

**DETERMINANTS OF FARMERS' ADOPTION OF
SWARNA RICE VARIETY IN KURIGRAM
DISTRICT OF BANGLADESH**

JANNATUN FERDOUSI ANNA



**DEPARTMENT OF
AGRICULTURAL EXTENSION AND INFORMATION SYSTEM
SHER-E-BANGLA AGRICULTURAL UNIVERSITY
SHER-E-BANGLA NAGAR, DHAKA-1207**

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**DETERMINANTS OF FARMERS' ADOPTION OF
SWARNA RICE VARIETY IN KURIGRAM
DISTRICT OF BANGLADESH**

By

JANNATUN FERDOUSI ANNA

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Approved by

.....
(Prof. Md. Mahbubul Alam, PhD)
Supervisor
Dept. of Agril. Ext. and Info. System
Sher-e-Bangla Agricultural University

.....
(Dr. Muhammad Humayun Kabir)
Co-Supervisor and
Associate professor
Dept. of Agril. Ext. and Info System
Sher-e Bangla Agriculture University

.....
(Prof. Md. Mahbubul Alam, PhD)
Chairman
Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University, Dhaka

**Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University
Dhaka - 1207, Bangladesh**

CERTIFICATE

This is to certify that the thesis enlighten, “**DETERMINANTS OF FARMERS’ ADOPTION OF SWARNA RICE VARIETY IN KURIGRAM DISTRICT OF BANGLADESH**” submitted to the faculty of agriculture, Sher-e-Bangla Agricultural University, Dhaka in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE in AGRICULTURAL EXTENSION**, embodies the result of a piece of bona fide research work conducted by **JANNATUN FERDOUSI ANNA, Registration no. 17-08183** under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this study has been dully acknowledgement.

Dated: December, 2017

Dhaka, Bangladesh

Md. Mahbubul Alam, PhD

Supervisor

Professor

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University

Dhaka-1207

DEDICATED
TO
MY BELOVED PARENTS

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LIST OF ABBREVIATIONS

Abbreviation	Full word
Ag. Ext. Ed	Agricultural Extension Education
Ag. Ext. and Info. Sys.	Agricultural Extension and Information system
AIS	Agricultural Information Service
AEO	Agricultural Extension Officer
β	Beta co-efficient
BBS	Bangladesh Bureau of Statistics
BRRRI	Bangladesh Rice Research Institute
DAE	Department of Agriculture Extension
FAO	Food and Agriculture Organization
HYV	High Yielding Variety
IRRI	International Rice Research Institute
NGO	Non-Government Organization
SAAO	Sub-Assistant Agricultural Officer
SPSS	Statistical Package of Social Science

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ABSTRACT

The specific purpose of the study was to determine the extent of adoption of Swarna rice variety by the farmers in a Kurigram district of Bangladesh. Attempt was also made to determine and describe the selected factors that influence farmers' adoption decision regarding Swarna rice cultivation. The study also determined the contribution of the selected factors to farmers' adoption of Swarna rice variety. A two-step approach was adopted for selecting the study locale. First, Nageswari upazila of Kurigram district was purposively selected, and second two unions of the selected upazila namely, Santoshpur and Raigonj were randomly selected as the locale of the study. A total of 4311 farmers constituted the population of the study from which 145 respondents were selected using proportionate random sampling technique. A structured interview schedule was developed and administered for collecting data during the period of 15th May, 2018 to 25th June, 2018. The findings of the study indicate that majority (72.40 percent) of the farmers had medium adoption while 17.90 percent had high adoption and 9.70 percent had low adoption of Swarna rice, respectively. Multiple regression analysis showed that education, farming experience and ease of farm management had significant contribution to the adoption of Swarna rice variety while age, farm size, annual family income, relative advantage, social influence, habit and knowledge in rice cultivation showed no significant contribution to the extent of adoption of Swarna rice variety. Therefore, emphasis should be given on the significant factors for further improvement of the situation.

CHAPTER I

INTRODUCTION

1.1 General Background

Population of Bangladesh is gradually increasing as a result the farm holding size of a family is ever decreasing. Practically nowadays all cultivable land is in use and the pressure of increasing population reduced the average size of the farm holding from 1.69 acres in 1996 to 1.48 acres (BBS, 2014). Almost all of the 13 million farm families of the country grow rice. Rice is grown on about 10.5 million hectares which has remained almost stable over the past three decades. The population of Bangladesh is still growing by two million every year and may increase by another 30 million over the next 20 years. Thus, Bangladesh will require about 27.26 million tons of rice for the year 2020. During this time total rice area will also shrink to 10.28 million hectares (BRKB, 2016). Rice yield therefore, needs to be increased from the present 2.74 to 3.74 t/ha. The country is now producing about 25.0 million tons to feed her 135 million people (BRKB, 2016).

