This is to certify that the

thesis entitled

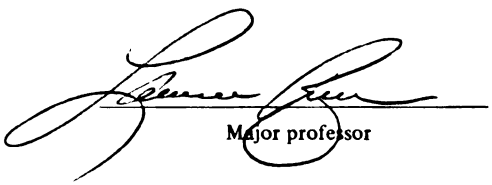
The Social Construction Of
Rice Post-Harvest Losses

presented by

Indera Ratna Irawati

has been accepted towards fulfillment
of the requirements for

MA degree in Sociology



Major professor

Date March 31, 1994

THE SOCIAL CONSTRUCTION OF RICE POST-HARVEST LOSSES

By

Indera Ratna Irawati

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Department of Sociology

1994

ABSTRACT

THE SOCIAL CONSTRUCTION OF RICE POST-HARVEST LOSSES

by

Indera Ratna Irawati

This paper focuses on the problem of a lack of agreement in measurement to be used in analyzing rice post-harvest losses. Social construction theory is used to analyze the case of Bangladesh.

This paper use data from two sources: Martin Greeley's book entitled Postharvest Losses, Technology, and Employment (1987), and A.K.M. Anwarul Haque et al.'s article entitled "Rice Post-harvest Practices and Loss Estimates in Bangladesh: Threshing through Sundrying" that was published in Agricultural Mechanization in Asia, Africa and Latin America, vol.22 no.1 1991.

The findings of this paper are that the researchers construct their own measurements in rice post-harvest losses by based on various explanations of loss operations/causes covered by estimates, methods of conducting research, seasons in which research was conducted, loss estimation, and characteristics of researchers. Another finding is that different interests of the researchers influence them in constructing their measurements and explanations.

Dedicated to my parents

for their encouragement and understanding

ACKNOWLEDGMENTS

I gratefully acknowledge the support of the individuals who contributed to this thesis and made it possible. In particular I wish to express my appreciation to:

Dr. Lawrence Busch, my major professor, for his guidance, valuable assistance, support, and understanding during the process of development this thesis.

Dr. Christopher Vanderpool and Dr. Marilyn Aronoff, my guidance committee, for their guidance, their helpful suggestions and ideas in developing this thesis.

Rusdibjono, MA, who give some advices in choosing the topic and developing the thesis proposal.

TABLE OF CONTENTS

	Page
List of Tables	vi
Chapter 1. INTRODUCTION	1
1.1. The Social Construction of Science and Technology	2 - 6
1.2. Measurement	6 - 11
Chapter 2. GENERAL DESCRIPTION OF RICE POST-HARVEST LOSSES	12 - 13
2.1. Some Studies of Rice Post-harvest Losses	13 - 15
2.2. Measurement of Rice Post-harvest Losses	15 - 18
Chapter 3. DESCRIPTION AND ANALYSIS OF RICE POST-HARVEST LOSSES IN BANGLADESH	19
3.1. Description of Rice Post-harvest Losses in Bangladesh	20 - 28
3.2. The Social Construction of Rice Post-harvest Losses	28

3.2.1. The Lack of Agreement in Measurement 28 - 35
3.2.2. The Different Interests of Researchers 35 - 40

Chapter 4. CONCLUSION 41 - 43

BIBLIOGRAPHY 44 - 46

LIST OF TABLES

	Page
Table 1. Loss Operations / Causes Covered by Estimates	20
Table 2. Methods of Conducting Research	21
Table 3. Seasons in Which Research was Conducted	23
Table 4. Loss Estimation	24
Table 5. Characteristics of Researchers	26

CHAPTER 1
INTRODUCTION

Social construction theory focuses on the interpretive process by which phenomena are constructed by the members of a society. The sociologist's concern is in how and why a phenomenon is defined as a social problem. From this perspective, the study of social problems is focused on the process by which a set of conditions is defined as a "social problem" among members of a society, and the resulting claims which arise (Gusfield 1984). For the proponents of social constructionist theory, the problem-making process is the main focus in understanding social problems. From this perspective, all things in social construction theory are arbitrary. One aspect of this is measurement. A problem occurs when there is no agreement about the measures to be used.

This paper will discuss and analyze the various measurements used by various researchers in analyzing rice post-harvest losses in Bangladesh. The main reason for using Bangladesh as the case is that Bangladesh is a developing country that was among the twenty principal producers of rice in the world from 1970 until 1990 (UNCTAD Commodity Yearbook 1992). Another reason is that numerous studies of rice post-harvest losses were conducted by various researchers that produced various data and interpretations in Bangladesh.

1.1. The Social Construction of Science and Technology

One branch of social construction theory comes from the sociology of science. In the sociology of science, social construction has been selected to stress the way that science is produced by individuals working together within a certain cultural context (Jagtenberg 1983). Trevor Pinch and Wiebe Bijker argue that science and technology are socially constructed. They are a matter of social negotiation, and they are socially produced in a variety of social circumstances (Bijker et al. 1989). They further explain that all knowledge and all knowledge claims are assumed as socially constructed. An implication is that products of knowledge, and explanations of knowledge are considered to be in the domain of the social world.

Pinch and Bijker underline three central key concepts of this approach: interpretative flexibility, closure, and relevant social groups (Bijker et al. 1989). These three key concepts are explained in detail in discussing two approaches within social construction theory. The two approaches are the Empirical Program of Relativism (EPOR) and the Social Construction of Technology (SCOT). The EPOR is built on the sociology of scientific knowledge, and the SCOT is developed by Bijker in the sociology of technology.

In the EPOR, there are three stages that can be identified in a social construction of scientific knowledge. The first stage is the interpretative flexibility of scientific findings. Here the scientific findings can be interpreted in various ways, or in other words, there is more than one interpretation possible in the scientific findings. The second stage shows that the interpretative flexibility will disappear. A scientific consensus usually occurs

that is called the "truth" in any particular instance (Bijker et al. 1989). In this stage, social mechanisms play an important role in limiting interpretative flexibility; they conclude controversies that emerge in the scientific findings. The third stage connects the closure mechanism to the larger socio-cultural environment. In the EPOR approach, Collins emphasizes the significance of controversies in the construction of scientific knowledge (Bijker et al. 1989). The groups that get involved in a scientific controversy will come to a consensus as the result of the controversy.

In SCOT, the process of development of a technological artifact is described as an alternation of variation and selection (Bijker et al. 1989). This approach concerns the problems and solutions shown by every artifact in a specific time. A problem develops only when a social group defines something as a problem. The key point is that all members of the social group are concerned with a certain artifact and share the same set of meanings of this artifact. In each problem, there are various solutions that can be identified. This approach sees that in the development process, all kinds of conflicts emerge: conflicting technical requirements by different social groups, conflicting solutions to the same problems, and moral conflicts.

Having discussed the two approaches, Pinch and Bijker give a more detailed explanation of the parallels between them. The first stage is interpretative flexibility. In the first stage of EPOR, the interpretative flexibility of scientific findings is shown. The SCOT demonstrates that technological artifacts are culturally constructed and interpreted (Bijker et al. 1989). Here there is a flexibility of defining and interpreting the technological artifacts, and also designing the technological artifacts as well. From this point it is assumed that different social groups have different constructions, interpretations, and designs of one technological artifact.

