series of interrelated actions and mental decisions guided by the attributes of the innovation and proceeding from the initial knowledge of the innovation to its complete adoption. According to Zaltman and Duncan (1977) and Rogers (1983), the innovation adoption process involves need or problem recognition, basic and applied research to problems, technology development, diffusion and adoption, commercialization and the social consequences.

The problems of the increasing number of injuries sustained by operators at harvest, and the dwindling palm oil production in Rivers State were recognized after the civil war in Nigeria, when oil prices in the local market tripled and Unilever and other soap manufacturers started to import oil from other African Countries (Federal Office of Statistics, 1977). Research carried out in the Elele Oil Palm Plantation showed that within a period of two months, there were 8 recorded cases of operators falling

off the tree, resulting in two deaths.\* In an attempt to solve this problem, the government increased the number of cultured trees planted in the plantations only to discover that the real problem was in harvesting the palm bunches. There were not enough operators to harvest the trees because the number of accidents was high. The plantation owners and managers then decided to introduce the picking knife which was already developed and had been found to reduce the injury sustainable by the operator at harvest (Hartley, 1977).

However, this did not increase production or reduce the accident rate to the level of expectation of the plantation owners/managers, and thus there was a need to re-evaluate the harvesting system, of the oil palm in the Rivers State. (See Table 2.1)

#### Attributes of the Innovation

The failure of the introduction of the picking knife in the Rivers State (1974) to reduce the number of accidents, or increase the production of palm oil was probably due to the fact that the rate of adoption of the knife was visibly slow. This slow adoption of the knife in the Rivers State may be attributed to some factors associated with the adoption of such innovations. The

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\*Mechanization of the Oil Palm Processes in Nigeria (Akor, 1977). Proceedings of the NSAE on "Agricultural Mechanization and Operation - Feed the Nation," University of Ibadan, April 4-7, 1977.

reception given to a new idea is not so fortuitous and predictable as it sometimes appears to be. The character of the idea is itself an important determinant (Barnett, 1953, p. 313).

Table 2.1

## World Production of Palm Oil (1000 tonnes)

Country	1972	1976	1980	1984
Peninsula Malaysia	657	1,250	1,721	1,916
Nigeria	460	510	438	441
Indonesia	269	450	772	933
Zaire Rep.	180	170	163	159
Ivory Coast	93	176	198	235
Sabah	72	140	182	201
Angola	70	40	36	27
Cameroon	58	60	68	74
Benin (Dahomey)	39	35	31	33
Others	317	487	511	596
<b>World Total</b>	<b>2,216</b>	<b>3,318</b>	<b>4,120</b>	<b>4,615</b>

Source: FAO Production Yearbook.

Unfortunately, a careful search of the literature showed that little effort had been devoted to analyzing "innovation" differences (that is, in investigating how the properties of an innovation affect its rate of adoption). This type of research can be of great value to change agents seeking to predict the reactions of their clients to an innovation, and perhaps to modify certain of these reactions by the way they name and position an innovation and relate the new idea to existing beliefs (Rogers, 1983). According to Rogers, diffusion researchers in the past

tended to regard all innovations as equivalent units from the viewpoint of study and analysis. This oversimplification could be responsible for the poor adoption stance of the picking knife in the Rivers State.

Relative Advantage. This aspect of an innovation refers to the unique benefit the innovation provides that other ideas, practices, or things do not provide at all or as well. The relative advantage is important at the interest and evaluation stages of the adoption decision process. It may take the form of more economy, a lessening of social conflict, psychological security, greater production, and so forth (Zaltman and Duncan, 1977). The relative advantage of an innovation, as perceived by members of a social system, is positively related to its rate of adoption (Rogers, 1983).

Compatibility. Zaltman and Duncan (1977) equates compatibility of an innovation to the "goodness of fit" the idea has with the situation in which it is to be used. The situation includes psychological, sociological, and cultural factors. According to Rogers, the compatibility of an innovation, as perceived by the social system, is positively related to its rate of adoption.

Complexity. The complexity of an innovation can be seen in the light of its use (ease of operation and maintenance) and understanding of the principle of



operation. The greater the degree of difficulty in using and understanding a change, the less the likelihood that it will be adopted voluntarily (Zaltman and Duncan, 1977). It is important that the change agent be able to distinguish between complexity-in-use and complexity-in-understanding, because different people may respond differently to the same change (Lionberger 1960 and Smith and Sheppard, 1959). Zaltman and Duncan cautioned against change agents not giving enough time to explain about the technical aspects of a change and instruction in its use (relationistic and technocratic biases).

Trialability. Rogers (1983) describes this aspect of the attribute of innovation as the degree to which an innovation may be experimented with on a limited basis. Trialability of an innovation can be separated into two closely related parts - divisibility and reversibility (Zaltman and Duncan, 1977). Divisibility refers to the extent to which a change can be implemented on a limited scale. Thus, a new product like the picking knife can be purchased at a relatively low cost and tried without the fear of a major economic loss if it is not adopted for that particular use. Even if it is not used in some other ways, the loss would not be too much to bear.

The reversibility on the other hand, refers to the ease with which the status quo ante can be reestablished if

a change is introduced but is later rejected. The greater the ease with which a change may be discontinued, and the fewer the permanent consequences of having tried or adopted the change, the more likely it is that the change will be accepted (Fliegel and Kivlin, 1962). Trialability is important at the trial stage of adoption and greatly facilitates the trial use of an innovation.

Observability. This is the degree to which the results of an innovation are visible and can be communicated to others (Rogers, 1983 and Fliegel and Kivlin, 1966).

The ease with which information about a change can be disseminated is a critical dimension of the attribute of the change or idea. Some innovations and some social structures are more amenable to word-of-mouth communication than others (Blau, 1974 and Rogers and Argawala-Rogers, 1976). Communicability is important at the awareness and interest decision-making stages. Certain industrial structures, as well as organization structures, are more conducive to communication about innovation than others (Czepiel, 1973; Zaltman, Duncan, and Holbek, 1973; and Rogers and Argawala-Rogers, 1976).

The observability of an innovation, as perceived by the potential adopters, is positively related to its rate of adoption. White (1967) found that using a large volume

of mass media does not necessarily lead to increased knowledge about one innovation. The specific media used and the type of material consumed should be considered when designing a communication program. White also found that interpersonal communication is important in spreading knowledge about innovations particularly for adopters.

#### Other Dimensions of Innovation-Diffusion Research

Time. The speed with which an innovation is introduced is an important dimension. It is necessary to think in terms of optimal time (Zaltman and Duncan, 1977). The most appropriate rate of change may not correspond to the maximum rate of change possible. Change can be introduced too quickly or too slowly (Fliegel, 1956).

Commitment. The commitment required to adopt and implement change is also important. The greater the commitment, that is, the greater the amount of time, money and other resources that must be allocated, the less likely change is to take place. Susceptibility to successive modification is important where technology is changing rapidly or where different persons or groups use the change or innovation but have somewhat different use patterns.

Age. The variations within the ages of potential users of an innovation is an important consideration among the factors associated with the adoption of the innovation. The physical demands of the innovation have to be matched

to the physical condition of the target group (Copp, 1956). Generally, the more the physical requirement for an innovation, the less the chances for its adoption.

Education. In his paper "Agricultural Technology for Increased Food Production in Developing Nations: Problems and Opportunities," Sen argues that the reasons for the slow rate of diffusion of innovations in the Third World countries include, lack of consideration for certain sociological, cultural and economic consequences. He suggested that when research is oriented towards a target group, the provision of effective and imaginative nonformal education opportunities, extension services closely supported by feedback arrangements, and greater geographical and social mobility are likely to reduce many of the cultural and social barriers, because although technology itself is important, technology by itself is not enough (Sen, 1978). Sen contended that the slow adoption of technologies, especially in the Third World, usually have specific cause factors which have to be identified in every situation, as an important first step towards change at the grass root level, and that this should be followed by appropriately educating the target group.

Writing about agricultural education and development in Taiwan, Meaders agreed with Harbison that the high rate of economic growth was the consequence of a constellation

of policies designed to utilize, with maximum effectiveness, the countries' (both Korea and Taiwan) great wealth of human resources (Meaders, 1979). The great wealth of human resources can be maximized through education. In the case of the oil palm picking knife, the education of the target group could take the form of planned demonstrations, diffusion effect, radio and television programs. This requires the involvement of the Extension Division of the Ministry of Agriculture.

According to Lionberger and Gwin, background such as education, childhood environment, and parents' education and occupation obviously affect a person's reaction to a new idea (Lionberger and Gwin, 1982).

Applying Miller's analysis to the oil palm harvesting methods, one is inclined to predict that a healthy oil palm harvesting situation in Rivers State will exist only when the operators have sufficient facts about the advantages and disadvantages of different alternatives that are available, and making a choice of procedure based on the social and economic rationale (Miller, 1965).

Employment. Appropriate mechanization can be selected so as not to replace all human labor and increase unemployment, but rather increase overall production and improve the living conditions and optimism of rural people (Esmay, 1978). The identification of the factors

associated with the use of the picking knife as an appropriate oil palm harvesting device in the Rivers State is important in the type of selective mechanization mentioned above.

The oil palm tree has a peak as well as a low (trough) period of yield. Thus, the plantation managers do not usually need fully employed harvester operators. Operators are recruited on a daily basis during the peak harvest period and laid off at the trough period making the operator's job uncertain. As a result of this uncertainty in the operators' labor market and the unhealthy harvest conditions, there were bound to be some negative consequences on oil palm harvesting in the Rivers State. Such consequences could reflect on the factors associated in the adoption of the picking knife as a harvesting device.

Writing about "Agricultural Process Technologies in West Africa," Byerlee and his co-workers observed that despite the wide range of agricultural processing techniques which are in use in Africa and the importance of this sector for employment and income generation, there are very few economic studies of this sector (Byerlee, et. al., 1977).

Other areas of concern in the adoption of the picking knife include the experience of the potential adopters and

other social resistance to change. Resistance is not simply the lack of acceptance or the reverse of acceptance (Zaltman and Duncan, 1977). Although the same factors are relevant for both acceptance and resistance, they may be relevant in different ways. For example, when an innovation is incompatible with a particular norm (the relevant factor), it may be adopted as a symbol of defiance for one person and rejected by another person for fear of social disapproval. Similarly, the uniqueness of an innovation may be a cause of attraction for innovators and a cause of resistance for more conservative people (Zaltman and Pinson, 1974).

One very major barrier to change stems from cultural values and beliefs (Foster, 1962). Weber (1947), for example, ascribed lack of a work ethic, the absence of desire for upward mobility, and so forth, as major barriers to economic development prior to the use of capitalism in Europe. Rostow (1960), also discussing economic development, noted the absence of entrepreneurship and willingness to accept innovations as sources of resistance to change. Hagen (1962) described as barriers, the lack of socialization in early childhood of key social values such as achievement and autonomy as barriers causing resistance to change. Similarly, McClelland (1961) noted as the major barrier to change the absence of the central social values

he called achievement motivation, which is an inner drive to compete or do well relative to some standard of excellence. Strongly related to the absence of such cultural values and attitudes (such as thrift and achievement motivation) is a trust in traditional ways of doing things.

### Oil Palm Harvesting Techniques

The techniques of harvesting the oil palm bunch did not receive organized research attention until recently. In the early 50's, some colonial research workers started to put together pieces of information about the oil palm cultivation and harvesting. This information was obtained primarily in the Belgium Congo (now Zaire), West Africa and Malaya (now Malaysia and Singapore). In the area of oil palm harvesting, this information was merely documentation of the existing traditional practices.

Vanderweyen in 1952 presented some data from the Belgium Congo on the time required for each section of the harvesting process - cutting, walking, and carrying. This data showed a dramatic savings in the average time (75%) required to harvest a bunch of oil palm fruit by using the picking knife instead of the traditional climbing method. It was obvious from Vanderweyen's data that carrying (which includes bunch and fruit collection) the fruit was the most



time consuming component of the oil palm harvesting process.

The picking knife saves time in cutting the bunch, but does not address the fruit and bunch collection problem. Fruit collection demands assiduity on the part of the collector, and causes back-ache because of the arched position of the collector's body in the process of picking up the small fruits. Thus, using Vanderweyen's data, one could argue that the adoption of an oil palm harvesting device would be enhanced by serious consideration of the fruit and bunch collection components in the design of the harvester.

Dufrane and Berger (1957) overwhelmingly supported Vanderweyen's view in their publication "Etude Sur la Recolte Clans les Palmerais."

These research publications were among the first publications to devote some attention to the oil palm harvesting process. Subsequently, there were more and more discussions and research work about the various harvesting procedures and innovations in relation to them. In every situation, the innovations were products of descriptions and comparisons of the alternative processes. This is particularly evident in the following publications: "The Oil Palm in Malaya" (Ministry of Agriculture and

Cooperatives, Malaysia, 1966; Toh, 1972; and Hartley, 1977).

The publications mentioned above also contained a common emphasis on the need for timeliness, efficiency and the effectiveness of a harvesting procedure. Each of them agreed that the oil palm harvesting process consists of: cutting the bunch, collecting the bunch, and carrying the bunch and loose fruits to the processing mill. Cutting the bunches is accomplished by the use of the picking knives (or in the traditional method, the cutlass), while the loose fruits and bunches are collected by workers and transported to the processing factory by tractors, rail trucks, trucks, bullock-drawn carts, mule packsaddles or the workers. In all the estates in Rivers State, a combination of tractors, trucks and the estate workers are used to transport the bunches and loose fruits.

Turner and Gillbanks (1974), and Hartley (1976) provided the historical background of the origin of the Malayan Knife and the chisel. According to these authors, the Malayan Knife originated from Malaya (now Malaysia and Singapore) in the late 50's and the chisel originated from Honduras a little earlier. These tools were adapted from other harvesting operations primarily by the operators.

It is interesting to note that these tools, which are indeed basic technologies, have been in use in Rivers State

Nigeria for many years for harvesting other tree crops like the banana and plantain. The devices seem to provide natural alternatives to climbing the tree during harvesting. Though basic, the picking knives could be regarded as the intermediate technology in oil palm harvesting. The oil palm harvesters of the next generation (high technology devices) could be expected to carry the picking knife in a powered vehicle and provide a catchment for the bunch and loose fruits.

Hartley described, in his book, a machine which was the result of research in this direction. Nwanze (1965), reporting about the same harvester, noted that the harvester-carrying booms were mounted on trucks or high flotation wheeled tractors. This type of machine was used in Honduras and Costa Rica in the 60's.

Attempts to increase the efficiency of the picking knives are evident from the mathematical curvatures of the Malayan knife, the axe, and the chisel. Toh (1974) found that 60 percent of the harvesting time and energy is spent on bunch and loose fruit collection. Thus, in order to be mechanically attractive to the operator, any solution to the problem of oil palm harvesting, through the design of a harvester, has to take into consideration the fruit and bunch orientation on the tree, and collection (relative advantage).

In 1981, a group of agricultural engineers in Malaysia decided to further improve the efficiency of the harvesting system by introducing a mobile bunch catchment cart that follows the operator through the field (Ahmed, 1981). This innovation, the John Deere oil palm harvester, and the current oil palm harvester research in Rivers State are all attempts to integrate the other components of the harvesting system into the oil palm harvesting mechanism at different levels, as to further improve on the attributes of the knife.

The cart catchment addition seems to be a step in the right direction as far as the picking knife research is concerned, but there is no indication as to the perception of the operator on this. The John Deere harvester does not, however, provide for loose fruit collection, but has a cage for handling the bunch. This, unfortunately, is the result of adapting the date palm harvester to harvest oil palm without considering the physiological differences in the fruits of the trees. The current work on the development of oil palm harvesters in the Rivers State is considering the addition of a bunch or fruit catchment as well as the economy and size of machine, and the social consequences of the harvester. In this respect, the oil palm harvester research in Rivers State may benefit from the results of this work.

Unfortunately, agricultural research work in general in the Rivers State is biased in favor of "technology supply" and rarely considers the "technology need and demand". A consideration of "technology need and demand" must necessarily involve the consumers of technology (McLaughlin, 1978).<sup>\*\*</sup> However, the picking knife is a simple tool that should easily fall into the technology demand category, in which case, it could meet the need of the operators. But it seems that like similar innovations in the Third World Countries (Roger, 1976), the picking knife was presented to the operators as products of research centers, university or industry in the big cities, and hence the need for the classical diffusion model in disseminating the information about it to the operators. The classic diffusion model is mostly concerned with what happens to the innovation in the process of diffusion and adoption rather than what happens to the adopter and society.

In summary, a search of the literature revealed an interesting variety of possible factors that could be associated with the adoption of the picking knife in Rivers State. These factors include the relative advantage of the innovation, the compatibility, complexity, trailability,

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<sup>\*\*</sup>McLaughlin was quoting Denis Goulet in his publication "Value Conflicts in Technology Transfer."

observability, time dimension, education, employment, social, economic, and psychological resistances. The literature cited for the oil palm harvest techniques are supposed to throw some light on the research about the harvester itself, as a re-enforcement to the attributes of the innovation.

Based on the findings and recommendations of others doing research in the field, the present study evolved as one step towards improving the palm oil and kernel production in Rivers State through reducing the health hazards for the workers, by identifying factors responsible for the adoption of the picking knife. To this end, the following chapters contain a description of the study.

## **CHAPTER III**

### **RESEARCH DESIGN**

#### **Introduction**

The purpose of this study was to determine those factors that are associated with the adoption of the picking knife as an appropriate oil palm harvesting device in the Rivers State. This chapter contains an overview of the primary principles and features of the theory of diffusion of innovation and social change methodologies that serve as the basis for the study. The rationale focusing theories are also discussed along with the source of data (sample and population), instrumentation, data collection procedures and analysis.