The importance of agriculture in Bangladesh can never be emphasized. Rice (*Oryza Sativa*), the principal food crop of Bangladesh occupies about 80 percent of the total cropped area and it alone contributes about 28% of the GDP of the country (BBS, 2016). In fact Bangladesh is critically dependent on rice both in the past, present and will remain so in the foreseeable future. Like morden rice variety, various local variety is also popularly cultivated in many parts of this country. Various local rice varieties are cultivated in Kurigram district in Aus, Aman and Boro season. The important local varieties include Guti Swarna, Mamun Swarna, Kalijira etc. This will maximize the production from their small plots through higher yields and better prices in the market. Furthermore, the use of early maturing varieties enables them to increase the cropping intensity. The local variety is well adapted to the local area and gives satisfactory yields than new 'HYV'. Nevertheless, 'HYV' is more susceptible to different pests and diseases. As most of our farmers are not technically up-to-date and not familiar with the improved cultural practice for cultivation of morden varieties. So, they prefer to cultivate indigenous varieties. Local rice varieties can cope with climatic change effects and fight against natural disasters as well. Also, the local varieties of rice having wide genetic base for saving the crops from impending damage due to factors related global warming and

climate change. Therefore, use of the seeds of the local varieties of rice and associated technologies as developed by the farmers should be explored.

Submergence is one of the major constraints in rice production in Bangladesh. More than half of the total rice area is considered to be submergence-prone during the kharif season. The proportion of submergence-prone area is higher (55%) in Bangladesh than in India (17%) and Nepal (9%). To mitigate crop losses due to submergence, the International Rice Research Institute (IRRI) and its collaborators recently developed and released two submergence-tolerant rice varieties: BRRI dhan51 and BRRI dhan52. These two varieties can survive full submergence up to 15 days. In Bangladesh, BRRI dhan51 is also an improved Swarna (or Swarna-Sub1) which was developed based on a rice variety called Swarna. BRRI dhan52 was developed based on BR11 and was released in 2011. Because both Swarna and BR11 have been popular among farmers in northern Bangladesh, farmers are expected to readily adopt BRRI dhan51 and BRRI dhan52. In addition, these two submergence-tolerant rice varieties have been distributed by the project Stress-Tolerant Rice for Africa and South Asia (STRASA), which is funded by the Bill & Melinda Gates Foundation, and its collaborators (Yamano, 2013).

With having delectable aroma and taste the Swarna Rice is used for daily consumption and serves as staple food for rice eaters. The superior in quality rice is free from dust and stones. Processed with care and cleanliness, the rice is full of nutritional value and possesses longer shelf life. Generally Swarna rice is produced in India, but its cultivation in today's northern districts is widely appreciated. The farmers are interested in rice cultivation for the various benefits of Swarna rice. There are three kinds of Rice in Bangladesh named as Aus, Aman and Boro, which are cultivated during April to July, August to December and January to May respectively. About two-thirds of the cultivated land area of Bangladesh is occupied by rice. Aman is second main rice growing season in Bangladesh. Swarna rice is cultivated in such that time in Aman season.

An individual usually doesn't adopt a new variety of rice unless he finds the benefit of it by himself. Even if he is convinced about its benefit still he may not use the same due to lack of financial capability. Sometimes he may have means to use the Swarna rice variety and his social norms and traditions encourage him to use the same for necessary factors.

Swarna rice is cultivated in the northern districts of Bangladesh such as Dinajpur, Rangpur, Kurigram, Lalmonirhat and Nilphamari. This rice is known by several name.

Some farmers call it a Guti Swarna, Mamun Swarna, Chikon Swarna and some are call it Nepali Swarna. They know that it has been brought from India to this country but the government of Bangladesh calls it a local variety.

Kurigram district sometimes is considered as surplus rice production zone of the country, where rice production was a major enterprise. Nageswari upazila area, therefore, considered a most suitable location to study the phenomena of adoption of Swarna rice by the rice growers. Nageswari upazila of Kurigram district is an important place of rice cultivation in this country. To expand the cultivation of this crop in other parts of the country, the knowledge on the present situation of rice production in this region would be significantly contributory to design appropriate programs for its widespread cultivation.

These happenings are certainly due to a number of factors. Determinations of farmer's adoption of Swarna rice variety in the northern district of Bangladesh are influenced by the farmer's demographic and socio-economic position. An understanding about the same will be useful to the researchers, planners and extension workers in doing research, planning and execution of extension programs for enhancing adoption of Swarna rice.

1.2 Statement of the Problem

The success of any technology depends on its dissemination among the potential users, which ultimately is measured by the level of adoption of that variety. When an innovation is introduced to the farmer, it may be readily accepted, partly accepted, fully accepted and it may also happen that the adoption of innovation is discontinued or totally stopped.

Rice is the most important cereal crops in Bangladesh. The importance of the cultivation of this crop is increasingly recognized by the implement as of agricultural extension programs as well as policy makers. As a main crop, rice has much potentiality for widespread and stability for cultivation by the respondents. But before undertaking any massive programme for its increased production in Bangladesh, it is first necessary to know the existing situation of the extent of rice cultivation in the most potential areas of Bangladesh.

Nageswari upazila of Kurigram district is an important place of rice cultivation in this country. To expand the adoption of this crop in other parts of the country, the knowledge on the present situation of rice production in this region would be significantly contributory to design appropriate programs for its widespread cultivation.

These happenings are certainly due to a number of factors. Adoptions of Swarna rice are influenced by the farmer's demographic and socio-economic position. An understanding about the same will be useful to the researchers, planners and extension workers in doing research, planning and execution of extension programs for enhancing adoption of rice cultivation. For these respects, the answers to the following questions would be very much pertinent.

- What were the important characteristics of the rice growers influencing their adoption of Swarna rice production?
- To what extent the Swarna rice production were adopted by the rice growers?
- To what extent growers' characteristics influence their adoption of Swarna rice production?