The second stage is closure and stabilization. The EPOR explains the mechanism of the closure of debate, and the SCOT is concerned with the stabilization of an artifact. In this explanation, Pinch and Bijker state that:

> Closure occurs in science when a consensus emerges that the "truth" has been winnowed from the various interpretations; it occurs in technology when a consensus emerges that a problem arising during the development of technology has been solved (Bijker et al. 1989, p. 12).

If the social groups which are engaged in designing and using the technology decide that a problem is solved, they will stabilize the technology. Here the outcome of the process is closure. One can say the similar way that closure is reached if the stabilization of an artifact is established and the problems have disappeared. From this point, Pinch and Bijker underline that different social groups decide differently the definition of the problem and the achievement of closure and stabilization. They further explain rhetorical closure as one important point in this stage. They argue that in order to close the controversies or debates on the technology, the important point to consider is whether the social groups see the problems as solved. Another important point is closure by redefinition of the problem. Here, closure is reached while the main problem is redefined by the social groups involved in giving meaning to the technological artifacts and solutions.

The last stage considered is the wider context. The main consideration of this point is the relationship between a technological artifact and its wider sociopolitical environment. The sociocultural and political situation of a social group involved in construction a technological artifact forms its norms and values which affect the meaning given to a technological artifact (Bijker et al. 1989, p. 46).

Regarding the social construction of a technological artifact, Bruno Latour also explains further how controversy occurs in the fact construction process. In fact construction, scientists, engineers and politicians give us information that leads us in the direction of the fact. This effort is partly directed to get support because a fact cannot be constructed without any support. Moreover, in understanding what the facts are, it is necessary to understand who the people involved in fact construction.

In the fact construction process, fact builders face some problems. They have to know how to convince other people, how to control other people's behavior, how to gather sufficient resources in one place in order to convince others, and how to have the claim spread out in time and space (Latour 1987). Latour further explains that people, especially the fact builders, need others to help them transform their claims into a matter of fact. The problem that occurs is how to find these people. He suggests that the fact builders need to state their claim in such a way that it fulfills these people's explicit interests. Even if these interests are explicit, the meanings of them are may be differently understood and interpreted (Latour 1987). He also gives a meaning of interest as mentioned below:

> The name of interests are what lie in between actors and their goals, thus creating a tension that will make actors select only what helps them reach these goals among many possibilities (Latour 1987, p. 108).

In constructing a fact in science and technology, the fact builders usually bring pictures, figures, numbers, and names into the text. This has both a strength and a weakness. The strength lies, like a reference, in giving the readers information about what a statement is tied to. The major weakness is that the readers know where to pull if they wish to unravel the statement (Latour 1987). Latour states that text must explain how and who should read

it, to whom it is talking, and anticipate the readers' response. A good text should allow the readers to know where the figures, pictures, numbers, names in the text come from.

As mentioned above, Latour also focuses his attention on the controversies that occur in fact construction. He sees two important aspects in explaining a controversy. The first aspect is why an open controversy closes, and the second aspect is a new controversy dealing with how the controversy is closed. In the heat of controversy, the scientists, engineers, and politicians may themselves explain why their opponents think otherwise (Latour 1987).

From the description and explanation of the social construction theory of science and technology above, it should be stressed that all aspects of science and technology are socially negotiated. Science and technology as facts are constructed in a collective process. One aspect is measurement. My assumption here is that there is an interpretative flexibility in measurement, and initially there is no agreement on measurements to be used in science and technology.

1.2. Measurement

Measurement has been defined in a variety of ways. Campbell (1952), as discussed by Cicourel, defines measurement as the assignment of numbers/ numerals to represent properties (Cicourel 1960). The definition proposed by S. S. Stevens (1951) in Anderson et al.'s discussion mentions that measurement is the assignment of numerals to objects or events according to rules (Anderson et al. 1983). He further states that numerals can be assigned

through various rules that direct one to various kinds of scales and measurement.

In discussing measurement, social scientists are concerned with the important distinction between measurement and theory. Anderson et al. argue that there is no measurement without theory and every measurement implies theory (Anderson et al. 1983). They emphasize that all good measurement has a theoretical foundation. From this standpoint, it is clear that measurement includes a theoretical domain and a domain represented by a particular selected numerical relational system (Anderson et al. 1983, p. 233).

Regarding theory as a necessary aspect in measurement, sociology has a problem with the lack of developed theory. Ideally, the measurement of social phenomena requires the development of social theory, but it sometimes cannot represent theories, experiments and observations (Feyerabend 1979). A problem in measurement is that sociologists face a difficult task in developing measurements with high precision and reliability.

Measurement in sociology presupposes an understanding of society from inside, or an understanding of the society's everyday life. The understanding is changed as changes occur in the society's everyday life. These changes are partly caused by the development of science and technology. One form of the change is the formation of modern society. The structure of modern society reflects the rationalization of everyday life through its bureaucratic institutions. This universal phenomena can be seen for most of the data that sociologists honor, as given, are largely of a product of bureaucratically organized activities (Cicourel 1960).

The document or data produced is not only interpreted by one actor at one time. It is possible for it to be reinterpreted by different actors at different times. In other words the data is continually subject to the possibility of

reinterpretation, second thoughts or additional information (Cicourel 1960). The problem that occurs here is that there is a big possibility that the interpretations are different from different actors and different times for the same data. It is partly caused by the unknown process of data production, unknown factors operating in data selection, and unknown decisions made before the data production.

In the sociology of science and technology, measurement is considered as a basic research process. Measurement is used to give a description and identification about how the technology will be carried out, is being carried out, or has been carried out (Pinch 1993). Therefore, it is important to understand / know the construction process of measurement in order to get a clear and comprehensive understanding about how a technology will perform in the future.

The issue of measurement in this paper will focus on social construction theory. I see that measurement is basically socially constructed. The use of a certain number to represent and to measure a certain concept is constructed by people who are engaged in developing an issue discussed. The numbers and concepts are also designed by them. People have their own ideas, perspectives and interpretations about the measurement of the issue discussed.

In constructing the measurement, people produce their own measurement and confront it with others. In confronting their measurement, they struggle to convince others that their measurement is the best among others. I see that in order to convince others, they try to give explanations about how they produce their measurement and how important their measurements are, about the reasons of producing their measurements, and who they are.

In sociology of science and technology, the construction of a measurement is one major important aspect. The measurement is also socially constructed by people who are engaged and interested in research on science and technology. One important process in the sociology of science and technology is doing experiments about a certain technological artifact. Experiment, as the way to verify, confirm, or refute scientific theories is treated as a process of argumentation and persuasion (Pinch 1993). Here, the human actors who represent certain agencies play an important role in the production of the agreement on a measurement in science and technology as a technological artifact. They confront their own perspectives with others to get an agreement about what measurement will be best used. This idea is parallel with Knorr-Cetina's observation that the process of scientific production involves a decision and negotiation process through which its results are obtained (Knorr-Cetina 1983).

Measurement as a technological artifact has some forms. One of the forms is data. Data is also socially constructed by various people. Therefore, it can be interpreted in a variety of ways. One process in science and technology is interpretation of data by various human agencies. There is a big possibility of production of similarity and difference in data interpretation. The similarities and differences are closely related to the interests and commitments of the actors. They contest their interests in interpreting the data that are based upon their perspectives and ideologies. It is apparent that social and political issues are not separated from science and technology. In science and technology, experimental processes and replications are always found (Pinch 1993). The results of the replications are usually different from the original ones. The major differences of replications of data depend upon differences in the scientists' background assumptions and interests.