#### **Design of the Study**

##### **Rationale**

The innovation diffusion and social theories (case study) were used as the theoretical base. The innovation diffusion and social theory provided the explanation in general form for the behaviors of the target group. The case study, according to Merriam and Simpson, was used to explain areas of human interaction or social process as in the case of the adoption process of the picking knife in Rivers State. This was a substantive theoretical situation that dealt with real-world phenomena. Generating

substantive theory "is, or should be, a concern of researchers in applied professional fields such as adult education" (Darkenwald, 1980, p. 67). Among the areas of adult education and programs listed by Darkenwald, the adoption of the picking knife as an appropriate oil palm harvesting device in Rivers State should comfortably fit in. The major purpose of doing case study research in an applied field "is to improve professional practice through gaining a better understanding of it" (Darkenwald, 1980, p. 69). In essence that was what this study was all about.

#### Source of Data

Glaser and Strauss (1967) recommend selecting a population that seems to be the most likely group to provide data related to the problem area. The most obvious group to seek data from, for this study were those operators that adopted the use of the picking knife and those that had discontinued the use of the knife for some reasons, and all other oil palms harvest operators in Rivers State. However, this population seems so broad and diffused that a more specific population was defined. Such a specific population that could easily be identified was the oil palm harvest operators currently using the picking knife and those who had discontinued the use of the knife after some time of use.



A sample of 25 operators who had never used the knife was also interviewed. This sample was limited to 25 operators because of the unanimity in their responses. A detailed description of their responses is presented in the next chapter.

Because the total population size as specified above was small (about 46) in the Rivers State, the entire population was interviewed. In addition to this population, a simple random sample of a similar population in the Nigerian Oil Palm Research Institute where the picking knife was first adopted and from where it was introduced into Rivers State, were interviewed. Data from this sample served as a reference source for the population of current users and discontinued users of the picking knife in Rivers State.

The Nigerian Institute for Oil Palm Research (formally known as the West African Institute for Oil Palm Research) was established in Benin (Bendel State) to serve as a research center for oil palm in West Africa. In 1960, the Nigerian Government assumed the full responsibility for the station and renamed it. Currently, it serves as a research center as well as a center to disseminate information about the palm tree and its products.

The population for this study was located in four oil palm estates in the Rivers State - Elele, Ahoada, Omoku and

Echie Plantations, surrounding villages and NIFOR. Plate 1.3 in Chapter 1 shows the location of NIFOR and the Rivers State and the Plantation. As can be seen from the map, all four plantations in the Rivers State are located in the north of the State. The south of the State has mostly mangrove vegetation and does not easily support the palm tree.

The population for this study as described above was grouped into two major categories as follows:

1. Current users of the knife.
2. Discontinued users of the knife (Ex-users).

Operators who had never used the knife were used to support or refute evidence from these categories.

#### Operationalization of Variables

Data on each of these two major categories were further classified under the following discrete variables.

- A. Eleven age groups - 16-70 years.
- B. Education level
  - Formal
  - Non-formal
- C. Employer
  - Public
  - Private
  - Self
- D. Wage level
  - Below minimum
  - At minimum
  - Above minimum
- E. Provider of knife
  - Employer
  - Employee

- F. Physical condition
  - Sight problems
  - Muscle and joint problem
  - None of the above
- G. Years of experience in oil palm harvesting
  - 5 or less
  - 5-10
  - 10-15
  - 15 and above
- H. Years of experience using the knife
  - 5 or less
  - 5-10
  - 10-15
  - 15 and above
- I. Perception as to:
  - Savings in effort (positive, same, negative)
  - Time to harvest (faster, same)
  - Cost of knife (more, less)
  - Status placement (positive, same, negative)
  - Social impact (positive, same, negative)
  - Cultural belief (positive, negative)
  - Met need (yes, no)
  - Use (easier, difficult)
  - Visibility (visible, not visible)
  - Communication (demonstration, diffusion, effect)

### Null Hypotheses

The following are the null hypotheses posed for testing each variable:

- H<sub>01</sub> The adoption of the picking knife is independent of who is required to provide the picking knife - the employer or the operator.
- H<sub>02</sub> The adoption of the picking knife is independent of the cost of the knife.
- H<sub>03</sub> The adoption of the picking knife is independent of the pay-back period of the knife.

- H<sub>04</sub> The adoption of the picking knife is independent of the saving in effort as a result of the use of the picking knife.
- H<sub>05</sub> The adoption of the picking knife is independent of the degree of discomfort in the use of the picking knife.
- H<sub>06</sub> The adoption of the picking knife is independent of the average time required to harvest a bunch.
- H<sub>07</sub> The adoption of the knife is independent of the wage level of the operator.
- H<sub>08</sub> The adoption of the picking knife is independent of the status placement of the adopter as perceived by him.
- H<sub>09</sub> The adoption of the picking knife is independent of the social impact of the use of the knife.
- H<sub>010</sub> The adoption of the picking knife is independent of the consistency of the innovation with social, cultural values and belief of the adopter.
- H<sub>011</sub> The adoption of the picking knife is independent of the past experiences of the adopter under similar social changes.
- H<sub>012</sub> The adoption of the picking knife is independent of the real need of the operators.
- H<sub>013</sub> The adoption of the picking knife in Rivers State is independent of the perceived ease of use of the knife.
- H<sub>014</sub> The adoption of the picking knife is independent of the perceived maintenance and repair requirements.
- H<sub>015</sub> The adoption of the picking knife is independent of the construction requirements of the knife.
- H<sub>016</sub> The adoption of the picking knife is independent of the small scale demonstrability and trial requirements of the knife.
- H<sub>017</sub> The adoption of the picking knife is independent of the reversibility effect of the adoption of the knife.
- H<sub>018</sub> The adoption of the picking knife is independent of the visibility of the knife.

- H<sub>0</sub>19 The adoption of the picking is independent of the communication system available for disseminating information about the picking knife.
- H<sub>0</sub>20 The adoption of the picking knife is independent of the time allotted for diffusion.
- H<sub>0</sub>21 The adoption of the picking knife is independent of the body structure, the health status and the age of the adopters.
- H<sub>0</sub>22 The adoption of the picking knife is independent of the employer category to which the operator belongs.
- H<sub>0</sub>23 The adoption of the picking knife is independent of the number of years of experience of the adopter in oil palm harvesting.
- H<sub>0</sub>24 The adoption of the picking knife is independent of number of years of experience of the adopter in using the picking knife.
- H<sub>0</sub>25 The adoption of the picking knife is independent of the education categories of the operators.

The expectation is that each null hypothesis will be rejected in favor of the alternatives in which case, the variables are identified as factors. It is also expected that these hypotheses will identify general similarities between the Rivers State operators and the NIFOR operators. However, in specific instances, there could be major differences, even opposing trends, because of the differences in the people, geography, history, and socio-political set up between the Rivers State plantations and the Nigerian Institute for Oil Palm Research.

### Collection of Information

The instrument was developed first by considering all of the possible factors that the interviewer perceived to be associated with the adoption of the knife. Open-ended questions were prepared to allow the participants to respond in whatever manner seemed most appropriate.

The first day of the interview was used to pretest the questions. The pretest was administered to five oil screw press operators. This group of people were chosen because they had the most characteristics in common with the oil palm picking knife operators. They all had little or no formal education, received about the government minimum wage, and were hired laborers. The oil screw press itself, has more similarities to the picking knife than any other recently adopted innovations in the Rivers State. The press is manually operated, processes oil palm fruits, and was introduced to the Rivers State through the Nigerian Institute for Oil Palm Research.

Based on the results of the pretest, some questions were reworded and others added. The added questions include questions 8 and 9 of the first part of the interview questions, questions 5, 6, 7, 8, and 9 of Section B, and questions 4, 5, 6, and 7 of Section C. The reworded questions are question 4 of Section A and questions 2 and 3 of Section 3 (Appendix A).

### Interview Opening

At the beginning of each interview, the study participant was put at ease with casual conversation, taking into consideration the values, beliefs and norms of the society. In these initial conversations, the participants were assured that the interview results would be used to improve their job.

The interview opening was made easier by traveling with an operator who was widely known in the area. This gave the interviewer acceptance within the villages and access to some information about the villages.

The operators were encouraged to respond without fear of government or individual persecution in any way.

### Interview Format

All of the interviews were conducted by the researcher. This procedure contributed to the reliability of the findings. Because the interviewer was the researcher, data collection, coding and analysis were done concurrently. The interview format was semi-structured using open-ended questions, which varied according to individual participant's response orientation. This way, there was a high degree of freedom in the exercise.

Open-ended questions were used because of the several advantages as cited by Stewart and Cash (1974), and Borg

and Gall (1979). According to these authors, open-ended questions:

1. Allow the participant to do most of the talking while the interviewer can determine the nature and amount of information to retain.
2. Help put the interviewer at ease because the participant can determine the nature and amount of information to be given.
3. Are more effective in learning about feelings and attitudes and the intensity of feeling and attitudes of the participant.
4. Are less likely to telegraph or lead the participant to respond in a particular way.
5. Help enable the interviewer to determine participant's frame of reference or stereotypes.

The disadvantages associated with this method of questioning are mostly related to the skills of the interviewer and replication, especially when several interviewers are employed. The disadvantages are not expected to be significant since the researcher served as the sole interviewer and because the researcher had some knowledge of and experience with the situation. The interview was conducted in Pigeon English and in the researcher's native languages - Ogba, Ikwere, Echie and Ekpeya.

The responses to the interview questions were taped with the consent of the study participants. However, there was no assumption that the operators would agree to be



taped, so the researcher was ready to write down responses in the best way possible.

#### Description of Interview Procedure

Beginning from the second day of the exercise, all of the operators that were using the knife and those who had discontinued the use of the knife in the Rivers State and a sample of both users and ex-users in the Nigerian Institute for Oil Palm Research were interviewed. The users as well as the discontinued users were identified with the help of their employers who provided the interviewer with their employee list and instructed the foreman to help in the identification process.

After the interviews with the users and ex-users, interviews 25 operators who had never used the knife were also interviewed (Appendix D). Seventeen of them were unemployed, while eight of them had been recently employed.

All except one of the participants agreed to the request that the interview be recorded with a tape recorder. This made the exercise faster and more reliable, because at the end of each day, it was possible to play the tapes and review the conversations in a more relaxed condition, making it easier to pick up the important points. Since there was minimum note-taking, the interviews were allowed to flow freely, thus reducing the time required for each interview.

The interviewer visited each participant without previous notification because the custom of the society permitted this. Besides, there were no telephones in the oil palm plantations and letters could possibly be delayed, mis-interpreted or lost. Usually, in this part of the world, previous notification would emphasize a formal meeting and serious government involvement, which had to be avoided, because it would lead to withholding and exaggerating of information.

In each case, the researcher casually walked into each participant's house. After a brief exchange of greetings with members of the household, he requested a short meeting with the operator (participant).

When seated, the problem was presented to the participant in his own language because they neither spoke nor wrote the English language, nor wrote in their own language. The interviewee was then promised that this was a personal study of the problem and that it would not be used against him in any way. Then, a gallon of prized, locally made wine (\$3.00) plus \$5 in cash was given to him as a gift for the season (Christmas). The participant was further put to ease by sharing of previous experiences (some of which were common) about the oil palm industry. Before starting the interview, the permission to use the tape recorder was requested. Then, the interview questions

were asked in the sequence as presented in the instrument. A temporary misplacement of the tape recorder resulted in one interview that was not taped. (On the average, there was on hour and fifteen minutes of tape for each interview.) At the end of each day, the data for that day were analyzed and compared to previous results.

The last day of the data collection process was used to review the data with the help of three members of the staff (two Doctors fo Extension Education and one Doctor of Agricultural Engineering) of the University of Science and Technology Port-Harcourt. These colleagues were given a brief of the research objectives and procedure before the commencement of data collection, and were consulted individually at least twice while the data collection was going on. The group reviewed the results and made suggestions, some of which were incorporated in the final analysis and interpretation of data.

#### Analysis of Data

This study was aimed at identifying those factors associated with the adoption of the picking knife as an appropriate oil palm harvesting device in the Rivers State. The data collected in the interview were, therefore, analyzed using appropriate statistical methods to reflect the purpose of the study.

First of all, the data were laid out in a table according to the age categories of the participants. Then, the data were divided into two groups (Rivers State and Nigerian Institute for Oil Palm Research), and analyzed based on two categories - current users and ex-users. The analysis of data was done for each hypothesized factor within these two categories. Using the chi-square procedure (equations 3.1 and 3.2), the significantly dependent factors to current users and ex-users of the picking knife were identified.

$$E = \frac{RC}{T} \dots \dots \dots 3.1$$

$$\chi^2 = \frac{(O-E)^2}{E} \dots \dots \dots 3.2$$

(See Nomenclature on page ix.)

The chi square is an important statistic which is used to test whether two discrete variables are independent of each other. In other words, if the observed frequencies in the cells deviate markedly, one would expect the two variables were not related to each other. A large chi-square statistic would indicate that the observed frequencies differ significantly from the expected frequencies. The cells with high values in the "contribution to the chi-square" are the ones that "contribute" the most to the significance of the chi-

square. All tests of hypotheses were done at the 0.05 level of significance.

In order to rank the magnitude of the effects of the factors identified by the chi-square statistic, the area moment procedure was used (equation 3.3).

$$M_a = LA \dots \dots \dots 3.3 \quad (\text{Appendix B})$$

(See Nomenclature on page ix.)

The factors were further examined by making a table of the coded rejection differences. This helped to visualize and understand the data. The comparison of the Rivers' State participants' responses to those of the Nigerian Institute for oil palm research was done by using the phi statistic (equation 3.4). This statistic measures the strength of the relationship between the two variables in question. When there is no relationship, phi is zero, and when there is a perfect positive relationship, phi is one. When there is a perfect negative relationship, phi is minus one.

$$\phi_N^2 = \frac{\chi^2}{N} \dots \dots \dots 3.4$$

(See Nomenclature on page ix.)

A table of  $\phi^2$  values was used for the between group comparison, because the phi statistic corrects for the fact that the chi-square statistic is directly proportional to the number of cases. In other words, phi could be used to compare two cross tabs with unequal observations.

Finally, an Omnibus hypothesis was tested for interaction using the multi-dimensional log-linear model and by tapping from the adoption decisions as portrayed by the responses of all participants.

#### Summary

In summary, open-ended questions were the basis for interviews with selected user and non-user operators on four plantations in Rivers State and at the Nigerian Institute for Oil Palm Research. All except one of the interviews were tape recorded. There were 25 research hypotheses which were tested using the following statistical tests: chi-square, area moment, phi, and multi-dimensional log-linear model. The personal interviews, all conducted by the researcher, provided an opportunity to collect additional information and impressions about the people and their customs in the area.

## **CHAPTER IV**

### **PRESENTATION OF FINDINGS AND DISCUSSION**

#### **Introduction**

The purpose of this study was to determine the factors associated with the adoption of the picking knife as an appropriate oil palm harvesting device in the Rivers State. This chapter presents the data obtained from the interviews, analysis of data, findings and a discussion of findings from other countries. The presentation is accomplished under the following sections:

1. Description of Study Area.
2. Description of Study Participants.
3. Outline of all Factors Hypothesized to be Associated with the Adoption of the Picking Knife.
4. Testing of Hypotheses.
5. Magnitude of Factors Identified.
6. Characteristics of Factors Identified.
7. Interaction Between Factors.
8. Comparison of Factors Identified.
9. Comparison with Findings from Other Countries.
10. Summary

#### **Description of Study Area**

Geographically, the plantations and the wild palms were located in a tropical rain forest region. The

topography was relatively flat. The Rivers State is located in the Niger Basin formed by the alluvial deposits of the River Niger and its tributaries. It rains all year round with a diminished amount of rainfall in the fall months and early winter (known as the dry season), and the yield of the oil palm tree tends to follow the seasons, with high yield in the rainy season and a lower yield in the dry season. The high yield season of the palm coincides with the intense farming season for yam, cocoyam and cassava in the Rivers State.

Historically, the oil palm farming always supplemented crop farming. The products of the oil palm tree were used with other food crops or as medicine. The palm oil was eaten with yam, cocoyam, plantain, banana or cassava.

Until the coming of the Europeans, the palm kernel oil was used as medicine for the skin and stomachache; and the raw palm oil as part of a variety of other cures. From 1944, when it became increasingly difficult for the Europeans to obtain the palm oil and palm kernel oil from the Far East because of the Second World War, oil palm became commercialized in Nigeria and the trade through the sea dramatically increased. The Rivers State became the major terminal for exporting the oils.



### Description of the Study Participants

The respondents were described according to age, users/ex-users of the harvest knife, years of experience in the industry, years of experience with the knife, education, employment, wages received and physical condition (See Table 4.1). In addition, a brief description of the families was provided. A general description follows (See Table 4.2):

Age. More than 50 percent of all the respondents were age 35 or under. Most of the respondents who were current users of the knife (60 percent) were age 35 or under. Most of the respondents who were ex-users (63 percent) were over age 40.

Education. Most of the 103 respondents (66 percent) had no formal education. All of those who had some formal education (34 percent) were age 45 or under.

Employment. The public sector (government and corporations) employed 86.41 percent of the operators interviewed. The Nigerian Institute for Oil Palm Research is a government institution and all operators working there were employed by the government. On the other hand, all of the privately employed operators were from the Rivers State. The private employers were the small-holders oil palm farmers who received some financial assistance from

Table 4.1  
Characteristics of Study Participants of the Different  
Age Categories

Age Categories	Current Users	Ex-Users	Sum of		Experience Index	Sum of		Education		Employment	
			Years of Experience in Industry	Years of Experience with Knife		Formal	None	Public	Private		
16-20	10	3	14	8	1.75	9	4	11	2		
21-25	9	2	37	11	3.36	7	4	6	5		
26-30	13	3	61	9	6.78	9	7	12	4		
31-35	11	3	92	7	13.14	6	9	12	2		
36-40	5	4	119	5	23.80	3	6	9	0		
41-45	3	3	145	4	36.25	1	5	5	1		
46-50	4	3	153	6	25.50	0	7	7	0		
51-55	3	6	210	4	52.50	0	9	9	0		
56-60	3	5	186	3	62.00	0	8	8	0		
61-65	2	5	219	3	73.00	0	7	7	0		
66-70	0	3	193	2	96.50	0	3	3	0		
TOTAL	63	40	1,429	62		35	68	89	14		
Percent	61.17	38.83				34.95	65.05	86.41	13.59		

Age Categories	Wage		Provider		Sight Problem	Muscle and Joint Problem of These	
	Below	Above	Employer	Employee		Problem	None
16-20	2	7	4	8	5	1	12
21-25	1	5	5	5	6	3	8
26-30	3	6	7	10	6	3	11
31-35	6	5	3	9	5	2	10
36-40	6	3	0	5	4	4	2
41-45	4	1	1	3	3	2	2
46-50	3	3	1	5	2	3	3
51-55	4	5	0	5	4	4	1
56-60	8	0	0	5	3	4	—
61-65	5	2	0	5	2	3	—
66-70	2	1	0	2	1	3	—
TOTAL	44	38	21	62	41	32	50
Percent	42.72	36.89	20.39	60.19	39.81	31.07	48.54

NOTE: Experience Index is the ratio of sum of years of experience in industry to the sum of years of experience with knife.