1.3 Objectives of the study

- To determine and describe the selected factors that influence farmers' adoption of Swarna rice variety,
- To determine the extent of adoption of Swarna rice variety by the farmers,
- To determine the contribution of the selected factors to the farmers' extent of adoption of Swarna rice variety.

1.4 Justification of the Study

The findings of the present study will be a key in extending the adoption of Swarna rice varieties in the northern district of Bangladesh. Adoption of swarna rice is not completely a new phenomenon, but its adoption by the farmers varies significantly. Moreover, to increase the adoption rate of swarna rice requires us to study the phenomenon critically. These will be helpful for planning adaptive research, formulating extension messages and production plans. At present there is a lack of adequate information to influence farmers' extent of adoption of swarna rice. The fact indicates the need for an investigation to ascertain the contribution of the selected demographic and socio-economic characteristics of the farmers with their adoption of swarna rice variety. This study will be helpful to the researcher for further studies of similar nature and the extension personnel to speed up the adoption of swarna rice variety. These will help to understand the picture of swarna rice varieties adopted by the farmers of Nageswari upazila under Kurigram district.

1.5 Scope of the Study

The main focus of the study was to determine the adoption of Swarna rice by the farmers. The findings of the study would be specifically applicable to Kurigram district. However, the findings would also have implications for other areas of the country having relevance to the sociocultural context of the study area. The investigator believes that the findings of the study would reveal the phenomenon related to diffusion of innovation. These would be of special interest to the policy makers and planners in formulating and redesigning the extension programmers especially for adoption of rice. The findings were expected to be helpful to the field workers of different nation building departments and organizations to develop appropriate extension strategies for effective working with the rural people.

1.6 Limitations of the Study

The limitations that this study was acknowledged are as follows:

1. The study was confined in two blocks of two unions under Nageswari upazila of Kurigram district.
2. Head of the farm families were considered as the population of the study.
3. There are many factors seems to be associated with adoption of Swarna rice production. Here, relative advantage, ease of farm management, social influence and habit were considered.
4. The study was confined with the rice growers during one season of the year 2016-2017.

1.7 Assumptions of the Study

The researcher had the following assumptions in mind while undertaking this study:

1. The respondent included in the sample was capable of providing proper answer to the question in the interview schedule.
2. The researcher who acted as interviewer was adjusted to social and environmental condition of the study area. Hence, the data collected by her and the respondents were free from bias.
3. The responses furnished by the respondents were reliable. They expressed the truth about their conviction and opinions.

4. Views and opinions furnished by farmers included in the sample were representative views and opinions of the whole population of the study.
5. The finding of the study will have general application to other parts of the country with similar, socio-economic, cultural and agro-ecological conditions of the study area.
6. The respondents were more or less conscious about the adoption of Swarna rice variety.

1.8 Definition of Important Terms

A concept is an abstract of observed thing; events or phenomenon or in other words, it is a short hand representation of variety of facts (Wilkinson and Bhandarkar, 1977). A researcher needs to know the meaning and contents of every term that he used. It should clarify the issue as well as explain the fact to the investigator and readers. However, for clarity of understanding, a number of key concepts/terms frequently used throughout the study are interpreted as follows:

Adoption: It is the decision to make full use of an innovation as the best course of action available (Rogers 1983).

Age: It refers to the period of time from his birth to the time of investigation. In this study the age of rice growers were considered only.

Education: Education refers to the desirable change of human behavior, i.e. change in knowledge, skill and attitude of an individual through reading, writing and other related activities. In this study education status of rice growers of Nageswari upazila under Kurigram district was taken into consideration.

Experience in rice cultivation: Experience in rice cultivation means how many years farmers have been engaged in rice cultivation.

Farm size: Farm size refers to the total area of rice grower on which family carry out farming operation. The area was estimated in terms of full benefit of the farmer's family.

Annual family Income: It refers to the earning by the respondents himself and the members of his family from agriculture and other sources during a year. It is expressed in Taka.

Relative advantage: Rogers (2003) defined relative advantage as “the degree to which an innovation is perceived as being better than the idea it supersedes” (p. 229). The cost and social status motivation aspects of innovations are elements of relative advantage. For instance, while innovators, early adopters, and early majority are more status-motivated for adopting innovations, the late majority and laggards perceive status as less significant.

Ease of farm management:

Ease of farm management was derived from the concept of ‘ease of use’ of technology adoption literature. Ease of use refers to the degree to which a person believes using a technology requires less effort (Davis, 1989 and Venkatesh et al., 2003). Based on that argument, this study defines ease of farm management as the extent to which a farmer believes farm management of Swarna rice variety is easier compared to other common varieties.

Social influence:

Social influence occurs when a person's emotions, opinions or behaviors are affected by others intentionally or unintentionally. Social influence takes many forms and can be seen in conformity, socialization, peer pressure, obedience, leadership, persuasion, sales, and marketing. In 1958, Harvard psychologist Herbert Kelman identified three broad varieties of social influence.

- i. **Compliance** is when people appear to agree with others but actually keep their dissenting opinions private.
- ii. **Identification** is when people are influenced by someone who is liked and respected, such as a famous celebrity.
- iii. **Internalization** is when people accept a belief or behavior and agree both publicly and privately.

Habit:

A habit (or wont) is a routine of behavior that is repeated regularly and tends to occur subconsciously.