From this point of view, the various interpretations and perceptions for such data become an important point to consider. Various interpretations and perceptions occur because there are various actors with various theoretical backgrounds, assumptions, interests, and perspectives involved in the process of interpretation and perception. Of significant interest to sociologists is how such bureaucratic personnel interpret and act on the data (Cicourel 1960). Another cause of the difference of interpretation of data is different types of actors who may have different structural and locational arrangements in society. I think they have different status and roles officially in the society and also different positions with respect to the center of power in society. Therefore their interpretations and perceptions are expected to reflect or express their social identities or characteristics, their status and roles, and their position in relation to the center of power. Data and its interpretation are not isolated from political reality. On this point, Rouse mentions that in order to fully understand the scientific practices (such as values and aims), one needs to evaluate their political significance (Rouse 1987).

In larger scale, the importance of understanding power relations is seen particularly in power relations between developing countries and developed countries. In this view, the developing countries are dependent on the developed countries in many aspects such as in science and technology.

The issue of measurement in science and technology is central to my discussion of rice post-harvest losses. In my study I will describe and analyze rice post-harvest losses from the perspective of social construction theory. To describe and analyze it I will use the data of the rice post-harvest losses produced by various agencies. They have differing data that are created by differences in measurements and methodologies they use in producing

their data. They also have differing motives and interests in producing their data.

CHAPTER 2
GENERAL DESCRIPTION OF RICE POST-HARVEST LOSSES

Rice post-harvest losses have become an issue discussed in various fields and perspectives by many countries and agencies at both the national and international levels. The important need to increase food production to meet the requirements of a rapidly growing world population through decreasing food losses is widely known. The increased awareness of this issue has emerged since the world food crisis in the 1970's. In 1975, this awareness was reflected in the resolution of the 7th Special Session of the United Nations General Assembly which set a target to reduce post-harvest loss by 50 percent by the year 1985.

In this paper, rice is chosen as the crop to be discussed. One reason for choosing rice is that it is one of the most important food crops in the world, and the major item in the diet of half the world's population. The availability of an adequate supply of rice means more than providing for people's food needs; rice has economic importance in national and international trade with significant political and social implications (Esmay et al. 1979). Another reason is that there is no staple food crop which more accurately reflects the problems which these national and international bodies have addressed than does rice (USDA 1980). FAO (Food and Agriculture Organization) also

recorded that rice post-harvest losses are among the highest of the major crops grown in developing countries, and documented the reduction of rice post-harvest losses as one of its programs (FAO 1978). The description above implies that the rice post-harvest losses issue is closely related to insufficient food production and inequality in food distribution among people, especially in the developing countries.

2.1. Some Studies of Rice Post-harvest Losses

Many studies of rice post-harvest losses have been conducted, especially in developing countries. A study in West Africa was conducted by the West Africa Rice Development Association (WARDA) at the Office du Niger in Mali in 1978-1980. The aim of this study was to assess the level of technologies used and determine where intervention is most needed in order to reduce post-harvest losses in West Africa (Kamuanga 1981). The result of this study shows that the percentage of rice post harvest losses is higher in the official marketing channel (23.3%) compared to the farmers private marketing channel (21.4%).

In Indonesia, several studies of rice post-harvest losses have been carried out by different institutions using different methodologies. It seems that the results are not comparable to each other. Results of the FAO-BULOG (the National Logistics Body) study in 1981 in East Java province showed that quantitative losses in the rainy and dry seasons account for 12% and 11.3%, respectively. The Indonesian Ministry of Agriculture and JICA (Japan International Cooperation Agency) (1981/1982) conducted a study on rice post-harvest losses in four provinces. The results revealed that the quantitative losses ranged from 12% to 21% and the qualitative losses

ranged from 2% to 23%. In 1987 the Indonesian Central Bureau of Statistics carried out a study in 15 provinces. It gave the amount of quantitative rice losses at each step of post-harvest activities, and the total magnitude of quantitative rice post-harvest losses was 22.01%. (Halim et al. 1991). This study indicated that a high loss exists in the harvesting, threshing, and milling processes.

In Malaysia, a rice post-harvest loss study was conducted in the Krian / Sungei Manik areas in 1982. The main goal of the study was to determine the magnitude of losses at each step of the post-harvest system so that effective control measures could be imposed to reduce the losses (Rohani et al. 1985). In the cutting operation, losses were estimated at about 5.1%. The estimation of losses in the threshing operation was from 9.1% to 18.5% with an average of 13.7%. In the milling operation, a 6.7% and 3.1% reduction in head rice yield were observed from the small and large mills, respectively (Rohani et al. 1985).

In Colombia, rice post-harvest losses in the field, during processing of clean, dry paddy to white rice and during marketing were analyzed in detail. Field losses ranged from 2.5% to 8.2%, processing losses from 7% to 34%, marketing losses were 0.11% to 0.28% at wholesale, 0.3% to 0.7% at retail level (Castaneda 1982).

A national survey of rice post-harvest losses, conducted in the Dominican Republic in March-Nov. 1979, is described in Tropical Stored Products Information (Boxall 1981). In this report, quality losses during drying and milling were among the major factors investigated. The average reduction in whole grain content on mechanical or sun drying was 8.06%, and on milling was 2.33%. Losses on harvesting (mean 18.08% loss) and storage

(mean of 0.35% loss) were also surveyed, and related to economic considerations.

In the Philippines, estimated rice post-harvest loss was 10% to 35%. Causes of post-harvest losses include inefficient harvesting and drying methods, poor processing techniques, inadequate storage and distribution, and poor preparation or use of foods in the home (Spurgeon 1977). The unsuitability of some of the new technology to reduce losses was also discussed.

A review of the Science and Education Administration, United States Department of Agriculture determined that the majority of rice losses occur when harvested rough rice is transformed into edible white rice (Saunders 1980). This review argued that future international assistance efforts to developing countries might be best focused to maximize loss reductions and the conservation of rice already produced.

2.2. Measurement of Rice Post-harvest Losses

Many attempts have been made to make a reasonable and reliable measurement of rice post-harvest losses, but it is very difficult to estimate rice post-harvest losses with precision. Even though there is much serious work in measuring rice post-harvest losses, there is still uncertainty as to the magnitude of rice post-harvest losses due to the variation in situations being assessed and of differences in methodology and definition. In general, the measurement of rice loss denotes disappearance of rice and should be directly measurable in economic, quantitative, qualitative, or nutritional terms (NAS 1978). NAS (National Academy of Sciences) describes those four terms as follows:

> Economic loss is the reduction in monetary value of food as a result of physical loss. Quantitative loss involves reduction in weight and, therefore, can be readily defined and valued. Qualitative loss, although difficult to assess because it is frequently based on subjective judgments, can often be described by comparison with local accepted quality standards. Nutritional and germinative loss, which may be a combination of loss of quantity and quality, are also difficult to measure (NAS 1978, p. 27).

The difficulty to estimate rice losses is also caused partly by the low accuracy of loss-survey techniques, and the limitations of inferring a specific and well characterized loss situation. Another reason is that standard methodologies for measuring and estimating loss are lacking for most kinds of food (NAS 1978). Although estimation techniques and standard methodology exist, the researcher must choose the estimation technique and methodology appropriate for a given situation and use it. Another problem that occurs in loss measurement is how much accuracy is necessary to make estimates that are generally used (NAS 1978). This depends upon the aims or objectives of the estimation.