**Table 4.2**  
**Frequency of Responses for Factor**  
**Categories - Comparison**

<u>Category</u>	<u>Current Users</u>		<u>Ex-Users</u>	
	<u>Rivers State</u> n=21	<u>NIFOR</u> n=38	<u>Rivers State</u> n=25	<u>NIFOR</u> n=19
<u>Provider</u>				
Employer	14	29	8	11
Employee	7	9	17	8
<u>Less Cost</u>	21	38	25	19
<u>Savings in Effort</u>				
Positive	13	26	5	4
Same	2	9	9	5
Negative	6	3	11	10
<u>Time</u>				
Faster	21	38	25	19
<u>Wage Level*</u>				
Above	5	14	1	5
At	10	17	4	3
Below	6	7	20	11
<u>Status Placement</u>				
Positive	13	30	5	6
Same	3	8	6	13
Negative	5	0	14	0
<u>Social Impact</u>				
Positive	7	26	14	6
None	12	4	3	9
Negative	2	8	8	4
<u>Cultural Belief</u>				
Positive	21	38	25	19
<u>Past Experience</u>				
Positive	18	33	9	8
None or Negative	13	5	16	11
<u>Met Need Use</u>				
Yes	16	31	11	9
No	5	7	14	10

\* Government minimum wage level is \$120.00 per month. There is no strict enforcement of this wage level in the rural areas.

Table 4.2 Cont'd.

Frequency of Responses for Factor  
Categories - Comparison

Category	<u>Current Users</u>		<u>Ex-Users</u>	
	Rivers State n=21	NIFOR n=38	Rivers State n=25	NIFOR n=19
<u>Use</u>				
Easier	16	29	10	7
Difficult	5	9	15	12
<u>Visibility</u>				
Visible	13	34	7	13
Not Visible	8	4	18	6
<u>Communication</u>				
Demonstration	19	38	25	19
Diffusion Effect	2	0	0	0
<u>Physical</u>				
Sick	0	2	11	13
Over 45	3	5	14	6
Healthy	18	31	0	0
<u>Employment</u>				
Public	21	38	11	19
Private	0	0	14	6
<u>Without Experience (Years)</u>				
5 or Less	12	23	0	0
5 - 10	6	9	0	6
10 - 15	3	6	6	11
15 or Above	0	0	19	2
<u>With Experience (Years)</u>				
5 or Less	15	22	25	17
5 - 10	6	9	0	2
10 - 15	0	6	0	0
15 or Above	0	0	0	0
<u>Education</u>				
Formal	8	24	1	3
Non-Formal	13	14	24	16

the World Bank Project in the Rivers State. There were no self-employed or female operators among the participants. This was not a chance event. All operators in the Rivers State work for the government or some richer oil palm estate owner. All operators who had enough money to own an oil palm plantation had to give up the harvesting job. This was what was expected by the society, and explains why there were no privately employed operators. Also, the society regards the operator's job as a man's job and so there are no females.

Wages. Table 4.1 also shows that 42.72 percent of the participants were below the government paid minimum wage level, while 36.89 percent are at the minimum wage level and 20.39 percent are above this level. Here again, curiously, the older age categories have more operators below and at the minimum wage level than the younger categories. More than half of the Rivers State operators were employed on a temporary\* basis. They were paid according to the number of bunches harvested. The daily wages paid operators were all below the government paid minimum wage level and the operators were not entitled to any benefits. This finding is discussed in more detail in Chapter V.

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\*Under temporary employment, the operator can only work and, therefore, receive pay whenever the employer wants him to. He has no rights to any benefits.

The description above indicates that most of the participants from the plantations in Rivers State were among the poorly paid. The wage structure shows some inconsistencies. The plantation records showed some newly employed operators promoted, without justifiable reasons, over others who had been on the job for a longer period. The discontinued users of the knife were mostly the older operators with little or no formal education.

Physical Conditions. Most of the older participants had sight problems, and as a result, found it difficult to use long picking knives. The sight problems were particularly serious for the older operators, most of whom had discontinued the use of the knife because it was becoming increasingly difficult for them to locate the peduncle of the bunch from the ground level. In all, 33.01 percent of the participants had sight problems.

During the interview, most of the discontinued users of the knife also complained of fatigue of the muscles of the arm due to continuous carrying of the knife, as against the intermittent carrying of ladders.

Unfortunately, employers had no contract obligations to part-time (temporarily) employed operators injured on duty. Operators who had been incapacitated by accidents due to oil palm harvesting could only return to their villages to be cared for by their families. The

interviewer met two of the previously injured operators in the village by chance.

All 25 of the operators who had never used the knife were from the Rivers State. All of the operators in NIFOR had either used the knife or were still using the knife.

Among the 25 who had never used the knife, only eight of them were found in the plantations. Seventeen of them were interviewed from the surrounding villages - Elele, Alimini, Ahoada and Omoku. The number of this category was only left at 25 because of the unanimity in their responses. In other words, most of their responses were unanimous (Table D.1, Appendix D). This was also the reason why their responses were not included in the following statistical analysis. Such responses did not lend themselves to statistical analysis. Therefore, their responses were used as supporting evidence to conclusions drawn from the statistical analysis of the data for the users and the ex-users.

Incidentally, all 17 of the operators interviewed from the surrounding villages had never heard of the idea of using the picking knife to harvest the oil palm bunches. If they had heard, they could not remember. One of the reasons for this was that these operators did not harvest the cultivated oil palm plants. They specialized in harvesting the tall wild plants that could not be reached

with the knife. Another reason was that nobody seriously talked to them about the idea. They joked at the researcher's suggestion that the knife could be used on the younger wild palm varieties. They pointed out that wild plants have tougher branches and bunch peduncles than the cultivated varieties.\*\*

Unlike the plantation operators, all of the operators in the villages were full-time farmers in other crops and only harvested the wild palm occasionally depending on when a land owner invited them to harvest for him or when the wild palms on their own land were ripe for harvesting (an average of two month intervals).

The eight plantation operators who had never used the knife were all newly employed and had never seen one of the periodic demonstrations. Three of them indicated interest in the knife but were afraid it could be more difficult to use than their ladder rope.

About 80 percent of the operators interviewed were married men living with their families on the plantations. Most of the wives were employed in other aspects of the oil palm processing, e.g. bunch and loose fruit collection, bunch stripping and fruit separation from the persistent

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\*\*This was also confirmed by a research work conducted in NIFOR by Nwanze (1960).



calyx. All of the families had small farms and gardens which provided a supplement to their cash incomes.

Some of the wives of both the plantation and the village operators were also petty traders in consumer goods. More than 60 percent of all of the participants were married to more than one wife.

### Outline of Factors

The ten factors that were hypothesized to be associated with the adoption of the picking knife as an appropriate oil palm harvesting device in the Rivers State are presented below. Data about each of these factors were studied to confirm whether or not they influenced the adoption of the knife.

### Relative Advantage

The factors associated with the relative advantage of the picking knife were as follows:

1. Who provides the knife.\*
2. Cost of picking knife.\*\*
3. Pay-back period of the knife.\*\*
4. Savings in effort as a result of the use of the picking knife.\*
5. Degree of discomfort in the use of the knife.\*\*
6. Average time required to harvest a bunch using the knife.\*\*

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\*Statistically tested (Appendix E).

\*\*Discussed - Data not statistically testable.

7. The wage level of the operator.\*
8. Status placement of the user as perceived by the user himself.\*
9. The social impact of the use of the knife.\*

### Compatibility

The compatibility factors included:

1. Consistency with social, cultural values and beliefs.\*\*
2. Past experience of operators as perceived by him in similar social changes.\*
3. The perceived real need of the operators.\*

### Complexity

The factors involved in the complexity of the innovation were:

1. Ease of use of the knife as perceived by the operators.\*
2. Perceived maintenance requirements.\*
3. Perceived repair requirements.\*
4. Perceived construction requirements.\*\*

### Trialibility

Trialibility of the knife included:

1. Small scale demonstrability.\*\*
2. Trial requirements.\*\*

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\*Statistically tested (Appendix E).

\*\*Discussed - Data not statistically testable.

### Reversibility

The factor involved in the reversibility of the innovation was the fear entertained by the operators about the known and the unknown effects of discontinuation of the practice.\*\*

### Observability

In this case, three factors of importance were:

1. Visibility of the picking knife.\*
2. Communication system available for dissemination of information about the picking knife.\*\*
3. The time allotment for diffusion.\*\*

### Physical Factors

These included operator health factors that could hinder or enhance the use of the picking knife in oil palm harvesting. They were:

1. Body structure.\*\*
2. Health status.\*\*
3. Age factors.\*\*

### Employment

The employment factors involved the employer of the operator:

1. Public.\*\*
2. Private.\*\*

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\*Statistically tested (Appendix E).

\*\*Discussed - Data not statistically testable.

### Years of Experience

Years of experience factors were:

1. On oil palm harvesting in general.\*\*
2. On oil palm harvesting using the picking knife.\*\*

### Education

The education factors were:

1. Formal training (education).\*
2. Non-formal training (education).\*

### Hypothesis Testing

In order to verify that the above factors were indeed associated with the adoption of the picking knife, the outcome variable (adoption) was tested for independence with each of the predictor variables as outlined above.

The most appropriate test procedure for this study was the chi-square test procedure using crosstab tables and histograms as visual display models. The chi-square test was used because both the predictor variables and the outcome variable were discrete quantities. The factors were tested in the sequence presented in the outline.

Data from Rivers State were treated as a sample rather than a population because the list of operators who were currently using the knife and those who have discontinued

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\*Statistically tested (Appendix E).

\*\*Discussed - Data not statistically testable.

the use of the knife was provided by the estate managers who made it clear that there existed the possibility of some users and non-users not being in their records. However, if this was correct, then the unlisted operators must be a very small fraction of the total.

Two statistical calculations (chi-square and standard critical chi-square) were made for the responses regarding each of the ten factors. The calculations were made separately for the responses from Rivers State and from NIFOR. A summary of the chi-square values and the degrees of freedom for each are shown in Table 4.3. (For additional details, see the Contingency Tables E.1A through E.11B in Appendix E.)

### Relative Advantage

#### Provider:

H<sub>01</sub> The adoption of the picking knife is independent of who is required to provide the picking knife - the employer or the operator.

H<sub>a1</sub> The adoption of the picking knife depends on who is required to provide the picking knife - the employer or the operator.

At 0.05 level of significance, the null hypothesis was rejected, in both cases in favor of the alternative and it was concluded that the adoption of the picking knife was not independent of the person required to provide the knife - employer or employee. The strength of rejection was greater for NIFOR than for the Rivers State, showing that

Table 4.3

Chi-Square Values and Degrees of Freedom for Ten  
Factors Which Were Hypothesized to Be  
Associated with Adoption of the Picking Knife

Factors	Degrees of Freedom (r-1) (c-1)	Chi-Square Value ( $X^2$ )	Standard Cited Chi-Square Value ( $X^2_{cr}$ )	Decision ( $\alpha = .05$ )
<b>I. <u>Relative Advantage</u></b>				
1. Provider				
Rivers State	1	5.910	3.841	Sign.
NIFOR	1	14.450	3.841	Sign.
2. Cost of Knife				
Rivers State	Unanimous			Not Sign.
NIFOR				
3. Pay-Back				
Rivers State	Unanimous			Not Sign.
NIFOR				
4. & 5. Savings in Effort Degree of Discomfort				
Rivers State	2	9.180	5.991	Sign.
NIFOR	2	16.560	5.991	Sign.
6. Time to Harvest				
Rivers State	Unanimous			Not Sign.
NIFOR				
7. Wage Level				
Rivers State	2	12.520	5.991	Sign.
NIFOR	2	9.700	5.991	Sign.
8. Status				
Rivers State	2	8.520	5.991	Sign.
NIFOR	1	12.210	3.841	Sign.
9. Social Impact				
Rivers State	2	11.090	5.991	Sign.
NIFOR	2	10.620	5.991	Sign.

**Legend:**

Sign. = Significant

Not. Sign. = Not Significant

Unanimous = Responses were not statistically tested.

Table 4.3 Cont'd.

Chi-Square Values and Degrees of Freedom for Ten  
Factors Which Were Hypothesized to Be  
Associated with Adoption of the Picking Knife

Factors	Degrees of Freedom (r-1) (c-1)	Chi-Square Value ( $X^2$ )	Standard Cited Chi-Square Value ( $X^2_{cr}$ )	Decision ( $\alpha = .05$ )
<b>II. <u>Compatibility</u></b>				
10. Social Impact				
Rivers State		Unanimous		Not Sign.
NIFOR				
11. Past Experience				
Rivers State	1	11.620	3.841	Sign.
NIFOR	1	12.570	3.841	Sign.
12. Needs Met				
Rivers State	1	4.870	5.991	Sign.
NIFOR	2	7.070	3.841	Sign.
<b>III. <u>Complexity</u></b>				
13. Ease of Use				
Rivers State	1	6.090	3.841	Sign.
NIFOR	1	7.070	3.841	Sign.
14. & 15. Maintenance and Repair/Construction				
Rivers State	1	0.070	3.841	Sign.
NIFOR	1	2.060	3.841	Sign.
<b>IV. <u>Triability</u></b>				
16. Demonstrability				
Rivers State		Unanimous		Not Sign.
NIFOR				
<b>V. <u>Reversibility</u></b>				
17. Reversibility				
Rivers State		Unanimous		Not Sign.
NIFOR				

**Legend:**

Sign. = Significant

Not. Sign. = Not Significant

Unanimous = Responses were not statistically tested.

Table 4.3 Cont'd.

Chi-Square Values and Degrees of Freedom for Ten  
Factors Which Were Hypothesized to Be  
Associated with Adoption of the Picking Knife

Factors		Degrees of Freedom (r-1) (c-1)	Chi-Square Value ( $\chi^2$ )	Standard Cited Chi-Square Value ( $\chi^2_{cr}$ )	Decision ( =.05)
<u>VI. Observability</u>					
18. Visibility					
	Rivers State	1	5.340	3.841	Sign.
	NIFOR	1	3.890	3.841	Sign.
19. Communication					
	Rivers State	Unanimous			Not Sign.
	NIFOR				
20. Time to Diffuse					
	Rivers State	Unanimous			Not Sign.
	NIFOR				
<u>VII. Physical Factors</u>					
21. Body, Health and Age					
	Rivers State	Unanimous			Not Sign.
	NIFOR				
<u>VIII. Employment Category</u>					
22. Employer					
	Rivers State	Unanimous			Not Sign.
	NIFOR				
<u>IX. Years of Experience</u>					
23. Without Knife					
	Rivers State	Unanimous			Not Sign.
	NIFOR				
24. With Knife					
	Rivers State	Unanimous			Not Sign.
	NIFOR				
<u>X. Education</u>					
25. Education					
	Rivers State	1	8.420	3.841	Sign.
	NIFOR	1	11.400	3.841	Sign.

**Legend:**

Sign. = Significant

Not. Sign. = Not Significant

Unanimous = Responses were not statistically tested.



this factor was of greater concern in NIFOR than in the Rivers State.

While the NIFOR operators seemed to be consistent with expectations, (more participants favored employer-provider), the Rivers State ex-user operators presented strange responses. One would have expected that the ex-users would favor employer-provider instead of employee-provider.

Cost of Knife:

H<sub>0</sub>2 The adoption of the picking knife is independent of the cost of the knife.

H<sub>a</sub>2 The adoption of the picking knife depends on the cost of the knife.

This hypothesis is similar to the above hypothesis (H<sub>0</sub>1) in that the knife at no cost to the operator was equivalent to the employer providing the knife in the case of a publicly or privately employed operator (all participants were employed by the government, an individual or a cooperative). When asked about the cost of the knife, if the operator had to provide it, there was a unanimous response from all of the Rivers State participants, that the cheaper the knife, the easier it would be to purchase and adopt its use. This response was what one would expect in a normal situation, holding all other variables at a constant level. However, the participants in NIFOR did not consider the cost of the knife as a significant factor in their

decision to adopt the use of the knife, because they already knew they would not purchase the knives themselves.

The conclusion was that, in a situation where the operator had to provide the knife, the adoption of the knife was not independent of the cost of the knife. When the employer provided the knife, it was not considered as a factor, as was the case in NIFOR.

Payback Period:

- $H_{03}$  The adoption of the picking knife is independent of the pay-back period of the knife.
- $H_{a3}$  The adoption of the picking knife depends on the pay-back period of the knife.

In response to question B8 (see Appendix A), every participant indicated that there was no conscious effort to evaluate the pay-back period of the knife in the adoption decision process. The average cost of the knife was \$15.00. Usually, the operator could reduce the cost of the knife by purchasing the cutting edge and assembling the knife using locally available materials. The average cost of the knife to an operator, in this way would be approximately \$6.50. The participants apparently equated the pay-back period of the knife to the number of hours of harvest necessary to earn the cost of the knife - 1 hour on the average. Thus, a picking knife could pay for itself in the first day of harvest. The pay-back period was considered as a part of the total cost of harvesting. The pay-back period was,

therefore, a factor of negligible intensity on itself in the adoption decision process of the picking knife.