The *American Journal of Psychology* (1903) defines a "habit, from the standpoint of psychology, [as] a more or less fixed way of thinking, willing, or feeling acquired through previous repetition of a mental experience. Habitual behavior often goes unnoticed in persons exhibiting it, because a person does not need to engage in self-analysis when

undertaking routine tasks. Habits are sometimes compulsory. New behavior can become automatic through the process of habit formation. Old habits are hard to break and new habits are hard to form because the behavioral patterns which humans repeat become imprinted in neural pathways, but it is possible to form new habits through repetition.

When behaviors are repeated in a consistent context, there is an incremental increase in the link between the context and the action. This increases the automaticity of the behavior in that context.

Knowledge in rice cultivation:

It is the extent of basic understanding of the farmers in rice cultivation. It also includes the basic understanding of the use of different agricultural inputs and practices.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to review the literature having relevance to the present study. The researcher made an elaborate search of available literature for the above purpose. The researcher attempted to search the literatures on a number of studies have been conducted on the adoption of innovations by the farmers. Therefore, the findings of such studies related to the extent of adoption of Swarna rice cultivation by the farmers and other partial studies have been reviewed in this chapter. In Bangladesh, research in adoption of Swarna rice has also started and some studies have already come out from different organizations and journal paper. Review of adoption research including studies concerning adoption of Swarna rice have been presented here into following three sections:

Section 1: Review of Literature on General Context of Adoption

Section 2: Relationship of the Selected Characteristics of the Farmers with Their Adoption Decision

Section 3: Conceptual Framework of the Study

2.1 Review of Literature on General Context of Adoption

Innovation-decision is a psychological process through which an individual of a social system engages in mental activities from first hearing about an innovation to its final adoption. The entire process consists of five stages viz.; knowledge, persuasion, decision, implementation and confirmation (Bhuiyan, 2012). Simply, adoption is an implementation of a decision to use of an innovation. According to Rogers (1995), “adoption is a decision to make full use of an innovation as the best course of action available”. When an individual takes up a new idea as the best course of action and practices it, the phenomenon is known as adoption (Ray, 1991). In this study adoption means a decision to cultivate Swarna rice by the rice farmers. Adoption is decision to use and continue to use of the innovation for a certain period of time (Ray, 1991).

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of social system (Rogers, 1995). Rogers and Shoemaker (1971) stated that the adoption process as: the traditional view of the

innovation-decision process, called “adoption process” was postulated by a committee of rural sociologists in 1955 as consisting of five stages:

Awareness stage: The individual learns of the existence of the new idea but lacks detailed information about it.

Interest stage: The individual develops interest in the innovation and seeks additional information about it.

Evaluation stage: The individual makes mental application of the new idea to his present and anticipated future situation and decides whether or not try it.

Trail stage: The individual actually applies the new idea on a small scale in order to determine its utility in its own situation.

Adoption stage: The individual uses the new idea continuously on a full scale.

The innovation-decision process is the process through which individual (or other decision making unit) passes from knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of new idea and to confirmation of this decision (Rogers, 1995). This process consists of series of actions and choice over time through which an individual or organization evaluates a new idea into ongoing practices. The behavior consists essentially of dealing with the uncertainty that is inherently involved in deciding about a new alternative to those previously in existence. It is the perceived newness of the innovation and the uncertainty associated with this newness that is a distinctive aspect of innovation-decision making.

Swarna is the number-one rice variety in India, with high yield and good grain quality, and it requires 25% less nitrogen, as widely claimed by farmers. Released in Andhra Pradesh in 1979, it spread across the Subcontinent and into Bangladesh, where it was never officially released. The improved Swarna-Sub1 variety is now targeted to replace Swarna on 5–6 million hectares of rice in eastern India and Bangladesh. The new varieties are effectively identical to their susceptible counterparts but recover after severe flooding, making them ideal to replace popular varieties in flood-prone areas. Seeds have been disseminated and released through the IRRI Stress-Tolerant Rice for Poor Farmers in Africa and South Asia (STRASA) program, which aims to increase yields by 50% and benefit an estimated 20 million households through improved cultivars and management practices over ten years. Although it was released in India in 2009 and in Bangladesh in 2010, during 2009, Swarna-Sub1 was cultivated by approximately 10,000 farmers in

these two countries. During 2010, this variety was cultivated by over 100,000 farmers in India alone.

According to Ministry of Agriculture (2011), In Bangladesh, Swarna-Sub1 and BR11-Sub1 cultivation made remarkable progress in the country's rice development history. These varieties will make a significant contribution to further increasing aman rice production, ensuring food security in the country. Both Swarna-Sub1 and BR11-Sub1 were released in Bangladesh in 2010 and were cultivated by more than 25,000 farmers during the 2010 aman season. Because of the strong support from the Ministry of Agriculture, government of Bangladesh, during aman 2011, these two Sub1 rice varieties have reached 54 out of a total of 64 districts in the country.

Despite it was first time released in India, Swarna becomes as one of the most popular high yielding rice varieties cultivated in many parts of Bangladesh. It had good grain quality and requires 25% less nitrogen as widely claimed by the farmers. Swarna recorded maximum number of tillers per hill (9.83) over most other common rice varieties. Significantly maximum number of panicles was recorded by long duration variety Swarna over rest of the rice varieties. Long duration rice variety Swarna recorded the maximum grain yield (5782 kg ha⁻¹) as well as straw yield (6462 Kg ha⁻¹), which was significantly higher over all other varieties under study as were reported by Oteng *et al.* (2013), Manjunath *et al.* (2012) and Reddy *et al.* (2012).