In measuring rice losses, it is very important to consider social and cultural aspects of a given situation. There are social and cultural differences in post-harvest activities among cultures such as steps conducted in post-harvest practices. Even the perception of what constitutes a loss often varies greatly among cultures (NAS 1978). Further, techniques of measurement and information produced should be culturally and socially agreed upon by the particular society.

Another aspect considered is differences in defining post-harvest and loss among cultures and agencies that conduct the research. One definition of post-harvest is given by NAS. It states that:

> The post-harvest period of time begins at separation of the food item from the medium of immediate growth or production (Greeley 1987, p. 58).

One definition of loss is a reduction in weight in the amount of food available for consumption (NAS 1978). Again, it is important to remember and understand that cultural differences create location-specific and time-specific definitions of loss. Loss estimation in a given situation should be formed and constructed in order to be culturally appropriate and meaningful. In other words, measurement in rice post-harvest losses is socially constructed. Only then can analysis of the results be implemented in the form of decisions regarding loss reduction.

From the description of rice post-harvest losses in some countries above, one can see that all countries focus on the discussion of loss estimations. The various loss estimations are partly caused by culturally definitions of rice post-harvest losses given by each country, and various methodologies and measurements used. In addition to loss estimation discussions, each country has also its specific discussion that is considered socially and culturally important. From this point, it is apparent that loss estimations and specific discussions are constructed by each country that are based upon its social and cultural situations. They are constructed in order to be culturally meaningful for each country.

Differing from description of some countries above, the Science and Education Administration, United States Department of Agriculture focuses on the importance of technical international assistance efforts for the developing countries. International assistance efforts can cause the dependency of the recipient countries (in this case developing countries) on the donor countries. This situation happens since the recipient countries get

all the elements of technology and they use a few local technologies and skills. Assistance does not give an opportunity to the recipient countries to choose the technology. The dependency has a lot of consequences, such as the weakening of local science and technology capabilities, and the crippling of local initiative and local adaptive possibilities (Althuis et al. 1982). Another consequence that is closely related to the power relation is the loss of local control over decisions concerning technology of the recipient countries.

CHAPTER 3
DESCRIPTION AND ANALYSIS
OF RICE POST-HARVEST LOSSES IN BANGLADESH

In Bangladesh, the agriculture sector is the most important sector of the economy, providing almost two-thirds of GDP (Gross Domestic Product) (Asean Economic Handbook 1987). Specifically, agriculture is dominated by the production of rice. Rice is the biggest product among the principal crops produced (Statistical Yearbook for Asian and the Pacific 1992; Asean Economic Handbook 1987). Based on a report of Bangladesh Rice Research Institute in 1984, rice as the staple food in Bangladesh is cultivated on 89% of the 11.5 million ha. of cultivable land (Haque et al. 1991).

In discussing and analyzing rice post-harvest losses in Bangladesh, I will use data presented by Martin Greeley in his book entitled Postharvest Losses, Technology, and Employment, and a research report written by A.K.M. Anwarul Haque, M. A. Quasem, and Jose R. Arboleda entitled "Rice Post-harvest Practices and Loss Estimated in Bangladesh: Threshing through Sundrying" that was published in Agricultural Mechanization in Asia, Africa, and Latin America, vol.22 no.1 1991.

3.1. Description of Rice Post-harvest Losses in Bangladesh

In this section, I will present some tables and a description of each research project conducted on rice post-harvest losses.

Table 1
Loss Operations / Causes Covered by Estimates

Researcher	Before Harvest	Cutting	Transport	Stacking	Threshing	Winnowing	Soaking	Parboiling	Drying	Storage	Husking & Milling
Bala									o		
Samajpati et al.		o	o	o	o	o	o	o	o	o	o
Hurley et al.	o	o	o	o	o	o	o	o	o		
Sarker									o	o	
Karim & Rashid									o		
Molla									o		
Ahmed et al.		o	o	o	o			o	o		
Haque et al.					o		o		o		

Source: developed from Greeley (1987) and Haque et al. (1991).

The rice post-harvest operations mentioned above are the practices that are traditionally followed in Bangladesh. Table 1 shows post-harvest operations that are estimated to be the causes of losses by researchers.

From this table, Bala, Karim & Rashid, and Molla estimate that the drying operation is the principal cause of rice post-harvest losses in Bangladesh. Bala states explicitly that loss is caused by the lack of drying facilities. Samajpati et al. focus on storage and processing operations in conducting their survey on rice post-harvest losses. They do not mention clearly what the processing is. In my understanding, the processing operation includes operations from cutting until milling. Hurley et al. covers operations

from before harvest until parboiling in estimating rice losses. In the rice post-harvest technical project, Sarker identifies drying and storage operations as the causes of rice post-harvest losses. Differing from Sarker, Ahmed et al. in their research point out cutting, transportation, stacking, threshing, parboiling, and drying operations in determining the losses in rice post-harvest processes. Haque et al. observe three post-harvest operations, threshing, cleaning and drying, to estimate the size and causes of rice losses.

From the description above it can be seen that each researcher conducted different operations in their research in determining rice post-harvest losses.

Table 2
Methods of conducting research

Researcher	Methods of Conducting Research
Bala	Not given
Samajpati et al.	Not given
Hurley et al.	Farm-level research
Sarker	Not-given
Karim & Rashid	Farm-level research with questionnaire
Molla	Farm-level research with questionnaire
Ahmed et al.	Farm-level research with questionnaire
Haque et al.	Village-level research

Source: developed from Greeley (1987) and Haque et al. (1991).

Bala, Samajpati et al., and Sarker provide no information about how they conduct their research (table 2). Further Samajpati et al. state that

because of the absence of farm-level experience, there is little that can be usefully said about their research results (Greeley 1987).

Hurley et al. in their farm-level research show that farmers have no problem with rice loss. However, they argue that the farmers themselves are the problem since they suffer from a lack of appreciation of the losses currently being incurred (Greeley 1987).

Karim & Rashid, Molla, and Ahmed et al. conducted farm-level research by using questionnaires. Karim & Rashid's research was in a village where they were organizing an extension project to promote improved village technology and where they had installed a rice drier. They argued that the rice loss problem was important to solve and recommended the using of reducing loss techniques. From 30 questionnaires, their research also shows that farmers do not have any opinion about the losses. Molla conducted a study at a government seed farm. In his study, two small samples were district-specific and a large sample was a nationwide survey with between 5 and 15 replies from each district. Of the rest, only one estimate appears to involve some loss measurement. The result of the study was that the estimation was a guess because the background to the estimates was not known. From the questionnaire used in the research entitled "Rice Drying Problem During Rainy Season in Bangladesh", Ahmed et al. concluded that technical change is not supported by the evidence.

There are three common features in research conducted by Sarker, Karim & Rashid, Molla, and Ahmed et al. First, they were all planned explicitly with the purpose of reducing losses. They were deliberately cautious in the absence of reliable farm-level measurement of rice loss. Second, they all addressed in detail the economic and institutional considerations affecting farmer adoption of their techniques. Third, they

concluded that farmers were not very willing to use their techniques (Greeley 1987).

The last study, Haque et al., conducted village-level research in 35 villages from five areas. The selection was based upon accessibility, cooperation of the farmers and representativeness of the village in the cropping pattern and post-harvest practices (Haque et al.1991).