Savings in Effort:

H<sub>0</sub>4 The adoption of the picking knife is independent of the saving in effort as a result of the use of the picking knife.

H<sub>a</sub>4 The adoption of the picking knife depends on the saving in effort as a result of the use of the picking knife.

In both tables E.2A and E.2B of in Appendix E, the null hypothesis was rejected in favor of the alternative, and it was concluded that savings in effort was a factor associated with the adoption of the knife in the Rivers State as well as in NIFOR. The rejection of the null hypothesis was stronger in NIFOR probably because they were more used to the knife.

In both Rivers State and NIFOR, responses showed similarities in the perception of the operators. The direction of the responses of the current users was expected, however, the responses of the ex-users was not consistent with expectation. Probably, since they were no longer using the knife, they did not give serious consideration to the question.

Degree of Discomfort:

H<sub>0</sub>5 The adoption of the picking knife is independent of the degree of discomfort in the use of the picking knife.

H<sub>a</sub>5 The adoption of the picking knife depends on the degree of discomfort in the use of the picking knife.

It turned out that the participants preferred to combine the degree of discomfort and savings in effort

involved in the use of the picking knife, in their assessment of the innovation. This combination seems obvious from the fact that any savings in effort reduced the degree of discomfort. The inverse relationship was maintained in all of the investigation. Thus, the decision reached in  $H_{05}$  was true in the reverse for this hypothesis, concluding that the adoption of the picking knife was not independent of the degree of discomfort experience in the use of the knife.

Time to Harvest:

$H_{06}$  The adoption of the picking knife is independent of the average time required to harvest a bunch.

$H_{a6}$  The adoption of the picking knife depends on the average time required to harvest a bunch.

In responding to question B9, no participant would adopt the picking knife if the rate of harvesting using the knife was slower than rope and ladder methods. Every participant would consider the adoption of the knife only if the rate of harvesting was faster than the traditional methods. Thus, the conclusion was that the adoption of the picking knife was not independent of the average time required to harvest a bunch.

Wage Level:

$H_{07}$  The adoption of the knife is independent of the wage level of the operator.

$H_{a7}$  The adoption of the knife depends on the wage level of the operator.

Using the results of Tables E.3A and E.3B in Appendix E, the null hypothesis was rejected in favor of the alternative and it was concluded that the adoption of the picking knife was not independent of the wage level of the operator.

Comparing the Rivers State data to the NIFOR data in the contingency table, there was almost a reverse in the frequencies. In the Rivers State, most operators were at or below minimum wage while in NIFOR, most operators were at or above the minimum wage level. This could be explained by the fact that all of the operators in NIFOR were employed by the government and were supposed to be at or above the minimum wage level, while in the Rivers State, most of the operators were daily recruits who were paid on a production basis.

Status:

- $H_{08}$  The adoption of the picking knife is independent of the status placement of the adopter as perceived by him.
- $H_{a8}$  The adoption of the picking knife depends on the status placement of the adopter as perceived by him.

At the 0.05 level of significance, the null hypothesis was rejected in favor of the alternative and it was concluded that the adoption of the picking knife in the Rivers State was not independent of the status placement of the adopter.

In each case, more of the current users considered status as positive while more of the ex-users thought status

was not affected by the use of the knife. The trend was the same for the Rivers State and NIFOR showing similarities in their perception of this factor.

Social Impact:

H<sub>0</sub>9 The adoption of the picking knife is independent of the social impact of the use of the knife.

H<sub>a</sub>9 The adoption of the picking knife depends on the social impact of the use of the knife.

At the 0.05 level of significance, the null hypothesis was rejected in favor of the alternative in both cases. The conclusion then was that social impact was a factor associated with the adoption of the picking knife in both Rivers State and NIFOR.

In the Rivers State, a majority of the current users believed that the use of the knife had no social impact, while a majority of the ex-users felt that the picking knife had positive social impact. Generally speaking, a majority of the participants in the Rivers State perceived the use of the knife as having positive or no social impact. This was also true of the participants in NIFOR. This similarity was expected since the social structure of the two communities had a lot of commonalities.

CompatibilityConsistency:

H<sub>0</sub>10 The adoption of the picking knife is independent of the consistency of the innovation with social, cultural values and belief of the adopter.

H<sub>a</sub>10 The adoption of the picking knife depends on the consistency of the innovation with social, cultural values and belief of the adopter.

Responding to question C6, the participants pointed to the fact that the picking knife had been a part of the culture from time immemorial. They suggested that it could not be used on the tall wild oil palm trees because of the height of the trees. This response was unanimous. They would not consider using the knife if the use of the knife was against their social and cultural belief and values. Thus, the conclusion was that the null hypothesis was rejected at a high margin, and it was concluded that the adoption of the picking knife was not independent of the social and cultural values and beliefs.

Past Experience:

H<sub>0</sub>11 The adoption of the picking knife is independent of the past experiences of the adopter under similar social changes.

H<sub>a</sub>11 The adoption of the picking knife depends on the past experiences of the adopter under similar social changes.

In both Tables E.6A and E.6B in Appendix E, the null hypothesis was rejected in favor of the alternative, that the adoption of the picking knife was not independent of the past experiences of the participants.

In both the Rivers State and NIFOR, the trend was similar - more positive experiences with current users and more no or negative experiences with ex-users. These experiences could possibly contribute to why the current users adopted the use of the knife and why the ex-users discontinued the use of the knife.

Real Need:

H<sub>0</sub>12 The adoption of the picking knife is independent of the real need of the operators.

H<sub>a</sub>12 The adoption of the picking knife depends on the real need of the operators.

At the 0.05 level of significance, the null hypothesis was rejected in favor of the alternative, that the adoption of the picking knife was not independent of the real need of the adopters. However, the magnitude of rejection was curiously low, especially for the Rivers State.

It is possible that the current users whose needs are not met would discontinue the use of the knife or leave the operators' job as soon as they can find some more attractive alternatives. Another possibility is that some of the ex-users discontinued the use of the device because it did not meet their needs. However, for both categories, the Rivers State and NIFOR data show consistency with the expectations.



### Complexity

#### Ease of Use:

H<sub>0</sub>13 The adoption of the picking knife in Rivers State is independent of the perceived ease of use of the knife.

H<sub>a</sub>13 The adoption of the picking knife in Rivers State depends on the perceived ease of use of the knife.

In testing this hypothesis, the reference point was the "ease of using the ladder" because this was the most common means of harvesting the cultured trees.

At the 0.05 level of significance, the null hypothesis was rejected for both cases and thus, the adoption of the picking knife was not independent of the ease of use of the knife as perceived by the adopter.

As expected, the data for "ease of use" shows a similarity in trend for both Rivers State and NIFOR. The participants who perceived the use of the knife as more difficult than the traditional methods could have some other reasons, such as ill-health or need for more practice with the knife.

#### Maintenance and Repair:

H<sub>0</sub>14 The adoption of the picking knife is independent of the perceived maintenance and repair requirements.

H<sub>a</sub>14 The adoption of the picking knife depends on the perceived maintenance and repair requirements.

For the participants, maintenance and repair of the knife were related activities. Thus the responses to the questions on maintenance and repair of the picking knife were the same.

At the 0.05 level of significance, there was a failure to reject the null hypothesis. The conclusion was, therefore, that the adoption of the picking knife was independent of the perceived repair and maintenance requirements.

Here again, data from both the Rivers State and NIFOR show consistency with expectation and have the same trend. With the local interpretation for repair and maintenance and the fact that the knife was also native in this locality (though for harvesting another plant), it would be expected that repair and maintenance would not be a factor of importance in the operators' decision to adopt the innovation.

Construction:

$H_{015}$  The adoption of the picking knife is independent of the construction requirements of the knife.

$H_{a15}$  The adoption of the picking knife depends on the construction requirements of the knife.

Here again, the responses of the participants were exactly like the previous hypothesis on repair and maintenance. There was a very close relationship in the meaning of the words construction (manufacturing) and repair in the local languages. The local languages imply that anyone who was able to construct or manufacture a device could also repair it. Thus, the adoption of the picking knife was considered independent of the construction requirements.

**Trialability****Demonstrability:**

H<sub>0</sub>16 The adoption of the picking knife is independent of the small scale demonstrability and trial requirements of the knife.

H<sub>a</sub>16 The adoption of the picking knife depends on the small scale demonstrability and trial requirements of the knife.

In response to questions about the picking knife, all the participants made it clear that the small scale demonstrability of the knife and trial requirements were not considered in the adoption of the knife, because the plantain harvesting knife was a small version of the picking knife and the practice had been going on for years in the society. Thus, the null hypothesis was accepted and it is concluded that the adoption of the picking knife was independent of the small scale demonstrability and trial requirements of the knife.

**Reversibility****Reversibility Effect:**

H<sub>0</sub>17 The adoption of the picking knife is independent of the reversibility effect of the adoption of the knife.

H<sub>a</sub>17 The adoption of the picking knife depends on the reversibility effect of the adoption of the knife.

Here again, the unanimous response was that the participant entertained no fear about the known and the unknown effects of discontinuation of the practice, and so did not consider the reversibility effect of the knife in

their decision to adopt or discontinue the use of the knife. Thus, there was a failure to reject the null hypothesis.

### Observability

Observability of an innovation is the degree to which the results of the innovation are visible to others (Rogers, 1983). The hardware of the picking knife innovation is quite observable. The tool can easily be seen. However, the productive capacity of the knife depends on many of the other factors (such as physical factors, complexity, etc.), and may not be easily visible to adopters.

### Visibility:

H<sub>0</sub>18 The adoption of the picking knife is independent of the visibility of the knife.

H<sub>a</sub>18 The adoption of the picking knife depends on the visibility of the knife.

From the chi-square computation, the null hypothesis was rejected for Rivers State and just barely rejected for NIFOR at the 0.05 level of significance.

Visibility was slightly more significant in the Rivers State than in NIFOR because of the irregularity of demonstration in the Rivers State as compared to the better organized and regular demonstration in NIFOR. Also, in the Rivers State, the demonstration only took place in one of the four plantations and operators from the three plantations did not usually actively take part the demonstrations.

Communication:

H<sub>0</sub>19 The adoption of the picking knife is independent of the communication system available for disseminating information about the picking knife.

H<sub>a</sub>19 The adoption of the picking knife depends on the communication system available for disseminating information about the picking knife.

The communication channel that had been most frequently used in the dissemination of information about the picking knife in Rivers State and in the Nigerian Institute for Oil Palm Research was the formal demonstration method. In the Rivers State, this had only been done once since 1975 when the knife was first introduced. On the other hand, the demonstration of the use of the knife is done every two years at NIFOR. As was determined by the study, "diffusion effect" plays a limited role in the communication of the innovation because NIFOR has a demonstration every two years and within this period no operator took interest in trying to use the knife except those introduced to it. In the Rivers State, even the village operators were not aware of the idea. The newly recruited operators were usually few in number within this period, whereas, in the Rivers State there was little incentive to do this and there seemed to be no consistency on the part of the management in the dissemination effort. Besides, all of the activities were nearly confined to workers in the oil palm estates.

In the Rivers State, 97 percent of the participants were introduced to the picking knife by demonstrations,

while 100 percent of the participants at NIFOR heard about the picking knife from demonstration.

All of the participants in this study (users and ex-users) agreed that they were convinced to use the knife through the demonstrations and very few through fellow operators already using the knife. Thus, it was concluded that the adoption of the picking knife was not independent of the communication system available for disseminating information about the knife.

#### Diffusion Time:

H<sub>0</sub>20 The adoption of the picking knife is independent of the time allotted for diffusion.

H<sub>a</sub>20 The adoption of the picking knife depends on the time allotted for diffusion.

There was no time allotted for the diffusion of the use of the knife by the government, the estate management or the operators themselves. Thus, time allotment for diffusion was never a factor in the adoption of the picking knife method in the Rivers State.

#### Physical Factors

##### Body Structure, Health and Age:

H<sub>0</sub>21 The adoption of the picking knife is independent of the body structure, the health status and the age of the adopters.

H<sub>a</sub>21 The adoption of the picking knife depends on the body structure, the health status and the age of the adopters.

On the average, an operator in the Rivers State is 5'6" tall with a broad and powerful upper body. The participants said that they did not consider body structure in their decision to use the knife because none of them had any problem carrying the knife in the field. However, ill-health (like arthritis, painful joints, hypermetropia, etc.) which are also related to aging, were major factors in their decision to discontinue the use of the knife. Thus, age and ill-health were co-factors that affect the use of the picking knife. Most of the ex-users were old operators (See Table 4.1).

#### Employment Category

##### Employer:

H<sub>0</sub>22 The adoption of the picking knife is independent of the employer category to which the operator belongs.

H<sub>a</sub>22 The adoption of the picking knife depends on the employer category to which the operator belongs.

Among the participants in the survey, all the current users of the knife were employed by the government and their knives were provided by the employer. Some of the privately employed operators indicated that they might consider using the knife if they were encouraged through incentives. The public sector provided the knife and demonstrations as part of these incentives.

Thus, to a large extent, the chances of an operator using the knife were reduced if he was privately employed

and enhanced if publicly employed. Therefore, the adoption of the picking knife was not independent of the employment category of the operator. The null hypothesis was thus rejected in favor of the alternative.

### Years of Experience

#### Without Knife:

$H_{023}$  The adoption of the picking knife is independent of the number of years of experience of the adopter in oil palm harvesting.

$H_{a23}$  The adoption of the picking knife depends on the number of years of experience of the adopter in oil palm harvesting.

The responses indicated that the operators who had been in the business for a long time were the older operators and these have fewer members among those who were using the knife currently and a majority of those who were the ex-users. The majority of the current users were those who were new to the profession (see Table 1.1). Thus, it could be concluded that the longer the number of years of experience in oil palm harvesting, the more difficult it was for the operator to adopt the innovation. This was an expected trend (Appendix C.  $a_1$   $a_2$ ) because in most cases, the inertia of social change is more when an individual is used to a particular way of life for a long time (Rogers, 1983). Therefore, it can be concluded that the adoption of the picking knife was not independent of the number of years of experience of the adopter in oil palm harvesting.



**With Knife:**

**H<sub>0</sub>24** The adoption of the picking knife is independent of number of years of experience of the adopter in using the picking knife.

**H<sub>a</sub>24** The adoption of the picking knife depends on number of years of experience of the adopter in using the picking knife.

Most of those who discontinued the use of the knife did so because of age or sickness, or the discontinuation of provision of the knife by the employer. The indication was that the longer an operator uses the knife, the more he was willing to continue using the knife, all things being equal. The reason given by the operators was that the more experience gained in the use of the knife, the easier, and faster the operation, and consequently, the more money the operator was able to make per day of work. Thus, the adoption of the picking knife was not independent of the experience of the adopter in the use of the knife.

**Education (Formal and Non-Formal)**

**H<sub>0</sub>25** The adoption of the picking knife is independent of the education categories of the operators.

**H<sub>a</sub>25** The adoption of the picking knife depends on the education categories of the operators.

At the 0.05 levels of significance, the chi-square computed for the Rivers State and NIFOR showed a rejection of the null hypothesis in favor of the alternative. Hence, the conclusion was that the adoption of the picking knife

was not independent of the education category to which the operator belonged.

The education categories showed the most unexpected results. It was expected that education would be a very important factor in the adoption of the knife. The opposing trend in the case of current users for the Rivers State and NIFOR could be explained from the employment requirement (6 months of oil palm harvesting experience or five years of formal education) as opposed to no required educational standard for the Rivers State operators.

However, the results for education cannot stand alone. They have to be considered in line with the age of the operator, which also interacts with the health status. Most of the older operators had no opportunity to be formally educated.

#### Magnitude of Factors

The factors that were associated with the use of the picking knife as an appropriate oil palm harvesting device in the Rivers State, as identified by this survey are listed below (Table 4.3) by their magnitude as defined by the descriptive terms: very low (1), low (2), moderately low (3), moderately high (4), high (5) and very high (6). Table 4.4 shows the identified factors and their level as determined by the chi-square computations or the hypotheses.

Table 4.4

Level of Factors in Rivers State and NIFOR\*

Factors	1	2	3	4	5	6
I. Relative Advantage:						
1. Provider of knife		X			O	
2. Cost of knife						X
3. Saving in effort			X		O	
4. Degree of discomfort			X		O	
5. Average time of harvest						Ø
6. Wage level			O	X		
7. Status placement		X		O		
8. Social impact			Ø			
II. Compatibility:						
1. Consistency with culture						Ø
2. Past experience				Ø		
3. Real need		X	O			
III. Complexity:						
1. Ease of use		X	O			
IV. Observability:						
1. Visibility of knife	O	X				
2. Communication system						Ø
V. Physical Factors:						
1. Health status and age						Ø
VI. Years of Experience:						
1. Without						Ø
2. With						Ø
VII. Employer						Ø
VIII. Education:			X	O		

<u>Level Key</u>			
$x^2 - x^2_{acr}$		<u>Level</u>	
0 - 1		Very Low (1)	X = Rivers State
1.1 - 3		Low (2)	O = NIFOR
3.1 - 6		Moderately Low (3)	Ø = Both
6.1 - 10		Moderately High (4)	
10.1 - 15		High (5)	
15.1 and over		Very High (6)	
Unanimity			

$x^2 - x^2_{cr}$  = The magnitude of significance of factor (i.e. the difference between computed chi-square and standard critical chi-square).

Histograms of the factor magnitudes are shown in Appendix B, with their area moments. "Ma" represents the area moment for each factor. These area moments were used to grade the factors associated with the use of the picking knife (in the Rivers State and compared to NIFOR) hierarchy is shown in Table 4.5. This table simply indicates the intensity of factors, which could be useful in resource allocation planning for any oil palm bunch picking knife diffusion program in the Rivers State, and at NIFOR.

Table 4.5

Hierarchy of Significant Factors

<u>Rivers State</u>		<u>NIFOR</u>	
<u>Factor</u>	<u>Level</u>	<u>Factor</u>	<u>Level</u>
Relative Advantage	29	Relative Advantage	31
Compatibility	12	Compatibility	13
Years of Experience	12	Years of Experience	12
Observability	8	Observability	7
Employer Category	6	Employer Category	6
Physical Factors	6	Physical Factors	6
Education	3	Education	4
Complexity	2	Complexity	3

The area moment was an indicator of the strength of population of operators that identify with each factor.