Concerning adoption of rice varieties by the farmers, studies suggest farmers show higher interest to those technologies where their economic safety is guaranteed (Islam, 1996).

2.2 Relationship between Farmers' Characteristics with their Adoption Decision

2.2.1 Age and adoption

Age is one of the important demographic variables often predicts human behavior and explains their psychological characteristics. It is often assumed and reported that older aged individuals tend to adopt an innovation later compared to mid- and –young aged individuals. Likewise, Hussen (2001) reported a negative significant relationship between sugarcane farmers' age and their adoption of modern cultivation practices. However, age positive influence to farmers' adoption decision is also very common (e.g. Kashem, 1991; Ali *et al.*, 1986; Singh and Rajendra, 1990; Okoro *et al.*, 1992; Narwal *et al.*, 1991; Hossain *et al.*, 1991).

Elsewhere, Islam (1993) reported that there was no relationship between the ages of potato growers with their adoption of improved practices in potato cultivation. Similar results were observed by Karim and Mahaboob (1986), Rahman (1986), Singh (1992), Kher (1992) and Pathak *et al.* (1992).

2.2.2 Education and adoption

Education is one of the important determinants of development. An educated person is more capable to compare the pros- and –cons of any innovation and thus make consent decision regarding technology adoption. Despite studies found (e.g. Mustafi *et al.*, 1987; Hasan, 1996; Kher, 1992; Islam, 1996) education had no significant effect on individual's adoption decision of modern varieties of rice in Bangladesh, in most cases researcher reported a positive significant relationship between education and adoption of technology. Likewise, Kaur (1988) found that education influenced the opinion of the women about adoption of vegetable gardening, animal husbandry etc.

Alam (1997) observed that the level of education of the farmer had a positive and significant relationship with the use of improved farm practices. Sarker (1997) and Chowdhury (1997) also found similar findings about the relationship between education and adoption of improved technologies.

Hossain (2003) and Hossain (2006) respectively concluded that education of the farmers had a significant and positive relationship with their adoption of modern Boro-rice and selected of HYV rice cultivation practices. Similar findings were also observed by Humid (1995), Khan (1993) and Haque (1993).

2.2.3 Farm size and adoption

Hossain (2006) found that the farm size of the farmers had a non-significant relationship with their adoption of selected HYV rice. However, in another study, Hossain (2003) revealed that farm size of the farmers had a significant and positive relationship with their adoption of modern Boro rice cultivation practices.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Aalok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that farm size of the farmers had a significant and positive relationship with their adoption of Aalok 6201 hybrid rice.

2.2.4 Annual family income and adoption

Hossain (2003) revealed that annual family income of the farmers had a significant relationship with their adoption of modern Boro rice cultivation practices.

Aurangozeb (2002) observed that there was a positive relationship between annual family income from field crop and adoption of integrated homestead farming technologies.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Alok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that annual family income of the farmers had a significant and positive relationship with their adoption of Aalok 6201 hybrid rice.

Hussen (2001) found that the annual family income had positive significant relationship with their adoption of modern sugarcane cultivation practices.

Sarker (1997) found that annual family income of potato growers had a significant positive relationship with their adoption of improved potato cultivation practices. Similar results were observed by Hossain (1999), Rahman (1986), Kashem (1991), Singh (1991), Pal (1995), Islam (1993) and Khan (1993).

As opposed to those studies, Islam (1996), Hossain (1983) and Hoque (1993) reported a significant negative relationship between the annual family income of the farmers and their extent of use of ITK.

2.2.5 Farming experience and adoption

Patel (2007) reported that farming experience of rice growers had positive and significant correlation with their extent of adoption. Tambat (2007) indicated that the association between farming experience and adoption of recommended cultivation practices by the summer rice growers was significant.

Khaljeet et al. (2008) reported that there was positive and significant correlation between farming experience of paddy growers and extent of adoption of recommended paddy cultivation practices.

Bhosale (2010) indicated that farming experience of the paddy growers had positive and highly significant relationship with their extent of adoption of recommended paddy cultivation practices.

2.2.6 Relative advantage and adoption

Relative advantage is referred to the degree to which an innovation is perceived as better compare to the other innovations of its kind (Rogers, 2003). It may further be characterized as an innovation which is more productive, efficient and less costly. Therefore, relative advantage is considered as one of the important characteristics of a technology that motivates potential users to adopt or use that technology.

Swarna has good grain quality and requires 25% less nitrogen as widely claimed by the farmers. Furthermore, Swarna recorded maximum number of tillers per hill (9.83), maximum grain yield (5782 kg ha⁻¹) as well as straw yield (6462 Kg ha⁻¹) over most other common rice varieties (Oteng *et al.*, 2013), Manjunath *et al.*, 2012 and Reddy *et al.*, 2012). Furthermore, Swarna was found to be well adapted to agro-climatic condition particularly in northern parts of Bangladesh and less prone to disease and climatic variance. Therefore, relative advantage of Swarna rice variety is expected to be an important determinant for its adoption by the rice farmers.