Table 3
Seasons in which research was conducted

Researcher	Boro (April - June)	Aus (July - Aug.)	Aman (Nov. - Dec.)	Note
Bala		o		
Samajpati et al.				Not given
Hurley et al.				Not given
Sarker	o	o		
Karim & Rashid	o	o		
Molla	o	o		
Ahmed et al.	o	o		
Haque et al.	o	o	o	

Source: developed from Greeley (1987) and Haque et al. (1991).

Rice in Bangladesh is grown and harvested during the boro (early summer), aus (summer) and aman (winter) seasons. The boro and aus seasons are defined as the wet seasons, there is a lot of rain during these seasons. In the aman season, the weather is cool and dry, no rain, and the paddy and straw are already dried (Haque et al. 1991). There are differences in the kind of lands used for planting and harvesting crops in these seasons. Aman and early boro crops are harvested in dry lands while late boro and aus

crops are harvested in wet and flooded fields (Haque et al. 1991, p. 53). The boro crop was traditionally lowland grown using traditional irrigation equipment or where water remains after the annual floods have diminished. The aus crop is grown on highlands under rainfed conditions; it is also grown on medium highland where flooding provides the water and these cases it is sown mixed with an aman crop (Greeley 1987).

From table 3, one can see that Bala conducted research in the aus season. Samajpati et al. and Hurley et al. do not give information about when they conducted their research. Sarker, Karim & Rashid, Molla, and Ahmed et al. conducted their research in the boro and aus seasons. Haque et al. did their study in boro, aus and aman seasons. The boro and aus seasons were chosen as the time for conducting the research by most of the researchers. The reason is that these two seasons were treated together in one harvesting season that extends from April through the monsoon to September (Greeley 1987).

Table 4
Loss Estimation

Researcher	Loss Estimation (in percent)	Notes
Bala	30 ----- 50	
Samajpati et al.	10 ----- 20	
Hurley et al.	5 ----- 44	
Sarker	30 10 ----- 25	Storage operation Drying operation
Karim & Rashid	51 ---- 100	
Molla	22.70	
Ahmed et al.	0.82	
Haque et al.	3.50 3.10 4.01	Aman season Boro season Aus season

Source: developed from Greeley (1987) and Haque et al. (1991).

As noted in table 4 above, Bala estimates that rice losses in post-harvest operation are 30% to 50%. The second research group, Samajpati et al., in their research proposal said that losses were 10%, and the research report said they were 10% to 20%. In loss estimation, Hurley et al. said that in relation to the estimates they believe that "very few of the figures have actually been measured, and where they have been measured they are confined to a few years, a few places and a few varieties" (Greeley 1987). They estimate the rice losses between 5% and 44%, but they do not state where these measurements come from or what they were (Greeley 1987). Differing from Hurley et al., Sarker divides loss estimation into two operations. He estimated the rice loss in the storage operation was 30%, and 10% to 25% loss was caused by the lack of drying facilities. Karim & Rashid mentioned that 70% of farmers lost the quality of their boro grain to the extent of 51% to 100% (Greeley 1987). Molla estimated a 22.70% loss due to the lack of drying facilities. Ahmed et al. in their research mentioned that rice losses from post-harvest operations were very low (below 1%). Differing from other researchers, Haque et al. consider operations and seasons in determining loss estimation. They said that total losses in three operations (threshing, cleaning and drying) were 3.50%, 3.10% and 4.01% for the aman, boro and aus seasons respectively.

Table 5
Characteristics of Researchers

Researcher	Characteristics
Bala	engineer ; work on drying project ; lobbyist
Samajpati et al.	engineer ; work on storage project ; lobbyist
Hurley et al.	engineer ; work on drying project ; lobbyist
Sarker	engineer ; work on drying project ; lobbyist
Karim & Rashid	not given ; work on drying project
Molla	not given ; work on drying project
Ahmed et al.	not given
Haque et al.	scientific officer on Rice Technical Division of B.R.R.I (Bangladesh Rice Research Institute)

Source: developed from Greeley (1987) and Haque et al. (1991).

Bala, Samajpati et al., Hurley et al., and Sarker are engineers and lobbyists. Lobbyists are a group of people who act for a special interest, who try to influence others to take a desired action, and to urge others by lobbying. As lobbyists, they persuaded others that the rice loss problem was important and suggested that it is a crucial problem. As engineers, Bala, Samajpati et al. and Sarker attempted to develop loss reducing post-harvest techniques. They convinced themselves purely based on a research station assessment of new techniques.

Bala worked on a drying project. He argued that steps must be taken in order to solve the drying problem so that there is no rice produced that is wasted. He recommended further research since the actual performance of the drier he built differed from that predicted by theory. Samajpati et al. worked on a storage project and they recommended use of their own improved techniques. Hurley et al. also worked on a drying project. They

stated that the project was to develop paddy dryers for village use. They would assist small farmers to save in total a large quantity of paddy each year (Greeley 1987). Their original intent was to evaluate specific loss prevention options that are related to the introduction of drying facilities. They also suggested the importance of understanding the loss levels in traditional systems. They see that traditional crop drying is predominantly women's work and extension of drying facilities to men possibly constrains their adoption because it is women who have more expertise concerning crop drying requirements and would better appreciate the benefit from efficient drying facilities (Greeley 1987).

Sarker, Karim & Rashid, Molla, and Ahmed et al. were concerned with the prevention of rice losses. Sarker mentions that proper grain drying research would yield results which could minimize the large loss of food and seed grain every year in Bangladesh (Greeley 1987). Ahmed et al. focused their research on the need for technical change in rice processing and on the employment implications of the shift from the dheki (traditional rice husking methods) to the custom mill. They argued that if levels of rice loss were properly measured, they could be shown to be insignificant in determining the rate and direction of technical change. This finding is developed empirically in an explanation of why farm-level rice drying projects have failed and why rice milling is being affected by technical change with serious consequences for the wage labor opportunities of the poorest women. They emphasized the effect upon the poorest women of the replacement of dheki technology by custom milling and the need for intervention to develop alternative sources of income (Greeley 1987).

In conducting research on rice post-harvest losses, Haque et al. estimated the size and causes of losses. They also gave a description of the

post-harvest loss practices and a detailed measurement of losses in three operation (threshing, cleaning, and drying). They suggest some methods to reduce losses, and also recommended that to increase rice yield by reducing post-harvest losses, the Bangladesh government should provide the necessary inputs and training to the farmers (Haque et al. 1991). These suggestions would not only increase rice yield but also would reduce post-harvest losses.

3.2. The Social Construction of Rice Post-harvest Losses

In discussing rice post-harvest losses, there is some confusion. The confusion is not caused by where the research is conducted, nor is it a matter of who is right and who is wrong. The first confusion is caused by the lack or agreement on definition and measurement used in studying rice post-harvest losses. The second one is that there are different interests of researchers that influence them in producing their data on rice post-harvest losses.

3.2.1. The Lack of Agreement in Measurement

In table 1, it can be seen that there are differences in determining the causes of rice losses among the researchers. It can be said also that the researchers create various definitions of rice post-harvest losses. From this table, there is a similar feature from all researchers. They define the drying operation as one cause/or the only cause of losses. They imply that rice loss is defined as drying operation loss.