### Characteristics of Factors

#### Relative Advantage

As stated earlier, relative advantage of an innovation as perceived by members of a social system is positively related to its rate of adoption. In this study, eight sub-factors under relative advantage were identified as associated with the picking knife. These sub-factors were listed in Table 4.4.

The current users (adopters) of the picking knife in the Rivers State would prefer the employer to provide the knife, rather than the employee, at a ratio of 2 to 1. Those who felt that they would still use the knife even if they, rather than the employer, were to provide it, claimed that they would do so if their employers would increase their wages. They could obtain the pole from the bush and the curved knife from a nearby blacksmith and assemble the picking knife by themselves. Among the ex-users, 68 percent would provide the knife by themselves but for other factors (in which cost and physical condition were prominent). Thus, the current users and the ex-users tended to go in the opposite directions in their perception of who should provide the knife. As a result, it can be argued that the opinions were divided as to who should provide the knife. However, this statement ignores

possible interaction effects between variables as discussed later in this chapter.

In the Nigerian Institute for Oil Palm Research, both current users and ex-users favored their present situation, that is the employer provided the knife. In this case, an employer-provider situation was a perceived attribute of the knife. The cost of the picking knife was considered as a factor because the operators were not highly paid. In a situation where the employer provided the knife, the cost of the knife was not an important issue in the adoption of the picking knife. The picking knife was perceived as a fairly cheap device (about \$15 altogether) and thus, the cost of the knife contributed immensely to the attributes of the knife.

Savings in effort and degree of discomfort were perceived as related factors by the participants and were given an equal level of importance. To those who were in good health, savings in effort and degree of discomfort contributed positively to the attributes of the picking knife. Except the older and sick operators, every participant agreed that the picking knife was easier to use; saved effort of climbing the tree; reduced the danger of attack of snakes, insects, and fall; and reduced the degree of discomfort involved in the oil palm harvest, compared to the ladder or rope systems.

The average time of harvesting was intrinsically related to the wage level, particularly for the operators employed on a daily basis, and paid on production rate. If the rate of harvesting with the picking knife was faster as claimed by Hartley's experiment, then the operator would be able to harvest more bunches per day with the knife, thereby increasing his earning power.

Sixty-two percent (Table E.2A) of current users felt that the use of the picking knife resulted in a slightly higher level of regard (status) by their friends and neighbors. Among these there were cases of increased responsibility and respect from friends, and neighbors. The operators had acquired a new skill in their job. They had been delegated to teach newly recruited operators the skill of using the picking knife. Fourteen percent of the current users of the knife perceived their status in the society as not affected in any way by their using the picking knife; while 24 percent felt that the use of the picking knife negatively affected their social standing. Most of these, for some reason, could not learn to use the knife as fast as others. Others lost some earnings from the making of the ladders and climbing ropes, now replaced by the picking knife.

The ex-users showed an opposite trend in their responses. Fifty-six percent of them perceived their

status was negatively affected by the use of the picking knife. This contributed to their decision to discontinue the use of the knife.

Although the knife was a common tool for harvesting bananas and plantains, its use for oil palm harvesting was a new idea. Fortunately, there was no known taboo associated with the knife, and so it had a highly favorable social image. As perceived by the participants, the use of the picking knife had more positive social impacts than negative ones (Tables E.3A and E.3B). Forty-six percent of participants from the Rivers State perceived the social impact of the use of the knife was positive; 33 percent perceived it had no social impact; and 21 percent perceived the social impact was negative. There was a realignment of leadership roles in the plantations. New groups of skilled men who sometimes were called upon to teach their skills to new recruits now exist in the plantations and their presence was felt in the surrounding villages. Some of the operators who used the picking knife and had been noticed teaching others, were now occasionally invited to arbitrate in minor village disputes.

A combination of the above factors (the relative advantage) constituted the most important factors associated with adoption of the picking knife as an appropriate oil palm harvesting device in the Rivers State.



### Compatibility

The use of the picking knife as an oil palm harvesting device was a new way of using an existing idea in the Rivers State. A similar device was used to harvest plantains and bananas in this area. This statement was confirmed by the responses of the participants. The respondents would not consider using the knife to harvest the oil palm if there were any taboos or individual negative attitudes associated with it. The social consistency of the use of the picking knife in oil palm harvesting was largely recognized by the operators, who believe that it was a positive force in their adoption of the use of the knife.

In the Rivers State, 86 percent of the current users had positive past experiences in similar social changes. On the other hand, 64 percent of the ex-users have had negative or no past experience in similar social change. The same trend was seen in NIFOR, where there were only three participants who had no past experience in a similar social situation. The overall effect of "past experience" was high as indicated by the chi-square difference in Table 4.3. Responses from a majority of the operators were favorable towards their past experiences.

Most of the participants believed that the use of the picking knife was not meeting their need per se. They were

in the oil palm harvesting profession because they had no better alternative. The job paid poorly and did not have high social status. They had to rely on multiple self-employment to survive. Thus, most of the operators in the Rivers State did not put much emphasis on the use of the picking knife meeting their real need. However, 76 percent of the current users and 44 percent of the ex-users believed that the use of the picking knife partly met their need (sufficiently to maintain them in the job).

The combined effect of consistency, past experience and need placed compatibility at a fairly high level among the factors associated with use of the picking knife as an appropriate oil palm bunch harvester in the Rivers State.

### Complexity

The result of the interview indicated that 23 percent of the current users and 60 percent of ex-users considered the use of the picking knife more difficult than the traditional method. Most of these were among the ex-users above 40 years of age, who complained of muscle pains and short sightedness. The average current user viewed the picking knife as a relatively easy tool to use in harvesting oil palm bunch compared to the ladder or the rope methods. Thus, the attribute of complexity was positively reflected at a low level in the adoption of the picking knife in the Rivers State.

**Observability**

The visibility of the knife was low in the Rivers State because the knife was confined to the oil palm estates and usually left in the field after harvest. Thus, only those people in the demonstrations and some other people living in the oil palm estates, actually saw the knife in use.

The system by which information about the picking knife was diffused to the operators played a very important role in the adoption of the knife. This assertion, which was echoed by many authors and confirmed by this study, is enhanced by the fact that knowledge is the gateway to all the other activities involved in the innovation decision process. Communication is a major vendor of knowledge. The 17 village operators had not heard about the idea. The operators in the Rivers State were limited as to the sources and time of information about the picking knife. The Extension Division of the Ministry of Agriculture in the Rivers State was not actively involved in the effort to diffuse the information about the picking knife. The demonstrations which were done once in two years were usually more of a formality than learning and they missed many operators. Diffusion effect was weakened by limited social interaction between the estates and villages. So,

communication had a high magnitude among factors in the adoption of the picking knife in the Rivers State.

### Physical Factors

The body size and conformation of the average operator in the Rivers State was an asset to the adoption of the knife by this population. The broad, muscular and powerful upper body could easily carry the knife and use it in the field. However, as the length of the pole (handle) of the knife increases, the older and smaller (weaker) of the population of operators tended to discontinue the use of the knife.

The assessment of the individual capacity to carry the knife with any degree of discomfort was done by sight and handling.

Among the older operators, ill-health was the main complaint.

A poor sighted individual can hardly see the stalk of the bunch of a tall tree clearly from the ground level (Plate 4.1). He would find it difficult to position the knife for cutting. An operator who suffers from painful arm muscles and/or arthritis would prefer the intermittent carrying of the ladder or the rope, to the continuous carrying of the picking knife through the field.

Thus, health was an important factor associated with the use of the knife in the Rivers State. This was a



Plate 4.2 The Chisel in Use

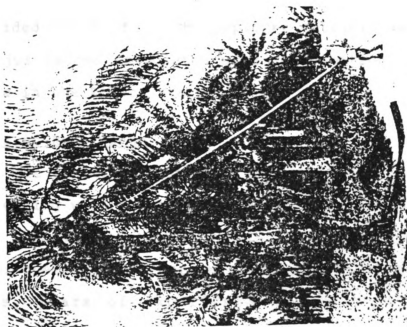


Plate 4.1 A 14 M Picking Knife,  
too long for a Short-  
Sighted Operator

factor which could easily force an operator to discontinue the use of the knife, even if all other factors were positively disposed.

#### Employer Category

The private ownership of the oil palm estates neither encouraged nor discouraged the use of the knife as an oil palm harvesting device. The operator was responsible for whatever method he employed in harvesting. Because the operator was accustomed to the traditional methods, he usually fell back to it when there was no effort to persuade him to use the knife. In the Rivers State, 21 current users were employed by the government which provided the knife. The employer category was, therefore, a major factor associated with the adoption of the picking knife in the Rivers State.

#### Years of Experience

The number of years of experience of the operator in harvesting with the traditional methods, increased with his age. As was mentioned earlier in this dissertation, the older operators had more militating factors aided by aging. Thus, years of experience in traditional oil palm harvesting was negatively related to the rate of adoption of the picking knife.

On the other hand, the number of years of experience of an operator using the picking knife was positively related to its rate of adoption. At a certain age level, the aging factors could intrude and reduce the effect of experience with the use of the knife.

As a result of the interaction of the years of experience with aging and health, the years of experience factor had a high magnitude of rating by the hierarchy table.

### Education

Sixty-two percent of the operators currently using the picking knife had some non-formal education, while 96 percent of the ex-users were in this category. This placed the type of education an operator had at a moderately low level among the factors associated with the adoption of the knife as an appropriate oil palm harvesting device in the Rivers State.

There was a high interaction effect between age and education in this population. Most of the non-formally educated persons were those who were age 45 years and above. Most younger operators had some classroom education of some sort. The interview results indicated that the younger operators tend to adopt the use of the knife more than the older operators.

The education category was, therefore, a factor associated with the adoption of the picking knife as an oil palm harvesting device.

#### Interaction Among Factors

An omnibus hypothesis, that there was no interaction effect among the factors associated with the use of the picking knife as an appropriate oil palm harvesting device in the Rivers State, using the log mean statistic, was rejected at the 0.05 level of significance. This indicated that there existed some interaction effect among some variables, as perceived by the operators.

It will require an independent apriori (planned) contrast study to examine in detail, the interacting factors and the nature of the interaction among the factors. In such a study, hypotheses are posed as to determine the magnitude and direction of the interaction effects for each pair of factors. A plot of the log mean values would indicate points of interaction and proportion of interaction attributable to each component.

It is important to understand these interaction effects and to adjust for them when planning for programs to diffuse the use of the picking knife as oil palm bunch harvester in the Rivers State for the sake of optimization.



### Comparison of Factors

The comparison of factors that are associated with the use of the picking knife as an appropriate oil palm harvester in the Rivers State was done using the chi-square procedure, according to the level of rejection of the null hypothesis, and by the cell values. Table 4.3 showed the between comparisons.

The within comparison was done by comparing the cell sizes. The cells with high values in the "contribution to the chi-square" are the ones that "contribute" the most to the significance of the chi-square.

Thus, it could be said, from Tables E.1A and E.1B of Appendix E, that the employer providing the knife has a significant influence on the operator's decision on the average. This was consistent with the opposing trend of employee-provider and employer-provider. On the other hand, it could be said that employees required to provide the knife contributed to the high number of ex-users in the Rivers State. The cost of the device seemed also to have a greater effect on the decision of the ex-users than that of the current users.

Savings in effort was shown to be the largest positive contributor to the significance level of this factor. Thus, the participant perceived "saving in effort" in the use of the picking knife as a positive factor. Other

significant factors perceived to be positively associated with the adoption of the picking knife in the Rivers State are: time required to harvest a bunch, social impact, cultural belief, past experiences of participants in a similar social change, met needs, ease of use, status, education, employment of operators, and experience in using the knife.

The factors that were perceived to be negative, on the average were: wage level, visibility of innovation, communication strategy, age (older were more sickly), and education, in that the educated operators tended to more actively look for other employment.

Generally, the same trend was noticeable at NIFOR. However, because of differences in employment conditions and management, there were some differences between the Rivers State and NIFOR data.

In the Nigerian Institute for Oil Palm Research, the current user, employer-provider category was the biggest influence on the significance of the factors, whereas, in the Rivers State, the ex-user employee-provider was the biggest influence.

On the average, the wage level at NIFOR was higher than that of the Rivers State. It was difficult to make a solid statement about the effect of wage level because of the many other variables that interacted with it. The

operators at NIFOR enjoyed a better status in their society than those in the Rivers State.

Current users in NIFOR perceive social impact, cultural belief, past experience, met need, ease of use, visibility, communication systems, past experience, and employment conditions as positive attributes of the picking knife. Table 4.5 shows a side by side comparison of the Rivers State and NIFOR data using equation 3.4.

The table indicates that on the average, the factors associated with adoption of the picking knife played a slightly more important role in the decision to use the knife at Rivers State than in NIFOR. The mean phi values for Rivers State were slightly higher than those of NIFOR. However, the differences were so small that the two populations of operators could be said to be fairly in agreement about the factors they perceived to be associated with the adoption of the picking knife.

This result was expected because the Rivers State operators look up to NIFOR operators from whom the use of the picking knife came to them (interaction effect).

The similarity in the trend of concern between the two groups was an interesting phenomenon, because both groups were heterogeneous in ethnic constituent. However, this work tested only the omnibus hypothesis, therefore, the analysis indicated a general trend. A detailed study of each observation would reveal particular differences.

Table 4.6

Side By Side Comparison of the Rivers State  
and NIFOR Data Using Equation 3.4

Factors	<u>Rivers State</u>		<u>NIFOR</u>	
	$\chi^2$	$\phi^2$	$\chi^2$	$\phi^2$
Relative Advantage:				
Provider of knife	5.91	.13	14.45	.25
Cost of knife	20.00	.43	--	--
Degree of discomfort				
Saving in effort	9.18	.20	16.56	.29
Average time of harvest	20.00	.43	20.00	.35
Wage level	12.52	.27	9.70	.17
Status placement	8.52	.19	12.21	.21
Social impact	11.09	.24	10.62	.19
MEAN		.27		.24
Compatibility:				
Beliefs and values	20.00	.43	20.00	.35
Past experience	11.62	.25	12.57	.22
Met need	4.87	.11	7.07	.12
MEAN		.26		.23
Complexity:				
Ease of use	6.09	.13	8.48	.15
Observability:				
Visibility	5.34	.12	3.89	.07
Communication	20.00	.43	20.00	.35
MEAN		.28		.21
Physical:	20.00	.43	20.00	.35
Employment Category:				
Experience 1	20.00	.43	20.00	.35
Experience 2	20.00	.43	20.00	.35
Education:	8.42	.18	11.40	.20

NOTE: The cost of the knife was eliminated by the employer-provider situation for NIFOR.

Comparison With Findings from Other Countries

Malaysia stands out in the use of the picking knife as an oil palm bunch harvester. The popular use of the knife for harvesting oil palm bunches started in Malaya, now Malaysia and Singapore, even though Malaysia was one of the late entrants into the commercialization of the oil palm industry. History traces the origin of the oil palm tree to equatorial Africa, from where it was transferred through Deli to Rantan Panjang in the Kuala Selangor district of Malaysia in 1911 and 1912 (Hartley, 1977).

Before World War II, the routine of manual cutting and carrying of oil palm fruit in Malaysia was undertaken by the same workers. This meant that for trees over two meters, the operator had to climb the palm tree by some means. Climbing the palm tree was done primarily by hand or ladder.

The picking knife came into use for oil palm harvest about the same period cultured plantations started to emerge. According to Hartley, this was about 1917 when the Rantan Panjang palms were in full bearing. However, activities in the oil palm industry were sluggish until after World War II. Rehabilitation of the oil palm industry was faster in Malaysia after the war than in Sumatra and production was again in full swing by 1947. Acreages of oil palm grew at a slow but steady rate at

first, then at a faster rate. Oil palm companies in Malaysia started to experience serious operator labor shortages. At this time, the companies had confidence in the future of the market for palm oil. The companies had also felt a need to diversify to reduce their dependency on rubber.

Thus, the widespread use of the picking knife for harvesting oil palm bunches in Malaysia was a matter of necessity. The diffusion of the use of the knife was, therefore, a major effort by the companies. The companies supplied the knife to operators and carried out frequent demonstration programs aimed at showing operators how to use the knife and the profitability of the use of the knife. Because the production of palm oil was mainly in the hands of competing companies and small holders, operators were cared for and were actively involved in production decisions. They were, therefore, in touch with available improved methods. Record has it that within a decade, almost every operator in Malaysia was using the picking knife for oil palm harvesting.

Company programs to promote the adoption of the picking knife included: intensive education of operators about the use of the knife, monetary incentives - a harvesting contractor was paid \$8.00 or higher per ton of fresh fruit bunches delivered at factory site; in 1966-

companies provided the knives, and encouraged operators to increase production through employment conditions (Ministry of Agriculture and Cooperatives, Malaysia, 1986).

Thus, the Malaysian situation has taken into consideration most of the factors identified in this dissertation.

In other palm oil producing countries, the trend was similar to that in Malaysia. Sumatra - Java has achieved a high adoption rate for the picking knife.

The earliest of the American planting was established in Honduras in 1943 by the United Fruit Company. Since then, efforts have been made to improve oil palm harvesting in this area. The company research efforts resulted in the development of axe and the famous John Deere tractor-mounted boom for conveying the operator to his reach of the bunch, in the early 60's.

In all other countries involved in oil palm production, the adoption of the picking knife was in varying levels, but there were similarities in other methods of harvesting.

### Summary

This chapter presented the description of the study participants, the data collected, analysis of data and the discussion thereof. Situations in other palm oil producing countries were also surveyed and compared to the case of

Rivers State. The analysis of data indicated that eight major factors were identified as being associated with the adoption of the picking knife as an appropriate oil palm harvesting device in the Rivers State. These factors included relative advantage, compatibility, years of experience, observability, employment category, health factors, education and complexity.