2.2.7 Ease of farm management and adoption

As mentioned in Chapter I, ease of farm management was adapted from the concept of ease of use of Information Technology adoption literature which refers to the extent to which a user perceives using a technology is easier to use. Based on this concept, it is expected that farmers would prefer those varieties which are high yielding and at the same time less disease prone and less susceptible to climatic variation like drought, rain and saline. As reported in many studies and from farmers' feedback that Swarna rice variety require less farm management compared to other common varieties cultivated in that locale, farmers tend to show more positive attitude towards Swarna rice variety cultivation.

2.2.8 Habit and adoption

A habit is a routine behavior that a person does repeatedly and a habitual behavior tends to occur subconsciously. Habitual behavior often goes unnoticed in persons exhibiting it, because a person does not need to engage in self-analysis when undertaking routine tasks. Behavior becomes often automatic due to habit. Old habits are hard to break and new habits are hard to form because of human behavioral patterns. Therefore, farmers who tend to cultivate Swarna rice variety as a part of their habit, are less likely to cultivate

other rice varieties. Hence, habit tends to show a relatively positive influence to continue cultivate Swarna rice variety over other common varieties.

2.2.9 Social influence and adoption

A number of studies proposed and proved the influence of peers and society to a user's decision regarding technology adoption (Venkatesh, et al., 2003). Social norms or influence was reported as an important determinant of human behavior in psychology literature (Ajzen, 1991; Fishbein & Ajzen, 1975). According to Theory of Planned Behavior (Ajzen, 1991), human behavior is guided by three forms of beliefs, "behavioral belief" (i.e. favorable and unfavorable attitude towards a choice), "normative belief" (i.e. social norms or social influence) and "control belief" (i.e. person's control on his behavioral action). Social influence is the perception on whether a person is expected by their family, friends, relatives and members of a social system to perform a certain behavior. Therefore, a person's decision or behavior is often dependent on social networks and groups whom he values. A farmer who drives by this characteristic might influence by his peers' adoption of Swarna rice cultivation and hence social influence is expected to be an influential factor for adoption.

2.2.10 Knowledge in rice cultivation and adoption

Reddy *et al.* (1987) found significant association between knowledge and use of improved package of practices in rice production by participant and non-participant farmers.

Mahatab (2010) reported that knowledge of majority of aerobic rice growers about recommended practices of aerobic rice cultivation was medium followed by low and high levels. Majority of farmers (53.33 per cent) were under medium overall knowledge category, whereas 14.44 and 32.23 per cent of them belonged to low and high overall knowledge category, respectively.

Kirar and Mehta (2009) found that in case of contact tribal farmers they had 58.33 per cent knowledge about improved rice variety and in case of non - contact tribal farmers had 55.42 per cent knowledge about improved variety.

Khalje *et al.* (2008) reported that majority (65.00 per cent) of paddy growers had medium level of knowledge, followed by 20.83 per cent with low and 14.17 per cent with high level of knowledge about recommended practices of paddy crop.

Wadekar (2013) observed that majority (54.17 per cent) of the tribal farmers had „medium“ knowledge, while 25.00 per cent of the respondents had high knowledge and 20.83 per cent of the respondents had low knowledge about improved rice cultivation practices.

Singh and Yadav (2014) in his study on knowledge and adoption gap of tribal farmers towards rice production technology observed that maximum number of the respondents (45.00 per cent) had medium level of knowledge, followed by 33.33 per cent who had high level of knowledge and 21.67 per cent had low level of knowledge.

2.3 The Conceptual Framework of the Study

This study was designed to investigate the salient factors and their contribution to farmers' choice of cultivating Swarna rice variety over the other common varieties in the selected parts, particularly in the northern region of Bangladesh. This is an explorative research and hence two set of variables, dependent and independent variables were considered for the study. Farmers' adoption of Swarna rice variety was considered as the dependent variable of the study. Concerning the independent variables, three set of characteristics, namely demographic, psychological and innovation characteristics, were considered. Age, education, farming experience, farm size and annual family income were considered as demographic characteristics while habit, social influence and knowledge in rice cultivation were considered as psychological characteristics. Lastly, relative advantage and ease of farm management were considered as the innovation characteristics. Based on the discussion presented in section 2.2, this study proposed a conceptual framework presented in Fig. 2.1.