In table 2, the researchers show their methods of conducting research. It can be seen that they have different ways of doing their research. From this table, some researchers give information about their research methods and

some of them do not mention their methods. From the researchers who give an explanation about their methods, it can be seen that Hurley et al. and Haque et al. do not mention in detail how they gather their data. Karim & Rashid, Molla, and Ahmed et al. mention more detail about their methods and ways of gathering their data. On the other hand, Bala, Samajpati et al. and Sarker do not give any information about their methods in conducting the research.

Table 3, shows that the researchers conducted research in different seasons of the rice post-harvest operation. The season of conducting research is important to consider since different times of post-harvest operations might influence losses. The most significant difference lies in the different climatic conditions such as rainfall and temperature. From this table, Samajpati et al. and Hurley et al. do not give information about when they conducted their research, while the other researchers mention the seasons when they conducted their research.

There are similar features in tables 2 and 3. Some researchers do not give any information about the methods and the time (seasons) they conducted research. There are some possible reasons for not giving information. The first one is that they might assume that the reader already knows about the research methods and time they conducted research without any explanation about them. They expect that from the research reports, the readers know to whom they are directed. They might also assume that their research reports clearly explain who their expected readers are. As Latour states, the text has to explain how and by whom it should be read (Latour 1987). The second reason is the researchers do not want anyone to know about their methods and time of conducting research. This reason can be understood in Latour's perspective that one weakness of showing references

of a text is that the readers know where to "pull" it if they wish to unravel the meaning of a text (Latour 1987). In this case, they might avoid the possibility of unraveling their research by not giving any information about their methods and time of doing the research. Another reason is that they assume that other researchers use the same methods and do research at the same time as they do. Therefore they do not have to give information about how and when they conducting their research.

Another similar feature of tables 2 and 3 is that some researchers give information about their various methods and time of conducting research. They implicitly open a controversy about the various ways and times of doing research on rice post-harvest losses by providing various research methods and times. These various research methods and times need to be presented and debated by various researchers. Furthermore, the controversy is directed to get an accurate and acceptable method and time of doing research on rice post-harvest losses.

In table 4, the researchers present various estimations of rice losses. Some of the loss estimations are not comparable to other ones because the estimations are highly varied. I see that, from this table, the amount of rice losses ranged from 0.82% to 100%. The researchers also have different ways of presenting their estimate of losses. Sarker gives a detailed explanation of loss estimation for each post-harvest operation. Haque et al. show their loss estimation in different seasons of conducting research. In contrast, the other researchers do not give any explanation of their loss estimation data.

In discussing various loss estimations, I relate the loss estimation (table 4) and the definition of rice post-harvest losses given by the researchers (table1). Bala, Karim & Rashid, and Molla produce a loss estimation for one post-harvest operation (they define rice post-harvest loss as rice loss in the

drying operation). Sarker gives the loss estimations for each operation: storage and drying operations. Samajpati et al., Hurley et al., and Ahmed et al. make a loss estimation based on their definition of rice losses in 10, 8, and 6 post-harvest operations respectively. Differing from the researchers mentioned before, Haque et al. make a loss estimation that is based upon seasons of conducting research. From the explanation above, I think one cannot compare the loss estimations produced by Bala, Karim & Rashid, Molla, Sarker, and by Samajpati et al., Hurley et al., and Ahmed et al. The reason is that the first estimation is estimation for definitions of loss for one operation, but the later one is estimation for definitions of loss for at least 6 operations. For example, Karim & Rashid make a loss estimation from 51% to 100% for their definition of loss of one operation, while Ahmed et al. mention a 0.82% loss estimation for 6 operations. In contrast, Haque et al. make a more complicated loss estimation. Their estimations are not only based upon post-harvest operations but also on seasons of conducting research. Each estimation in each season shown in their data includes three post-harvest operations. It is clear that the various estimations are insufficient to decide which estimation can accurately measure rice losses in post-harvest operations. The reasons are the loss estimations cannot be compared to each other, and the researchers use different ways of producing their loss estimation data.

From the explanation above in table 1, I see the researchers point to different causes of rice losses or to different definitions of rice post-harvest losses. In table 2 they conduct different methods of research on rice post-harvest losses, and in table 3 they do research at different times or seasons. Table 4 shows the different rice loss estimations that are produced by different researchers. The various loss estimations are produced partly by

different rice post-harvest operations chosen in their research or different definitions given, partly by different methods, and partly by different times of conducting research.

It is apparent that the researchers construct various views of the definition of rice post-harvest losses by designing their own methods and measurement. They interpret rice loss differently based upon different post-harvest operations, methods and times of conducting research. Furthermore, they also construct various loss estimations that are based upon various operations or definitions, methods, and times of conducting research.

One may argue, following Bijker and Pinch, that the researchers are on the first stage of EPOR and SCOT. The researchers have great interpretative flexibility in defining and interpreting rice post-harvest losses as a technological and scientific artifact. The flexibility of defining and interpreting rice post-harvest losses is shown in various definitions of rice loss given, methods and times of conducting research, and rice loss estimation. They also design rice post-harvest losses as a technological artifact by producing their scientific explanations: definitions of rice losses, methods and times of conducting research, and loss estimation. In EPOR the interpretative flexibility of scientific findings is shown. In this case, research, data produced, and explanations of rice post-harvest losses as scientific findings that are flexibly interpreted by various researchers are presented. In SCOT, technological artifacts are culturally constructed and interpreted. Rice post-harvest losses as a technological artifact is constructed and interpreted by different researchers. Their constructions and interpretations are influenced by their background as is partly shown by their different characteristics which lead them to have different constructions,

interpretations, and designs of rice post-harvest loss as a technological artifact.

Until now, the researchers, as Bijker and Pinch state, have not achieved a consensus in their debate about the definition and estimation of rice post-harvest losses. In analyzing the closure stage, the researchers debate to each other through seminars and publication of their research reports. The possible situations occur in the debate / controversy processes are given followed. First, are they response to each other, and are they response feedbacks from other researchers and public? Here, there is no explanation about the communication process in the controversy. Second, some researchers do not know exactly the farmer conditions and field conditions in conducting research in rice post-harvest losses. Some researchers do not consider farmers as a social group involved most in the rice post-harvest practices. Here, this condition cause other researchers who have more information about fied and farmer conditions assume that their measurements are more reliable than others since they give field evidence for their measurements. Third, one cannot see the role of decision maker agents that could be a mediator in this controversy. They are expected to give a comprehensive consideration in producing their decisions, instead of a partial consideration, such as technical, social considerations that are addressed by some researchers. Fourth, the farmers as a target group in research of rice post-harvest losses do not fully realize the problem occurs in rice post-harvest losses. Therefore, they do not have an idea whether the problem is solved or not. All situations show that the researchers see that the measurement problem has not been solved. The problem of communication of controversy process, the insufficient scientific proof of rice post-harvest losses, the absence of mediator agents, and a lack of similar idea and meaning of rice

post-harvest losses given by social groups involved in the controversy cause the absence of closure of the controversy. In other words, there are no mechanisms for the closure of their debate. Here the researchers have not gotten into the second stage of EPOR and SCOT: closure and stabilization.