The factors were sequenced according to the magnitude of importance using the area moment approach for rejection differences. The chi-square per observation was used to compare within group and the phi statistic for between group data. The Rivers State data is compared to the data from the Nigerian Institute for Oil Palm Research. Most of the participants were skeptical about the development of a fully mechanized harvester because of possible job losses for them and their wives. They, however, believe that it was possible to have a fully mechanized oil palm bunch harvester some day.

An omnibus hypothesis indicated that there are some forms of interaction between source of the factors. This is, however, an area for future investigation.



## **CHAPTER V**

### **CONCLUSIONS AND RECOMMENDATIONS**

In this study the factors associated with the adoption of the picking knife as an appropriate oil palm bunch harvester in the Rivers State were identified based on innovation-diffusion and social change theories.

This concluding chapter includes a summary, discussion and conclusions, and recommendations.

#### **Findings**

Among the ten major factors hypothesized as being associated with the adoption of the picking knife for oil palm bunch harvesting in the Rivers State, eight were identified as those that influenced the adoption-decision process of the participants. Those factors were:

1. Relative advantage
2. Compatibility
3. Complexity
4. Observability
5. Physical conditions
6. Employment
7. Years of experience
8. Educational category

## Discussion and Conclusions

### Relative Advantage

Relative advantage was composed of eight sub-factors: provider of knife, cost of knife, savings in effort, degree of discomfort, average time required to harvest a bunch, wage level of operator, perceived status enhancement, and social impact. The cost of knife, average rate of harvest and social impact ranked highest in the level of considerations among the positive sub-factors in the Rivers State. A comparison between the magnitude of association of relative advantage to the adoption of the knife in the Rivers State and the Nigerian Institute for Oil Palm Research (NIFOR), showed Rivers State to be slightly higher than that of NIFOR on the average.

The provision of the knife by the employer eliminated the cost of knife as a significant sub-factor at NIFOR, whereas in Rivers State, the employer provided the knife and the cost of the knife became a significant factor. Therefore, it can be concluded that the employee providing the knife was a negative factor associated with the adoption of the picking knife in the Rivers State.

In Malaysia, where the adoption of the knife was accomplished within a short period, the wage level was comparatively higher and the operators were permanent employees of the companies with full benefits. The operators were included in the decision making processes and

other aspects of the running of the companies, thereby enhancing the status of the operators. The same was true of the situation of the operators in NIFOR, though to a lesser extent. On the other hand, in the Rivers State, the operators were hired and paid less than minimum wages on a daily basis with no benefits. Comparing the adoption rates within these institutions, it could be said that low wage level and low status enhancement were negative factors associated with the adoption of the picking knife in the Rivers State.

The younger and healthier operators perceived the degree of discomfort and savings in effort of the picking knife as positive among the participants. On the other hand, the opposite was true for the older and sicker operators. Thus, it could be concluded that the degree of discomfort, savings in effort, health status and the age of the operator were positive factors associated with the adoption of the picking knife for younger operators but negative for older operators. The cumulative effects of all of the sub-factors make relative advantage a positive factor associated with the adoption of the knife.

#### Compatibility

The picking knife was found to be culturally and socially compatible with the values and beliefs of the Rivers State operators. Previous experiences in similar social changes for the operators in the Rivers State were

positive forces in the adoption of the knife. Most of the operators interviewed seem to be willing to participate in similar social change activities such as the picking knife innovation. They had nothing to regret about their previous involvements in projects similar to the adoption of the picking knife.

It was concluded that adoption of the picking knife was compatible with the values held by the operators in the Rivers State.

#### Complexity

The complexity of the knife was seen from how much mental and physical effort was required from an operator to become conversant with the use of the knife. The knife was generally perceived on the average as easier to use than either the ladder or the rope systems. A device very similar to the picking knife is a traditional tool for harvesting plantains and bananas. The operators who still depended on the tall wild oil palm trees did not consider the use of the picking knife because it would require a very long knife handle and would be difficult to harvest the tall trees using the knife.

The maintenance of the knife involves a regular sharpening of the edge in the same way the cutlass is sharpened using the file, and replacement of the knife handle (pole) or reconstructing a broken handle. It requires more time and effort on the average to construct

the ladder or the rope than to construct a picking knife when the cutting edge is provided. It can be said, therefore, that the use of the picking knife is relatively simple (not complex) compared to the other methods.

### Observability

In the Rivers State, the use of the picking knife is still restricted to the plantations for the obvious reason that only the plantations grow the cultured plant for which the picking knife was developed. Thus, the visibility of the knife was low outside of the plantations. The major formal means of communicating the benefits and the use of the knife to potential adopters was found to be through the irregularly scheduled demonstrations in Elele Oil Palm Plantation to employees only. Demonstrations at NIFOR were more regular and better organized than those in the Rivers State, but were restricted to the employees. Therefore, in the Rivers State, "diffusion effect" was more important in the communication of the picking knife idea than it was in the Institute.

The observability of the picking knife is an important factor associated with the adoption of the knife in the Rivers State and has potential for improving the adoption image of the knife.

### Physical (Health) Status

The result of work indicated that the younger operators were more receptive to the use of the picking knife than the older operators because of health problems. Harvesting with the picking knife requires better sight than harvesting with the ladder or rope where the operator is close to the bunch. Poor eyesight was observed more in the older operator and so were muscle pains and arthritis. The conclusion was, therefore, that better health and lower age of the operator were positive factors associated with the adoption of the knife.

### Employment Category

The employer's identity was not an important factor on its own, as long as the employer provided the knife and paid fair wages to the operator. The operators considered the employer's identity in their decision to adopt the use of the knife only when they thought of how they would obtain the knife, and the incentive in the wage level. Thus, employment category is a factor that has to be considered in line with the employment policies of the employer, and the wages received per ton of fresh fruit bunches.

Once an operator is fully employed as a worker for the government or a private company, he receives the government minimum wage or higher plus retirement benefits. Therefore, the full employment of the operator could be used as an incentive to induce the operator to adopt the use of the

knife. This is possible if the use of the knife becomes a condition for full employment. (The wages for fully employed operators were not based on productivity.)

### Experience of the Operators

The operator's years of experience harvesting oil palm bunches using the ladder or rope tended to have some inverse association with the adoption of the picking knife. This inertia of change may be due in part to habit formation, and so would differ with individuals. The years of experience on the job also increased with age which reinforced the previous statement.

On the other hand, the years of experience of an operator using the knife seemed to have a sort of proportional relationship. Experience in using the knife should normally improve the efficiency of use, if all other factors are held constant. The conclusion, therefore, was that the longer an operator harvested the palm without the knife, the more difficult it would be for him to adopt the knife, and the more an operator used the knife, the easier it would be for him to sustain the use.

### Education

Surprisingly enough, the type of education (formal or non-formal) an operator possessed was about the least important factor associated with the adoption of the picking knife among the factors identified. This could possibly be

as a result of the interaction effect of age, as stated earlier. However, education was a more important factor at NIFOR than in Rivers State. Education was even more important in a place like Malaysia where the operators were hired by companies on the same basis as other services. The direction of development in oil palm harvester operation was becoming more technical in Malaysia as shown by the trend toward motorizing the picking knife. History has shown that education on oil palm harvesting has been done informally through the generations. There is no real need for formal classroom work in learning to use the knife. The conclusion, therefore, is that the education of the operator, though not a major factor now in the use of the picking knife for oil palm harvesting in the Rivers State, would become one in time when modern technology finds its way into the oil palm bunch business in Nigeria.

#### Summary

The Rivers State operators perceived the attributes of the picking knife as positive. The factors identified to be associated with the adoption of the picking knife in their order of importance included: years of experience, observability, employer, physical factors, education, and complexity.

Communication was found to be an important factor negatively associated with the adoption of the knife. Most of the operators were informed about the use of the knife



through demonstrations. The visibility of the knife was found to be low and so was diffusion effect. These were the negative communication factors needing improvement. Also, the employer policies, target group for education about the knife, relative advantage and the complexity of the knife are important factors needing improvement. The operators perceived employer providing the knife and increasing their wage level as conditions appropriate for them in the adoption of the knife.

Finally, the positive social and cultural consistencies of the knife and partially met needs of the operators were found to be factors associated with adoption of the knife. There were no historical or geographical resistances to the adoption of the knife in the Rivers State.

### Recommendations

Based on the conclusions drawn from the analysis and discussion for this study, the following recommendations are made:

#### Relative Advantage

The conclusions reached indicate that the Rivers State can enhance the attributes of the picking knife if the employer provides the knife to the operators.

Although a detailed investigation as to the type of relationships between wage level, status enhancement, degree of discomfort, savings in effort, the ease of use of knife

with the rate of adoption of the knife, and their interaction effects, would provide useful information about optimum wage level, and the direction to which modifications of the knife should follow to be more readily acceptable to the operators in the Rivers State, it is important first to further investigate how employment opportunities, government policies and plantation owner/manager relationships affect the operator's decision to adopt the innovation.

Then studies could concentrate on one or two factors at a time and should attempt to determine the interaction between each pair or group of factors, using planned orthogonal multiple comparison techniques. Such studies should pose the hypothesis of no effect and no interaction between the factors and the dependent variable (adoption) and between the factors themselves.

These factors in relative advantage were selected because they are the ones that can more easily be manipulated.

If the safety of harvesting is enhanced, the wage paid to the operators increased, the improved safety and increase in earning power would improve the image of the operator job in the society (higher social placement) as is evident in the case of Malaysia. The increased productivity of an individual operator through the use of the picking knife could logically be the basis for increased earnings by the operator, thereby helping to meet more of his financial

needs. Fortunately, the social impact, savings in effort (degree of discomfort) and time required to harvest a bunch are all positively associated with the adoption of the knife.

It might be interesting to measure how the wage level interacts with need of the operators. Sociologists and economists believe that at the operator's economic level, met needs increase proportionately with increase in monetary income. However, this should not be at the expense of safety. The measurement and analysis of the interaction between wage level and met needs will use the hypothesis testing for planned multiple comparison as mentioned above. In each case, it will be necessary to examine the trend of relationships in order to use the optimum values.

#### Compatibility

Research efforts on oil palm harvesting (mechanization) in the Rivers State should be based on proven need and consistency of the outcome. This is important because some of the processes in oil palm harvesting provide jobs for the wives and children of the operators, and the diffusion of innovations that seem to threaten this relationship would meet with serious resistance from the communities. The operators were not particularly excited by research on fruit and bunch catchments and automation in harvesting procedures because these were seen as causes of unemployment for themselves, their wives and their children.

### Complexity

Any attempts to motorize the picking knife in the Rivers State should go along with the provision of alternative employment opportunities. The topography of the State is particularly suitable for the motorization of the knife as long as such vehicles run on track wheels, because of the deep alluvial soil.

The vehicles should be supplied by the government or employers and should have maintenance crew employed also. If left for the individual operators, the motors could not be afforded by the operators who are poor and not used to the operation of engines.

Modifications in the picking knife should make it simpler and easier to handle and maintain by the operators if such is to be acceptable to them.

### Observability

A reasonable target audience for the picking knife innovation should be the younger operators (up to the age of 40 years). Though no age group should be left out in any diffusion program, more effort should be concentrated on younger operators because they have more years to expect to use the knife before they begin to experience the health problems that were mentioned above.

Diffusion effort should not be restricted to the plantations only. Small holders should be able to gain access into diffusion programs. Diffusion programs should

use methods of communication that are available and known to have been successful in this area - demonstrations, home visits, and posters. The government could also provide legislation that would make the information about the knife available to everybody.

In fact, the employer could take up for the training of operators in the same way it does for other operators like laboratory technicians, tractor drivers, etc. This would also help the image of the job of the oil palm bunch operator. The government should seek to standardize the wages receivable by operators, to save them from ruthless plantation owners.

Except in the negotiation for the loan from the central bank, the government is not directly involved at any level with promoting the use of the picking knife in both Rivers State and in the Institute.

It seems, therefore, obvious that in order to improve the adoption of the picking knife in the Rivers State, more should be done in communicating the idea to the potential users. The increasing number of plantations in the Rivers State requires an intensified dissemination network for the picking knife in order to realize the intended improvement in the safety of harvesting the palm bunches, and (increase) in the output of the oil palm products.\* With the ladder or

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\*The government of the Rivers State has started to build two more oil palm plantations.

rope methods the oil palm industry in the Rivers State will continue to suffer from manpower shortages and low productivity, especially at the peak period, because of poor safety records and other competing employment.

#### Physical (Health Status)

While every operator should be involved in the diffusion of the picking knife, effort should be concentrated on the younger operators (from the youngest, up to 40 years), because they have few health problems, are more receptive to the idea and have more years to use the knife before they begin to experience the health problems associated with aging. On the other hand, it would be interesting to investigate the possibility of mounting a simple telescope on the handle of the picking knife. This presents a real possibility because such a telescope could be inexpensive and light in weight so as not to add too much to the cost and weight of the knife.

#### Employer Category

Legislation that requires all employers of operators to provide the knife should eliminate cost of knife and employer category as a factor associated with the adoption of the picking knife. An additional factor to be considered is the need to slash the thick undergrowth on the plantation periodically to make it easier for the operator to move through the field with ease, carrying the knife.

### Experience of the Operator

The negative effect of experience in oil palm harvesting without using the knife can be reduced by intensive and aggressive diffusion programs directed towards operators in this category. Such program should stress the safety record, the economic advantage of the knife and the relative ease of use. Operators who have already started to use the knife should be encouraged to continue to use it because perfection comes with continuous practice.

### Education

There is need to study in detail the effect of education (formal or non-formal) in the oil palm harvesting business. Through such study, it would be possible to formulate a structure for operator education in vocational schools. As technology creeps into the oil palm harvesting processes, formally educated operators would have an advantage in handling and maintaining the picking knife. Besides, structured operator education would further enhance the image of the operator in the community.

### Summary

Oil palm bunch harvesting is and continues to be an important component of the palm oil production system. It is, therefore, necessary that the number of operators who can use the picking knife increase as the population of cultured trees increase in the Rivers State. This should

result in an increase in production of palm oil and the other products of the palm tree with fewer accidents (safer) in oil palm bunch harvesting. It will also work more towards stabilizing the labor force in oil palm bunch harvesting than any of the traditional methods. There is a decline in the oil palm harvest labor force because of urban migration and the danger involved in climbing the palm tree, and since the picking knife is known to increase productivity, perhaps more than the ladder or rope methods, fewer operators will be needed to harvest a given quantity of fresh fruit bunches. The increased productivity by the operators through the use of the knife, should result in higher daily wages received.

#### Comments by the Author

This study was necessitated by the humanitarian consideration of the operators' situation in the Rivers State. However, a fringe benefit from the adoption of the picking knife as an oil palm bunch harvester in the Rivers State could be the increment of the operators' productivity which could translate into increased earning for the operator and consequently an overall increase in the production of the palm oil and palm kernel oil. This comment arises from the fact that the use of the knife was experimentally shown to increase the productivity of the operator (Hartley, 1977), though not linear in time. Even



then, the productivity of the operator with the traditional climbing methods declined too, with time.

In order to improve the communication network for the dissemination of information about the knife, the Rivers State Government has to be directly involved in the diffusion process through the Extension Division of the Ministry of Agriculture. As long as the plantations depend on the irregularly scheduled demonstrations and social interaction, most of the operators will have no access to information about the picking knife, because the plantation owners/managers do not seem to be interested in the potential of the knife. They either do not know enough about the knife or do not think it is their responsibility to help reduce the number of accidents in oil palm bunch harvesting.

Finally, there seems to be a potential for the study of the Rivers State Operators and the adoption of the picking knife using the grounded theory approach. In such a study, all existing social and scientific theories would be ignored with the assumption that the relationship between the Rivers State operators and the picking knife is a unique one that has not yet been understood. A study of this nature would generate theories based on the particular aspects of the operators resulting from the distinctive nature of the environment and socio-political details. According to Glaser and Strauss (1965), Glaser (1978), and

Merriam/Simpson (1984), the grounded theory is a general basis for generating theories that apply the research regarding a particular problem.

It is particularly suited for descriptive studies such as in this case where little prior or formal theory exists, based on empirical data, about the Rivers State people: their customs, social and economic linkages, and religious beliefs. The major purpose of doing grounded theory research in an applied field is to improve professional practice through gaining a better understanding of it.

Grounded theory provides the flexibility and latitude that is needed to develop initial hypotheses from which formal theory and verification can later occur. The end product of such a study is a set of conclusions derived from the descriptions offered by the participants of the study.

A basic premise of grounded theory is that theory is an "ever-developing entity, not a perfected product." Because the study's conclusions are based on data rather than existing theories, they are not likely to be completely refuted by more data or replaced by another theory.

Thus, the conclusions and hypotheses emerging from such a study are expected to provide a basis for further studies which can add to, expand or refine them.

## **A P P E N D I X    A**

## **INSTRUMENT**

### **Interview Questions**

1. Sex        M \_\_\_\_\_ F \_\_\_\_\_
2. Age \_\_\_\_\_
3. Employment    Public \_\_\_\_\_ Private \_\_\_\_\_ Self \_\_\_\_\_
4. Economic level    Below \_\_\_\_\_ At \_\_\_\_\_ Above \_\_\_\_\_
5. Education Category    Formal \_\_\_\_\_ Non-formal \_\_\_\_\_
6. User Category        Current \_\_\_\_\_ Ex \_\_\_\_\_
7. Years of experience (in oil palm harvesting) \_\_\_\_\_
8. Years of experience using the picking knife \_\_\_\_\_
9. Physical conditions \_\_\_\_\_

### **A. Questions**

1. How did you learn about the oil palm harvest picking knife?
2. Where was this?
3. When was this?
4. When and why did you decide to adopt the use of the picking knife? What major factor(s) affected your decision to try the use of the picking knife? What major factor(s) influenced your decision to adopt the use of the knife?

If you no more use the knife, when did you decide to discontinue usage?

Why did you decide to discontinue usage?

What types of changes in the knife would induce you to go back to using it?

Do you really need to use the picking knife? Why?