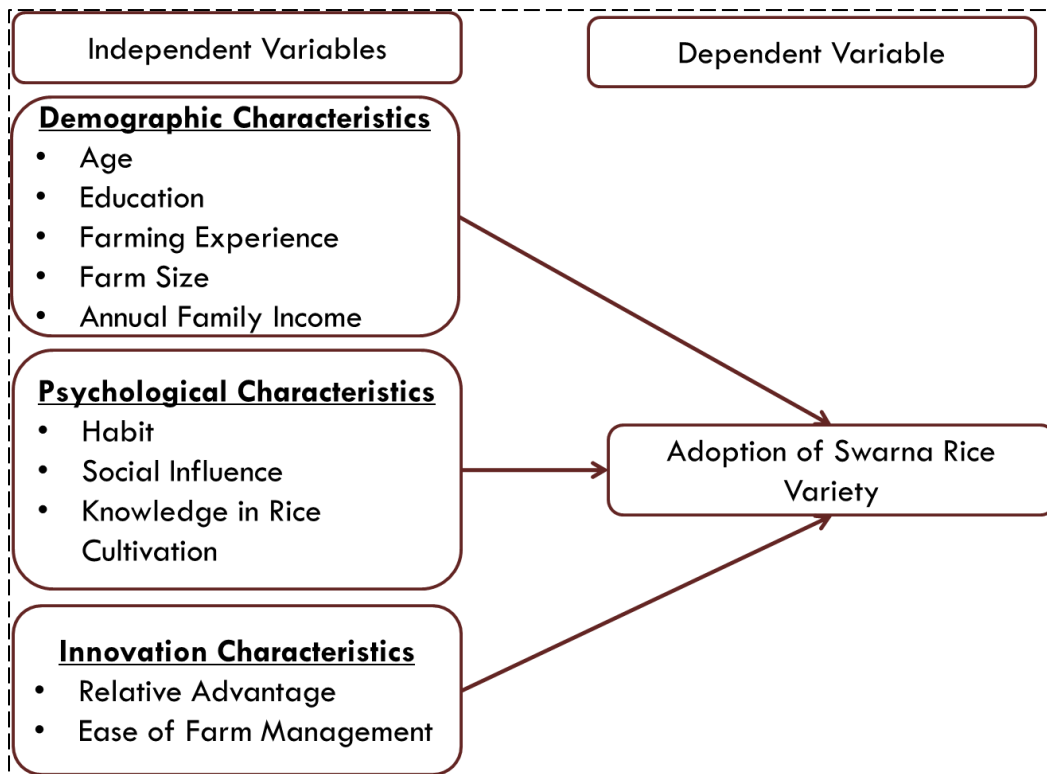


Figure 0.1 Conceptual framework of the study

CHAPTER III

METHODOLOGY

This section deals with the procedures and methods used in this study. This chapter is divided into three sections. First, it describes the overview of research design. Second, measurement of variables are described. Finally, the third section describes the methods applied in data analysis.

3.1 Research Design

3.1.1 Locale of the study

Nageswari upazila was purposively selected as the study area under Kurigram district. Nageswari upazila has 15 unions. Two unions namely Raigonj and Santoshpur of Nageswari upazila under Kurigram district were randomly selected as the locale of the study. There were three reasons to choose this upazila. First, the socio-economic and farming condition of this area was well known to the researcher. Second, this location was selected due to easy communication as well as easy contact with the rice growers of the study. Third, it was one of the Swarna rice production area. The study area is about 26 km from the district headquarter and situated north-east side of the district. Fig. No.3.1 and 3.2 show the map of the locale of the study.



Figure 0.1 A map of showing Kurigram district



Figure 0.2 A map of showing Nageswari upazila

3.1.2 Distribution of the population and sample

All rice growers of Raigonj and Santoshpur of the selected union of Nageshwari upazila constituted the population of the study. Updated lists of all farm family heads of the selected villages were prepared with the help of Sub-Assistant Agriculture officer (SAAO) and Upazila Agriculture Office (UAO). Therefore, all the rice farmers (4311) in the respected unions (here, two) were constituted the population of the study (Table 3.1). To determine the sample size, Kothari (2004) formula was used.

$$n = \frac{Z^2 pqN}{e^2 (N-1) + Z^2 pq}$$

Where, n = Sample size; N, Population size = 4311; e, the level of precision = 8%; z = the value of the standard normal variable given the chosen confidence level (e.g., z = 1.96 with a confidence level of 95%) and P, the proportion or degree of variability = 50%; Thus, the sample size (n) was determined as 145 (Table 3.1). Thereafter, proportionate random sampling technique was applied to identify the sample size from respective union. Besides, fifteen respondents were randomly selected for pre-test who were excluded from the sample list beforehand of data collection. Data collection were carried out during the period of 15th May, 2018 to 25th June, 2018. Twelve (12) respondents were kept in the reserve list in case of any respondent was missing during the data collection period. In fact, two respondents were replaced from the reserve list as two respondents from the original list were found absent during data collection period.

Table 0.1 Distribution of respondents of the selected unions with the reserve list

SL.NO.	Name of the unions	Total population	Sample size	Number of farmers in the reserve list
1.	Raigonj	1780	60	6
2.	Sontoshpur	2531	85	6
Total		4311	145	12

3.1.3 Instrument for data collection

In order to collect necessary information from respondents, an easy and realizable interview schedule was carefully designed focusing the objectives of the research work. Majority of items of the selected variables were adapted from previous literature with

little modifications considering the context of the study. The researcher seek experts' opinion before finalizing the interview schedule. All the questions were systematically arranged to help the respondents to understand the consequence easily.

3.1.4 Variables of the study

Two variables were used for this study:

- i. Dependent variable:** It is a variable that is the result or outcome or effect of other variables. This variables is often known as criterion or outcome variable. The value of the dependent variable depends on the value of the other variables, that is, independent variable. In this study, adoption of Swarna rice variety by the farmers in Kurigram district of Bangladesh was considered as the dependent variable.
- ii. Independent variable:** It is a variable that the researcher can control over or manipulate to predict other variable (i.e., dependent variable). Therefore, this variable is often called as predictor variable or causal variable. In an experimental setting, a researcher wants to manipulate the variable or introduce new variable to see its effect on the dependent variable. In this study, three set of independent variables, namely demographic, psychological and innovation characteristics, were considered. Age, education, farming experience, farm size and annual family income were considered as demographic characteristics while habit, social influence and knowledge in rice cultivation were considered as psychological characteristics. Lastly, relative advantage and ease of farm management were considered as the innovation characteristics.