From Latour's perspective, the researchers construct rice post-harvest losses as facts. The researchers are engaged in a controversy with competing ideas about the definition and estimation of rice post-harvest losses that will be used in Bangladesh. Rice post-harvest losses are interpreted differently by each of the researchers. The researchers give various definitions of rice post-harvest losses; they conduct research with various methods and at different times, and they produce various loss estimations. The differences can be caused by researchers' different theoretical backgrounds and assumptions about rice losses. From this point, it is seen that the researchers that are from different social groups, following Bijker and Pinch, have different constructions, interpretations, and designs of rice post-harvest loss. In the EPOR approach, the controversy that occurred among the researchers is significant in the construction of rice post-harvest loss as a scientific finding. In the SCOT approach, some conflicts emerge in the process of development of the rice post-harvest loss problem, such as conflict in technical requirements of methodologies used and in production of loss estimations.

In this fact construction process, the researchers try to convince other people that rice post-harvest loss is important. They convince people by publishing their research reports, by introducing their equipment to the farmers, by reporting a high degree of rice losses and so on. They also try to fulfill the peoples' needs. For example, they try to improve the farmers' rice production, to make the rice post-harvest operations easier by implementing improved technology. They try to fulfill the researchers' needs by producing

the scientific findings of rice post-harvest losses through research. In order to accomplish the engineers' need, they develop and produce the new loss reducing techniques.

From the explanation above I see that there is a lack of agreement about definitions and measurement of rice post-harvest losses. Therefore, rice post-harvest losses as scientific products still need to be negotiated among the researchers. The most important thing to be negotiated is measurement.

3.2.2. The Different Interests of Researchers

In table 5, it can be seen that the researchers vary on several characteristics. The characteristics of researchers are important to understand and analyze. In order to get a complete understanding of the post-harvest loss issue one needs to understand how it is produced and what are the backgrounds of researchers who are engaged in this issue. Related to this idea, Latour said that to understand a fact is to understand who the people involved in fact building are (Latour 1987). Here, rice post-harvest loss is a fact that needs to be understood by understanding the characteristics of the researchers that conducted research in rice post-harvest losses. Rice post-harvest losses can also be seen as a social phenomenon that needs to be understood by examining the historical and ideological perspectives of the researchers involved.

In discussing the researchers' different backgrounds, I start by relating Table 1 and Table 5. In Table 1 one can see that the researchers define rice losses differently among each other, while Table 5 describes various characteristics of the researchers. Bala, Karim & Rashid, and Molla define

rice loss as rice loss in the drying operation. The definition given might be influenced by their interest in the drying project. Samajpati et al. say that processing and storage operations are causes of rice losses. In this case, I think the operations include operations from cutting until milling. However, they only say processing and storage as if the storage operation was a separate operation from the processing operation. They intend to focus on the storage operations as the main cause. Their intention might be related to their interest as engineers who are engaged in a storage project. Hurley et al. and Sarker state some rice post-harvest operations as causes of rice losses and one of the operations is the drying operation. It is apparent that their backgrounds as engineers in a drying project influence them in citing the drying operation as one cause of rice losses. The researchers' interests and backgrounds influence them in defining rice losses and explaining the causes of rice post-harvest losses in their research.

In explaining the importance of understanding different backgrounds and interests of the researchers I focus my explanation on analysis of Tables 2, 4, and 5. From these tables one can see the researchers' different perspectives in doing research and producing the explanation of rice post-harvest losses.

Bala, Samajpati et al., Sarker, and Karim & Rashid all have similar backgrounds as lobbyists and engineers. By doing research in drying and storage projects, as engineers, they intend to improve loss reducing techniques (especially drying and storage techniques) and recommend the using of these techniques. The improvement of these techniques is assumed as an appropriate way of solving the rice loss problem. This is based on their argument that rice post-harvest losses are a crucial problem that must be solved. From their research they found farmers to be indifferent to rice losses.

Furthermore, Saker and Karim & Rashid's research show that they lack reliable farm-level measurement and farmers did not want to use their techniques. Even though they already know that farmers do not see the importance of the rice loss problem and of using their techniques, as lobbyists they persuade farmers to use their techniques and others to "follow" their argument. In order to convince others of the validity of their argument, they show a high degree of rice losses in their research. It is apparent that they can be grouped as interventionists.

Another researcher that can be grouped as an interventionist is Molla. He does not give any information about who he is. He works on a drying project at a government seed farm and is concerned with the prevention of rice losses. Similar to other interventionists mentioned above, he shows a relatively high degree of rice losses. The high degree of loss estimations have been taken as evidence that rice post-harvest loss prevention programs must be conducted. It implies the importance of the use of loss reducing techniques and also of funding for the programs. In his research Molla realizes that there is an absence of farm-level measurement of rice losses and the background of the estimation produced is not known. Even though he does not have an accurate estimation and explanation, he points to the importance of rice loss as a problem and of rice loss prevention. I also see his perspective as an interventionist one.

The next researchers are Hurley et al. They are lobbyists and also engineers who work on a drying project. As engineers they are interested in evaluating certain loss prevention technique options that are introduced in the society studied. From their research, they wish to get a better understanding of the loss level of traditional practices. They also show the importance of understanding women farmers as a group of people who predominantly work

on drying operations and have a better evaluation of using drying facilities. As lobbyists and engineers, Hurley et al. have a different perspective from the interventionist researchers. They persuade others of the importance of the rice post-harvest loss issue in Bangladesh, of improvement in the use of drying techniques to reduce losses, and of social considerations in their perspective. Their perspective considers not only the technical but also the social.

The following researchers I will discuss are Ahmed et al. In table 5, there is no information about who they are. They focus their research on the need for technical change and its consequences for employment (especially change from the dheki to the custom mill). In their research they argue that there is inadequate proof of the value of technical change, and even some evidence that technical changes cause some serious social consequences with respect to income of the poorest women. Their argument is strengthened by the data produced that show a low degree of rice loss. From their research they suggest the need of understanding the economic and institutional considerations in analyzing adoption processes of the new techniques. From the explanation above, I see that their interest is the social aspects of rice post-harvest losses. They orient their interests, methods, and arguments to social conditions as the main point of the rice post-harvest loss issue. It is apparent that their perspective can be called socially-oriented.

Haque et al., as scientific officers also have a specific characteristic. They focus their research on rice post-harvest loss operations and estimation of the size and causes of the rice losses. They give detailed explanations about rice post-harvest operations, the methods used in their research, the method used in measuring rice losses in every operation, effects of various methods used in every operation and season on rice losses, and estimation of rice losses. They also separate large farmers' and small farmers' practices in

rice post-harvest processes. Based on their research they give some suggestions to the Bangladesh government about some efforts to increase rice production and to eliminate rice losses. Haque et al. try systematically to explore all possible causes of rice loss, and to look for various ways to get a good estimation of rice losses by considering various operations and times. They discuss and analyze social aspects of rice post-harvest losses by giving scientific explanation and proof that are necessarily required. It is apparent that their explanation, arguments and interests show their perspective as scientific.

As I mentioned in the beginning description of rice post-harvest losses, this issue was defined as a problem by international agencies (i.e., United Nations General Assembly and Food and Agriculture Organization, and also by a developed country (in this case: United States of America). It is seen that, at first, the rice post-harvest loss was constructed by western thought. They constructed the importance of the rice post-harvest loss problem partly based upon the importance of reducing loss and of increasing rice production, especially in developing countries. They also see the importance of supporting for funding, research, and development in rice post-harvest losses in the developing countries.