**B. Questions**

1. What do you like about the picking knife?
2. What do you not like about the picking knife?
3. What aspect of harvesting with the picking knife do you like most?
4. What aspect of harvesting with the picking knife do you hate most?  
       repair \_\_\_\_\_ manufacturing \_\_\_\_\_
5. Who provides the picking knife?
6. Would you react differently if you or your employer has to provide the knife?
7. Does it matter to you how much the knife costs in money or in labor, if you were to pay for the knife?
8. Have you thought of the pay-back period of the picking knife. If so, did it in any way affect your decision to adopt or discontinue the use of the picking knife.
9. Would you have adopted the use of the knife if the average rate for harvesting a bunch was slower \_\_\_\_\_, the same \_\_\_\_\_, or faster \_\_\_\_\_ than the traditional method.
10. What improvements would you like be made for the picking knife and the use of it?
  - add a fruit catchment (F.C.) \_\_\_\_\_
  - add a bunch catchment (B.C.) \_\_\_\_\_
  - add both \_\_\_\_\_
  - motorize the picking knife \_\_\_\_\_
  - motorize the knife with F.C. \_\_\_\_\_
  - motorize the knife with B.C. \_\_\_\_\_
  - motorize the knife with both \_\_\_\_\_

**C. Questions**

1. What would you like your employer to do about the picking knife?
2. What incentives motivate you to continue using the knife or go back to using the knife?

3. What do your friends and neighbors tell you about your adopting the use of the picking knife?
4. What do your friends and neighbors tell you about your discontinuing the use of the picking knife?
5. Are you concerned about the social impact of the adoption of the knife? What impacts on (a) social structure (organizations), (b) leadership, (c) land tenure, social problem solving capacity.
6. Is the use of the picking knife consistent with your values and beliefs? If not, what aspect of the innovation is in conflict with your social, cultural values and beliefs? Would you have considered using the knife otherwise?
7. Where you required to learn how to use the knife within a given time? Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, how much time?

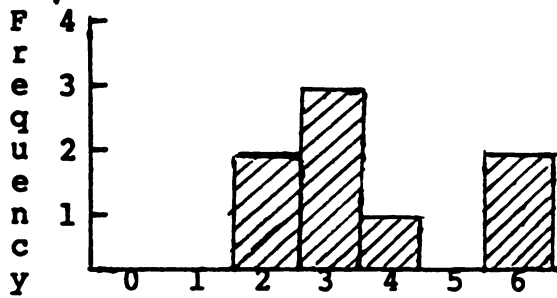
**A P P E N D I X    B**

# HISTOGRAMS

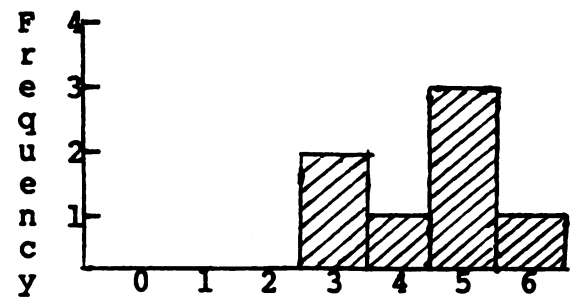
RIVERS STATE

NIFOR

## Relative Advantage

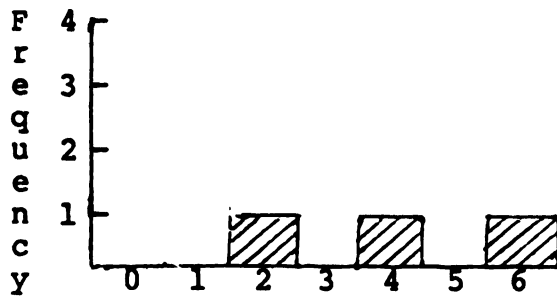


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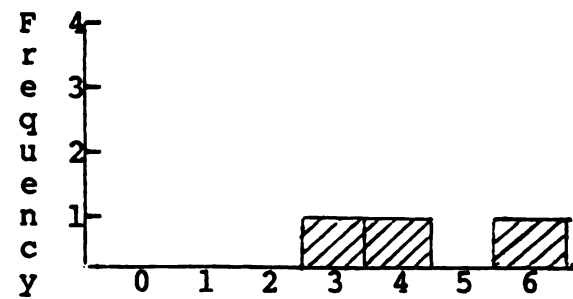


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## Compatibility

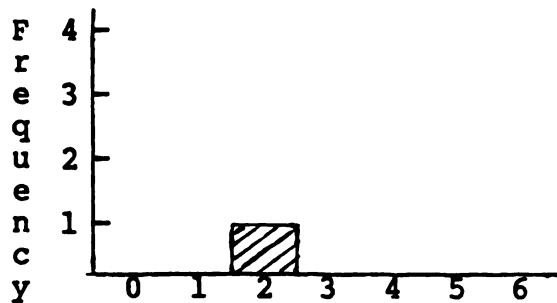


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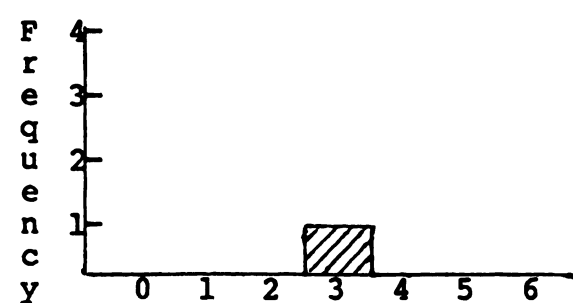


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## Complexity

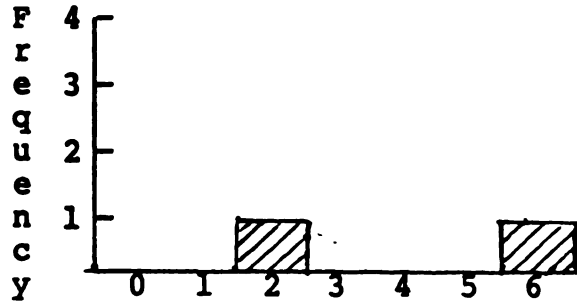


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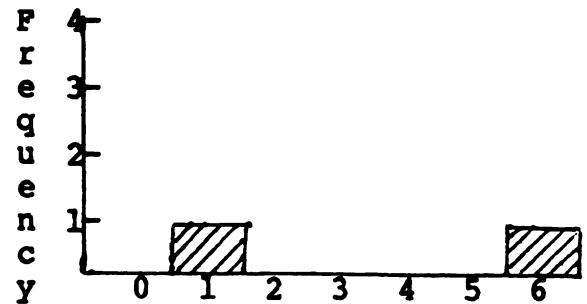


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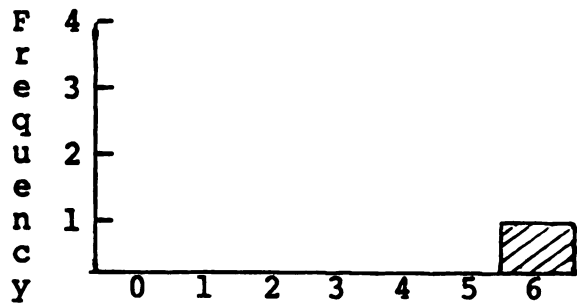


RIVERS STATENIFORObservability

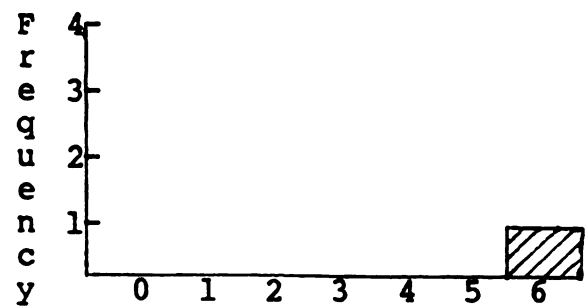
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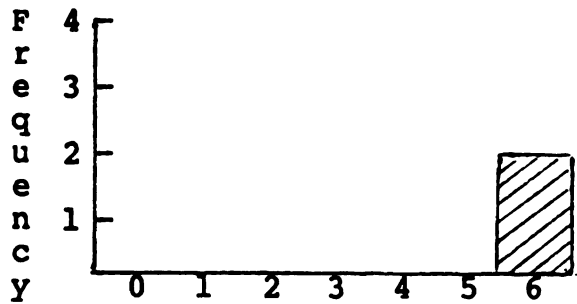
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Physical Factors

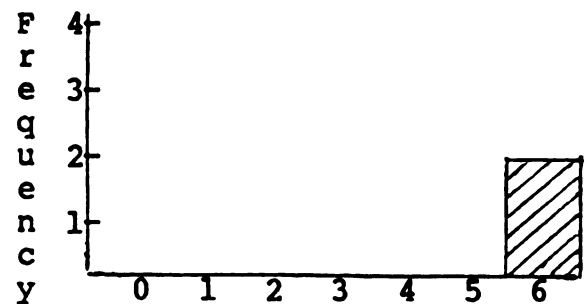
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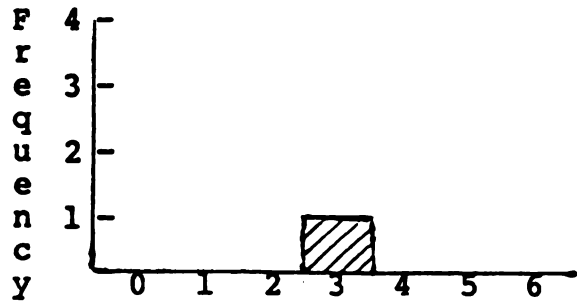
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Years of Experience

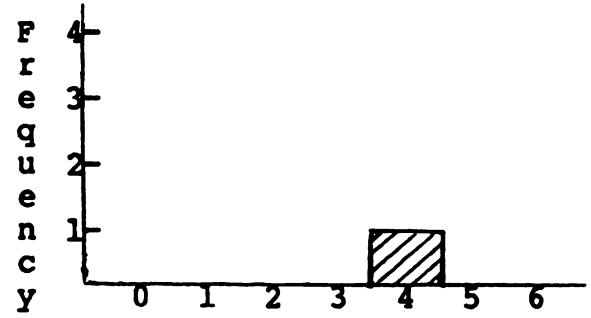
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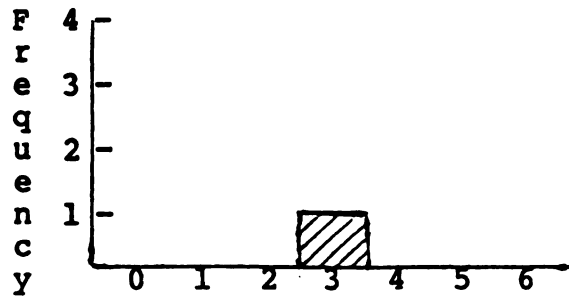
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RIVERS STATENIFOREducation

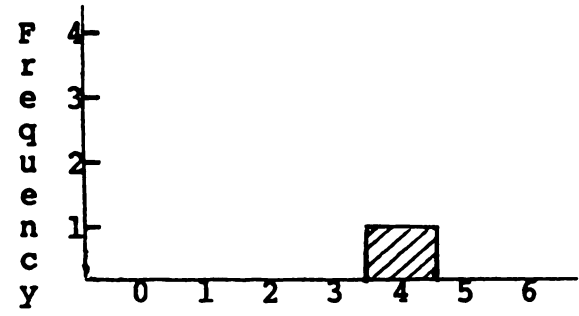
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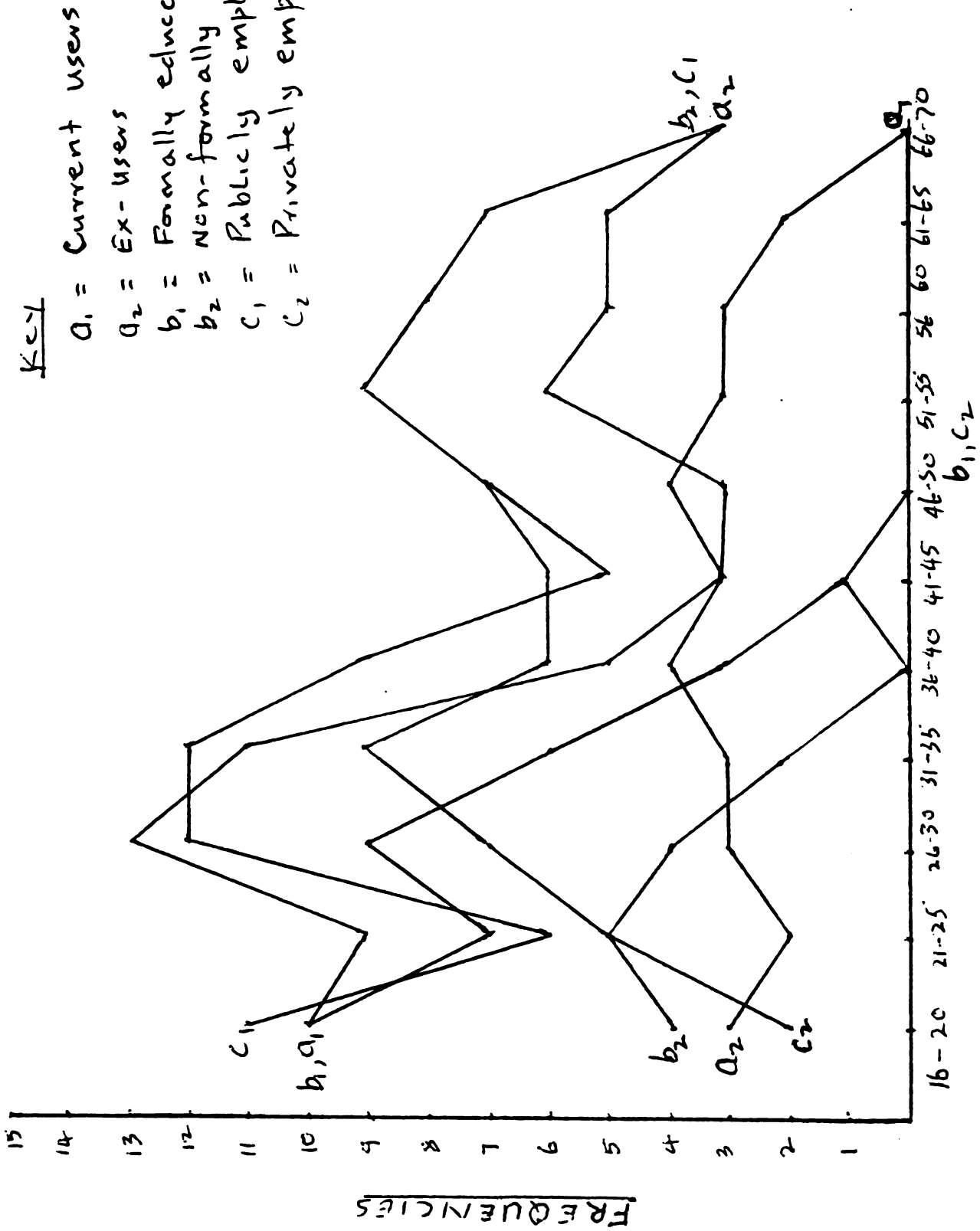
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Am = 4

## **A P P E N D I X . C**

**A P P E N D I X   D**



## **A P P E N D I X   E**

**Three Major Categories of Participants  
and Their Locations**

<b><u>Location</u></b>	<b><u>Current Users</u></b>	<b><u>Ex-Users</u></b>	<b><u>Never Used</u></b>
<b>Rivers State</b>			
<b><u>Plantations</u></b>			
Omoku	5	6	3
Ahoada	5	7	1
Elele	9	4	-
Echie	2	8	4
<b><u>Village</u></b>			
Omoku	-	-	4
Ahoada	-	-	4
Elele	-	-	5
Echie	-	-	<u>4</u>
<b><u>Total</u></b>	21	25	25
<b>NIFOR</b>	38	19	-

Note:       The oil palm plantations were named according to the nearest village. Thus, Omoku Plantation was the oil palm settlement close to Omoku Village.



## CONTINGENCY TABLES

Table E.1A

Contingency Table for  $H_{01}$   
Rivers State

<u>Provider</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Employer	14	8	22
Employee	7	17	24
<b>TOTAL</b>	<b>21</b>	<b>25</b>	<b>46</b>

$$x^2 = 5.910$$

$$x^2_{Cr} = 3.841$$

Table E.1B

Contingency Table for  $H_{01}$   
NIFOR

<u>Provider</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Employer	29	11	40
Employee	9	8	17
<b>TOTAL</b>	<b>38</b>	<b>19</b>	<b>57</b>

$$x^2 = 14.450$$

$$x^2_{Cr} = 3.841$$

Table E.2A

Contingency Table for  $H_{04}$   
Rivers State

<u>Savings in Effort</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Positive	13	5	18
Same	2	9	11
Negative	6	11	17
<b>TOTAL</b>	<b>21</b>	<b>25</b>	<b>46</b>

$$x^2 = 9.180$$

$$x^2_{Cr} = 5.991$$

Table E.2B

Contingency Table for H<sub>04</sub>  
NIFOR

<u>Savings in Effort</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Positive	26	4	30
Same	9	5	14
Negative	3	10	13
<b>TOTAL</b>	<b>38</b>	<b>19</b>	<b>57</b>

$x^2 = 16.560$

$x^2_{Cr} = 5.991$

Table E.3A

Contingency Table for H<sub>07</sub>  
Rivers State

<u>Wage Level</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Above	5	1	6
At	10	4	14
Below	6	20	26
<b>TOTAL</b>	<b>21</b>	<b>25</b>	<b>46</b>

$x^2 = 12.52$

$x^2_{Cr} = 5.991$

Table E.3B

Contingency Table for H<sub>07</sub>  
NIFOR

<u>Wage Level</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Above	14	5	19
At	17	3	20
Below	7	11	18
<b>TOTAL</b>	<b>38</b>	<b>19</b>	<b>57</b>

$x^2 = 9.7$

$x^2_{Cr} = 5.991$

Table E.4A

Contingency Table for  $H_{08}$   
Rivers State

Status	Current Users	Ex-Users	Total
Positive	13	5	18
Same	3	6	9
Negative	5	14	19
TOTAL	21	25	46

$$\chi^2 = 8.52$$

$$\chi^2_{Cr} = 5.991$$

Table E.4B

Contingency Table for  $H_{08}$   
NIFOR

Status	Current Users	Ex-Users	Total
Positive	30	6	36
Same	8	13	21
Negative			
TOTAL	38	19	57

$$\chi^2 = 12.21$$

$$\chi^2_{Cr} = 3.841$$

Table E.5A

Contingency Table for  $H_{09}$   
Rivers State

Social Impact	Current Users	Ex-Users	Total
Positive	7	15	21
None	12	3	15
Negative	2	8	10
TOTAL	21	25	46

$$\chi^2 = 11.09$$

$$\chi^2_{Cr} = 5.991$$

Table E.5B

Contingency Table for  $H_{09}$   
NIFOR

<u>Social Impact</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Positive	26	6	32
None	12	9	13
Negative	8	4	12
TOTAL	38	19	57

$$\chi^2 = 10.62$$

$$\chi^2_{Cr} = 5.991$$

Table E.6A

Contingency Table for  $H_{011}$   
Rivers State

<u>Past Experience</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Positive	18	9	27
No or Negative	3	16	19
TOTAL	21	25	46

$$\chi^2 = 11.62$$

$$\chi^2_{Cr} = 3.841$$

Table E.6B

Contingency Table for  $H_{011}$   
NIFOR

<u>Past Experience</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Positive	33	8	41
No or Negative	5	11	16
TOTAL	38	19	57

$$\chi^2 = 12.57$$

$$\chi^2_{Cr} = 3.841$$

Table E.7A

Contingency Table for  $H_{012}$   
Rivers State

<u>Need Met</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Yes	16	11	27
No	5	14	19
<b>TOTAL</b>	<b>21</b>	<b>25</b>	<b>46</b>

$$\chi^2 = 4.87$$

$$\chi^2_{Cr} = 3.841$$

Table E.7B

Contingency Table for  $H_{012}$   
NIFOR

<u>Need Met</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Yes	31	9	40
No	7	10	17
<b>TOTAL</b>	<b>38</b>	<b>19</b>	<b>57</b>

$$\chi^2 = 7.07$$

$$\chi^2_{Cr} = 3.841$$

Table E.8A

Contingency Table for  $H_{013}$   
Rivers State

<u>Ease of Use</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Easier	16	10	26
More Difficult	5	15	20
<b>TOTAL</b>	<b>21</b>	<b>25</b>	<b>46</b>

$$\chi^2 = 6.09$$

$$\chi^2_{Cr} = 3.841$$

Table E.8B

Contingency Table for  $H_{013}$   
NIFOR

<u>Ease of Use</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Easier	29	7	36
More Difficult	9	12	21
<b>TOTAL</b>	<b>38</b>	<b>19</b>	<b>57</b>

$$\chi^2 = 8.48$$

$$\chi^2_{Cr} = 3.841$$

Table E.9A

Contingency Table for  $H_{014}$   
Rivers State

<u>Maintenance and Repair</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Easier	19	22	41
More Difficult	2	3	5
<b>TOTAL</b>	<b>21</b>	<b>25</b>	<b>46</b>

$$\chi^2 = 0.07$$

$$\chi^2_{Cr} = 3.841$$

Table E.9B

Contingency Table for  $H_{014}$   
NIFOR

<u>Maintenance and Repair</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Easy	38	18	56
More Difficult	0	1	1
<b>TOTAL</b>	<b>38</b>	<b>19</b>	<b>57</b>

$$\chi^2 = 2.06$$

$$\chi^2_{Cr} = 3.841$$

Table E.10A

Contingency Table for  $H_{018}$   
Rivers State

<u>Visibility</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Visible	13	7	20
Not Visible	8	18	26
<b>TOTAL</b>	<b>21</b>	<b>25</b>	<b>46</b>

$$\chi^2 = 5.34$$

$$\chi^2_{Cr} = 3.841$$

Table E.10B

Contingency Table for  $H_{018}$   
NIFOR

<u>Visibility</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Visible	34	13	47
Not Visible	4	6	10
<b>TOTAL</b>	<b>38</b>	<b>19</b>	<b>57</b>

$$\chi^2 = 3.89$$

$$\chi^2_{Cr} = 3.841$$

Table E.11A

Contingency Table for  $H_{025}$   
Rivers State

<u>Education Category</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Formal	8	1	9
Non-Formal	13	24	37
<b>TOTAL</b>	<b>21</b>	<b>25</b>	<b>46</b>

$$\chi^2 = 8.42$$

$$\chi^2_{Cr} = 3.841$$

Table E.11B

Contingency Table for H<sub>0</sub>25  
NIFOR

<u>Education</u>			
<u>Category</u>	<u>Current Users</u>	<u>Ex-Users</u>	<u>Total</u>
Formal	24	3	27
Non-Formal	14	16	30
TOTAL	38	19	57

$$\chi^2 = 11.40$$

$$\chi^2_{Cr} = 3.841$$



## **R E F E R E N C E S**

## REFERENCES

- Anderson, S.; A. Auquier, W.W. Hanck; D. Oakes; W. Vandaele; and H.I. Weisberg (1980). Statistical Methods for Comparative Studies. Wiley Series in Probability and Mathematical Statistics.
- Babbie, E.R., (1973). Survey Research Methods, Belmont, CA.: Wadsworth.
- Bertrand, A.L. (eds.). "Agricultural Technology and Rural Social Change," Chapter 26 in Rural Sociology: An Analysis of Contemporary Life. New York: McGraw Hill.
- \_\_\_\_\_. (1951). "Agricultural Mechanization and Social Change in Rural Louisiana," Louisiana Agricultural Experimental Station, Bulletin No. 458.
- Bertrand, A.L.; J.L. Charlton; H.A. Pederson; R.L. Strabanek; and J.D. Tarrer (1956). "Factors Associated with Agricultural Mechanization in the Southwest Region," Arkansas Agricultural Experiment Station, Bulletin No. 567, Southwestern Regional Bulletin, No. 6.
- Bevan, J.W.L. and B.S. Gray (1969). The Organization and Control of Field Practice for Large-Scale Oil Palm Plantings in Malaysia. Knaia Lumpur. Incorporated Society of Planters, pp. 103-113.
- Bevan, J.W.L.; T. Fleming and B.S. Gray (1966). Planting Techniques for Oil Palms in Malaysia. Kuala Lumpur: Incorporated Society of Planters, pp. 156.
- Bohlen, J. (1964). "The Adoption and Diffusion of Ideas in Agriculture," In J.H. Copp (eds.), Our Changing Rural Society - Proceedings and Trends. Ames: Iowa State University.
- Bouterse, G.N. (1975). "A Diffusion Study: Adoption and Communication Practices of Professional Change Agents." Dissertation for the Degree of Ph.D. Michigan State University.
- Brandner, L., and B. Keave (1964). "Evaluation for Congruence as a Factor in Adoption of Rate of Innovations," Rural Sociology. 29:288-303.

- Brandner, L. and M.A. Straus (1959). "Congruence Versus Profitability in the Diffusion of Hybrid Sorghum," Rural Sociology. 24:381-383.
- Copp, J.H. (1956). "Personal and Social Factors Associated with the Adoption of Recommended Farm Practices Among Cattlemen," Kansas State Agricultural Experimental Station Technical Bulletin 83.
- Copp, J.H.; M.L. Sill and E.J. Brown (1958). "The Function of Information Sources in the Farm Prctice: Adoption Process," Rural Sociology. 23:146-157.
- Corley, R.H.V.; J.J. Harding; and B.J. Wood (1975). Developments in Crop Science 1: Oil Palm Research. Elseview Sc. Publishing Co., pp. 469-471.
- Diaz, B.J. (1969) "Un Nuevo Rumbo Para La Extensoin En America Latina." Desarrollo Rural en Las Americas 1:2.
- Dufrane, M. and J.L. Berger (1957) "Etude sur la recolte dans les palmerais," Bull Agric. Congo Belge, 48:581.
- Esmay, M.L. (1979). "Intermediate Agricultural Mechanization in East Asis Countries," Agricultural Mechanization in Asia. Vol. IX, No. 3.
- Federal Office of Statistics, Lagos, Nigeria (1980). Social Statistics in Nigeria.
- Federal Office of Statistics (1977-84). Lagos, Nigeria. Distribution Survey.
- Fliegel, F. (1956). "A Multiple Correlation Analysis of Factors Associated with Adaption of Farm Practices," Rural Sociology. 21:284.
- Fliegel, F. and J.E. Kivlin (1966). "Attributes of Innovation as Factors in Diffusion," The American Journal of Sociology. 72(3):235-248.
- 
- (1962). "Differences Among Improved Farm Practices as Related to Rate of Adoption," The Pennsylvania State University Ag. Exp. Station Bulletin 691.
- Gillbanks, R.A. (1967). Harvesting and Fruit Transport. A discussion on current practices. Planter, Kuala Lumpur, 43:227-322.

Glaser, B.G. (1978). Theoretical Sensitivity, Mill Valley, California: The Sociologist Press.

\_\_\_\_\_, and A.L. Strauss (1965). "The Discovery of Substantive Theory: A Basic Strategy Underlying Qualitative Research," The American Behavioral Scientist. 8:5-12.

Glass, G.V. and K.D. Hopkins (1984). Statistical Methods in Education and Psychology. 2nd Ed. pp. 46-104, 154-216.

Golman, G.P. (1976). "Decision to Adopt No-tillage Practices in Washington County, Iowa," In Decision-making Behavior on the Use of Information. Final Phase I Report. Report to the USDA, Contract No. USDA 53-3K06-9-76.

----- (1971). "Innovation and Diffusion," Agricultural History. 42:173-187.

Guba, E.G. and Y.S. Lincoln (1981). Effective Evaluation. San Francisco: Jossey-Bass.

Hagerstrand, T. (1968). "The Diffusion of Innovations," In D.L. Stills (eds.), The International Encyclopedia of the Social Sciences. New York: MacMillan & Co.

Harrisons and Crosfield (Malaysia) Limited (1966). Research and Advisory Scheme. Annual Report for 1964 and 1965 Part 2. Oil Palm Research Station. P.O. Box No. 207, Banting, Selangor, Malaysia.

Hartley, C.W.S. (1969, 1977). The Oil Palm. Tropical Agricultural Surveys 1st and 2nd Editions, pp. 459-464.

Helmstadter, G.C. (1970). Research Concepts in Human Behavior. New York: Appleton-Century Crofts, Inc.

Hernandez, P.F. and P.R. Acierto (1970). "Predicting Technological Change on Farms: A Study of Louisiana Farmers," Louisiana Exp. Stat. Bulletin No. 647.

Hoffer (1958). "Farmer's Attitudes and Values in Relation to Adoption of Approved Practices in Corn Growing," Rural Sociology. 23:112-120.

- Jamil, M.B. (1966). The Oil Palm in Malaya. Ministry of Agriculture and Co-operatives, Kuala Lumpur, Malaysia, pp. 199-212.
- John Deere Co. (1982). "Development and Testing of Oil Palm Mechanical Harvester." Malaysia:
- Khan, A.U (1978). "Locally Manufactured Small Farm Equipment for Asian Farmers." Proceedings of special International Conference on Agricultural Technology for Developing Nations.
- Kolshus, H.J. and E.D. Smith (1973). "The Relative Economic Advantage in Adoption of New Technology," University of Kentucky-Lexington, Department of Agricultural Economics, Staff Paper No. 6.
- Lionberger, H.F. (1963). "Community Adoption Patterns," Journal of Cooperative Extension. 1(4):201-209.
- \_\_\_\_\_. (1960). Adoption of New Ideas and Practices. Ames Iowa: The Iowa State University Press.
- Lionberger, H.F., and P.H. Gwin (1982). Communication Strategies: Guide for Agricultural Change Agents. The Interstate Printers and Publishers Inc., Danville, Illinois 61832-0594.
- Maimon, E.P. et al. (1981). Writing in the Arts and Sciences. Cambridge, Massachusetts: Winthrop Publishers, Inc.
- Marsh, C.P and A.L. Coleman (1955). "Group Influence and Agricultural Innovations: Some Tentative Findings and Hypotheses," The American Journal of Sociology. 588-599.
- \_\_\_\_\_. (1955). "Relation of Farmer Characteristics to the Adoption of Recommended Farm Practices," Rural Sociology. 20:289-296.
- McLaughlin, M.M. (1978). "Agricultural Technology Transfer and Value Conflicts in Developing Nations." Proceedings, special International Conference. University of Illinois, Urbana-Champaign.
- Meadows, O.D. (1979). "Agricultural Education and Agricultural Development in Taiwan." Second draft copy for presentation. Michigan State University.

- Merriam, S.B., and E.L. Simpson (1984). A Guide to Research for Educators and Trainers of Adults. Robert E. Krieger Publishing Company, Malabar, Florida.
- Miller, W.L. (1965). "An Economic Analysis of Oil Palm Fruit Processing in Eastern Nigeria." Ph.D. Dissertation, Michigan State University.
- Ministry of Agriculture and Cooperatives, Malaysia (1968). "The Oil Palm," Agricultural leaflet No. 34. Publications Branch, Ministry of Agriculture and co-operatives, Kuala-Lumpur, p. 22.
- Nigerian Annual Abstract of Statistics (1981). Federal Office of Statistics, Lagos, Nigeria.
- Norman, D.W.; D.H. Pryor; and C.J.N. Gibbs (1979). "Technical Changes and the Small Farmer in Hausaland, Northern Nigeria," African Rural Economy Paper No. 21. Michigan State University.
- Nwanze, S.C. (1965). "The Hydraulic Hand Press," Journal of the Nigerian Institute for Oil Palm Research 4.
- Oil Palm Advisory Bureau (1977). Oil Palm News. No. 22, Tropical Products Institute, 56/62 Gray's Inn Road, London WC1X8LV.
- Patton, M.A. (1980). Qualitative Evaluation Method. Beverly Hills: Sage Publications.
- Price, J.G.M. and D.D. Kidd (1973). Mechanized Loading and Transportation of Oil Palm Bunches in Malaysia, Planter, Kuala Lumpur. 46:339-41.
- Richards, J.M. and J.G. Claudy (1973). "Does Farm Practice Adoption Involve a General Trait," Journal of Applied Psychology. 57(3):360-362.
- Rogers, E.M. (1983). Diffusion of Innovations, 3rd Ed. Free Press, 134-265.
- (1976). Communication and Development, pp. 49.
- Rogers, E.M. and G.M. Beal (1958). "Reference Group of Ag. Tech. Aves," Iowa State College, Dept. of Economics and Sociology.

- Rogers, E.M. and R.J. Burdege (1961). "Much Vegetable Grower, Diffusion of Innovations Among Specialized Farmers," Ohio Agricultural Experimental Station Research Circular No. 94.
- Rogers, E.M. and A.E. Havens (1961). "The Impact of Demonstration on Farmer's Attitude Toward Fertilizer," Ohio Ag. Exp. Station, Research Bulletin No. 896.
- Rogers, E.M. and M.D. Yost (1960). "Communication Behavior of County Extension Agents," Wooster, Ohio: Ohio Ag. Exp. Station, Research Bulletin, No. 850.
- Sankar, N.S. (1966). Fruit Collection and Evacuation by Road, Planter, Kuala Lumpur, 43:568-573.]
- Scheaffer, R.L.; W. Mendenhall; and L. Ott (1979) Elementary Survey Sampling. 2nd Ed. North Scituate, MA: Duxbury, pp. 42-50, 76-89.
- Selltiz, Claire, et al. (1959). Research Methods in Social Relations. New York: Holt, Rinehart and Winston.
- Sen, S.R. (1978). "Agricultural Technology for Increased Food Production in Developing Nations: Problems and Opportunities." Proceedings, special International Conference, University of Illinois, Urbana-Champaign.
- Smith, M. and D. Sheppard (1959). "A Study of the Dissemination of Information About a New Technique in Dairy Farming," Farm Economists. 9:133-147.
- Toh, K.B. (1972). "Examine the Problem of the Oil Palm Fruit Bunches Harvesting and Evaluate the Various Practices as Well as What Future Engineering Development Could be Considered." Thesis Seminar Paper No. A.E. 53/72, Faculty of Agriculture, University of Malaya, Kuala Lumpur, p. 12.
- Turner, P.D. and R.A. Gillbanks (1974). Oil Palm Cultivation and Management, pp. 485-490.
- Van Den Ban, A.W. (1960). "Locality Group Differences in the Adoption of New Farm Practices," Rural Sociology. 25:308-320.
- Vanderweyen, R. (1952). La Maturite du fruit et du regime et la variability de la teneur en huile. In Norton's de cluture de l Elaeis an Congo Belge. pp. 239-247.

Brussels: Direction de l Agriculture, des Forets, des Elevages et de la colonisation.

Walpole, R.E. and R.H. Myers (1978). Probability and Statistics for Engineers and Scientists, 2nd Ed. MacMillan, pp. 189-268.

White, W.J. (1967). "Toward the Validation of a Functional Model of the Adoption-Rejection Process," Ph.D. Dissertation, Michigan State University.

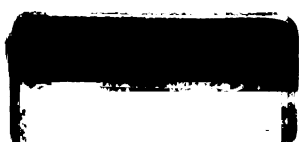
Wilkening, E.A. (1950). "A Sociopsychological Approach to the Study of the Adoption of Innovation in Farming," Rural Sociology. 15:352-360.

Young, J.A. and A.L. Coleman (1959). "Neighborhood Norms and the Adoption of Farm Practices," Rural Sociology. 24\_372-380.

Zaltman, G. (1983). "Theory in Use Among Change Agents," In E. Seidman (eds.) Handbook of Social Intervention. Beverly Hills: A. Sage.

Zaltman, G. and R. Duncan (1977). "Introduction to Social Change," In G. Zaltman and R. Duncan (eds.) Strategies for Planned Change. New York: John Wiley.





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