From the explanation above, I think that the researchers and the western people developed rice post-harvest loss findings as a scientific practice. The way for the construction and control over the phenomenon is seen as part of a network of power relations. The relations among the researchers, their scientific practices, their country, other countries, and international agencies illustrate the political character of scientific practices. Scientific practices are not separated from politics.

Different groups have different interests and ideologies in constructing rice post-harvest losses as a problem. They have different commitments to people they work for since they represent their agencies' interests and ideologies. All efforts in determining the definitions and estimations of rice losses are directed to reach their own goals.

CHAPTER 4
CONCLUSION

The researchers construct the idea of rice post-harvest losses as a problem that needs to be discussed. In the fact construction process, scientists and engineers give information that leads them in the direction of the fact. In this case, the researchers constructed rice post-harvest loss as a fact by giving information such as statistical tables and scientific explanations. The main problem with respect to rice post-harvest losses is measurement. They construct various measurements by constructing definitions of rice post-harvest losses, methods used in their research, times of conducting research, and rice loss estimation. Their efforts in constructing measurements are directed to achieve their goals by implementing their interests.

In constructing the measurements, they are in the interpretative flexibility stage in the EPOR and SCOT perspectives. In this stage, the researchers consider their sociopolitical environment. It implies that each definition or meaning of rice post-harvest losses given is influenced by their values and interests. The researchers construct their own measurements instead of developing an agreement among themselves. They have not reached a consensus of the measurement, or in other words, they have not had a closure of the measurement.

Regarding the researchers' interests, the scientific findings are basically directed to satisfy some important needs and wishes of groups. The scientific findings, and needs and wishes are socially and politically defined.

In the social construction theory of science and technology, the development of technological controversy is considered to be one important element. Here the social groups are faced by the fact that there is not just one possible way of designing a technological artifact. The importance of studying the social construction theory is basically to understand every social phenomenon in the social context. The assumption of social construction theory is that all social phenomenon are socially constructed. Ones cannot fully understand a social phenomenon if they do not understand its social context.

Some suggestions with respect to rice post-harvest losses are given below. It is proposed that loss measurement procedures be standardized in order to get a comparable measurement of rice post-harvest losses, from observations that are conducted in different locations and times. The measurement must be accurately measurable and defined.

Decision makers should consider the social, cultural, economic and technical considerations that are addressed by the people engaged in rice post-harvest loss research. In making the decisions, they should also consider various agents that have interests in the rice post-harvest loss issue. They are government agents, private agents (for profit and non-profit agents), and the public. Government agents, for example, they should cooperate with the legislative branch. With respect to private agents, the sphere of business influences the rice post-harvest loss partly in choosing directions for the research and development programs, and supporting scientific research and programs in universities. Non-profit agents play an important role in scientific

and technological activities in giving financial and expert support for research. Public opinion contributes information for the executive and legislative sphere about public interests and needs.

Another suggestion is further research questions. Are there any differences in rice post-harvest loss explanations and findings in places with the similar social and cultural backgrounds? Regarding the differences of loss estimation produced, how do the countries handle and solve the rice loss problems? Are there any specific ways to solve them? What are the social impacts of implementation of the transferred new loss reducing equipment?

BIBLIOGRAPHY

BIBLIOGRAPHY

Anderson, Andy B; Basilevsky, Alexander; and Hum, Derek P.J. "Measurement: Theory and Techniques." In Handbook of Survey Research, pp. 231 - 288. Edited by Peter H Rossi., James D Wright, and Andy B Anderson. San Diego: Academic Press, Inc, 1983.

Althuis, Paul; and Vervurt Art. Technological Movements on A World Scale. The Netherlands: Delft University Press, 1982.

"Bangladesh." Statistical Yearbook for Asian and the Pacific. Bangkok: Economic and Social Commission for Asian and the Pacific, United Nations Publications, 1992.

Bijker, Wiebe E; Hughes, Thomas P; and Pinch, Trevor. The Social Construction of Technological Systems. Cambridge: The MIT Press, 1987.

Board on Science and Technology for International Development. Commission on International Relations, National Research Council. Postharvest Food Losses in Developing Countries. Washington, DC.: National Academy of Sciences, 1978.

Boxall, R. A; Gra, J. La; Martinez, E; and Martinez, J. "Post Harvest Losses of Rice in the Dominican Republic." Tropical Stored Products Information 42 (1981): 5-10.

Campbell, Norman. What is Science ?. New York: Dover, 1952.

Cicourel, Aaron V. Method and Measurement in Sociology. London: The Free Press of Glencoe, 1964.

Esmay, Merle; Soemangat; Eriyatno; and Phillips, Allan. Rice Postproduction Technology in the Tropics. Honolulu, Hawaii: The East-West Center, 1979.

"FAO Action Program for the Prevention of Food Loses Guidelines and Procedures." FAO Bulletin. January 1978.

Feyerabend, Paul. Against Method. London: Redwood Burn Limited Trowbridge & Esher, 1979.

Greeley, Martin. Postharvest Losses, Technology, and Employment. The Case of Rice in Bangladesh. Boulder: Westview Press, 1987.

Gusfield, Joseph R. "On the side: Practical Action and Social Constructivism in Social Problems Theory." In Studies in the Sociology of Social Problems, edited by Joseph W. Scheinder., and John I. Kitsuse. Spur Norwood: Alex Publishing Company, 1984.

Haque, Anwarul A. K. M ; Quasem, M. A. ; Choudhury, N. H. ; and , Jose R. "Rice Post-harvest Practices and Loss Estimates in Bangladesh: Threshing through Sundrying." Agricultural Mechanization in Asia, Africa and Latin America 22 (1) (1991): 53-58.

"Indian Sub-Continent." Asean Economic Handbook. first edition. London: Euromonitor Publications Limited, 1987.

Jagtenberg, Tom. The Social Construction of Science. Dordrecht: D. Reidel Publishing Company, 1983.

Kamuanga, Mulumba., and Spencer, Dunstan S. C. Losses of Rice in West Africa. The Case of the Office Du Niger in Mali. Monrovia: West Africa Rice Development Association, 1981.

Latour, Bruno. Science in Action. Cambridge: Harvard University Press, 1987.

Pinch, Trevor. " "Testing - One, Two, Three ... Testing!": Toward a Sociology of Testing." Science, Technology, and Human. Journal of the Society for Social Study of Sciences. vol. 18 / no. 1 (Winter, 1993: 25-39).

"Rice, Paddy. Twenty Principal Producers in 1990." UNCTAD (United Nations Conference on Trade and Development) Commodity Yearbook 1992. New York: United Nations, 1992.

Rohani, M. Y; Norin, S. A. Shariffah; and Samsudin, A. "Post-Harvest Losses of Paddy in the Krian / Sungei Manik Areas." MARDI Research Bulletin. 1985, p. 148-154.

Rouse, Joseph. Knowledge and Power. Toward a Political Philosophy of Science. Ithaca: Cornell University Press, 1987.

Saunders, R. M; Mossman, A. P; Wasserman, T.; and Beagle, E. C. Rice Postharvest Losses in Developing Countries. Oakland: Agricultural Research (Western Region), Science and Education Administration, U. S. Department of Agriculture, 1980.

Spurgeon, David. Hidden Harvest. A System Approach to Postharvest Technology. Ottawa: International Development Research Center, 1976.

Stevens, S. S. "Mathematics, Measurement and Psychophysics." In Measurement Definitions and Theory. edited by C. W. Churchman and P. Ratoosh. New York: Wiley, 1951.