3.2 Measurement of Variables

3.2.1 Measurement of demographic variables

A total of ten (10) independent variables were considered for the study. The procedures followed in measuring the demographic variables are briefly discussed below:

Age

The age of a respondent is one of the important factors pertaining to his personal characteristic (Smith and Zope, 1970) which can play an important role in his adoption behavior. The age of respondent was measured by counting the actual years from his birth to the time of taking interview. It was measured in terms of actual years. No fraction of

year was considered. A score of one (1) was assigned for each years of age. Age was placed in item number 1 of the interview schedule.

Education

Education was the most important factor to understand the modern practices of rice production. It measured by the number of classes passed by a respondent. Zero (0) for can't read and write, A score half (0.5) was assigned to those respondents who could sign only, S.S.C for 10 and H.S.C for 12. For example, if a respondent passed class VIII his education score was 8.

Farming experience in rice cultivation

Farming experience in rice cultivation means how many years the farmer has been engaged with rice cultivation. A score of one (1) was assigned for each years of farming experience in rice cultivation.

Farm size

Farm size refers to the total area of rice grower on which family carry out farming operation. The area was estimated in terms of full benefit of the farmer's family. It included the area of farm owned his farming operations during the period of study. Farm size was calculated as the size of his farm (including rice and other crops production) on which he continued by him as well as those obtained from others as sharecropping, lease or mortgage or borga. The area was being estimated in terms of full benefit to the growers in term of hectare. The farm size of a respondent was measured by using the following formula:

$$FS = A1 + A2 + 1/2(A3 + A4) + A5$$

Where,

FS = Farm size

A1 = Homestead area (with kitchen garden and pond)

A2 = Own land under own cultivation

A3 = Land taken from others on borga

A4 = Own land given to others on borga

A5 = Land taken from others on lease

Annual family income

Annual family income of respondents was determined on the basis of his earnings from agriculture and other various sources of his family during the last cropping year. For calculation of income score, one (1) was assigned for each one thousand taka.

Relative advantage

Relative advantage refers to a respondent's belief about the advantage of cultivating Swarna rice variety over the other common varieties. Respondents' responses were captured by using a five-point rating scale (1-5) ranging from 'strongly disagree' to 'strongly agree' as follows against six statements.

Score	Assigned items
1	Strongly disagree
2	Disagree
3	Undecided
4	Agree
5	Strongly agree

Relative advantage score was determined by summing the scores of all 6 items. Thus, the score could range from 6 to 30, where '6' indicates strongly disagreement and '30' indicates strongly agreement.

Ease of farm management

Ease of farm management refers to as the degree to which a respondent beliefs farm management of Swarna rice is easier compared to the other common varieties. Respondents' responses were captured by using a five-point rating scale (1-5) ranging from 'strongly disagree' to 'strongly agree' as follows against five statement.

Score	Assigned items
1	Strongly disagree
2	Disagree
3	Undecided
4	Agree
5	Strongly agree

Ease of farm management score was determined by summing the scores of all 5 items. Thus, the score could range from 5 to 25, where '5' indicates strongly disagreement and '25' indicates strongly agreement.

Social influence

Social influence score of a respondent was computed on the basis of his belief on how other members of his social system value him for his decision regarding farming activities. Respondents' responses were captured by using a five-point rating scale (1-5) ranging from 'strongly disagree' to 'strongly agree' as follows against three statements.

Score	Assigned items
1	Strongly disagree
2	Disagree
3	Undecided
4	Agree
5	Strongly agree

Social influence score was determined by summing the scores of all 3 items. Thus, the score could range from 3 to 15, where '3' indicates strongly disagreement and '15' indicates strongly agreement.

Habit

Habit score of a respondent was computed on the basis of his agreement and disagreement regarding his practice of Swarna rice cultivation as a part of habit. Respondents' responses were captured by using a five-point rating scale (1-5) ranging from 'strongly disagree' to 'strongly agree' as follows against four statements.

Score	Assigned items
1	Strongly disagree
2	Disagree
3	Undecided
4	Agree
5	Strongly agree

Habit score was determined by summing the scores of all 4 items. Thus, the score could range from 4 to 20, where '4' indicates strongly disagreement and '20' indicates strongly agreement.

Knowledge in rice cultivation

To measure the rice cultivation knowledge of a respondent 17 questions were prepared in the interview schedule. Each respondent was asked to answer all the 17 questions. Out of assigned scores against each question, the summation of obtained scores against 17 questions represented the knowledge of adoption of Swarna rice cultivation of a respondent. It was measured by the total knowledge score about rice cultivation. The total assigned score was 34. The score of each question was equal; it was determined according to the extent of question. Full score was assigned for each correct answer and zero (0) for the wrong answer. However, for correct responses to all questions, a respondent could get a total score of 34, while wrong responses to all questions he could get 0 (zero). '0' indicating no rice cultivation knowledge and '34' indicates the highest knowledge of rice cultivation.

3.2.2 Measurement of dependent variable

The adoption of Swarna rice by the farmers was measured by percentage of area coverage by the selected practices in last three years by using the following formula developed by M.A. Kashem (2004).

$$Adoption (in year) = \frac{Used\ area\ (ha)}{Potential\ Area\ (ha)} \times 100$$

$$Adoption (in year) = \frac{Year\ 1 + Year\ 2 + Year\ 3}{No.\ of\ years\ (here,\ 3)}$$

3.3 Data Analysis

3.3.1 Editing

Raw data were properly reviewed for omitting errors. The researcher made a careful scrutiny when she completed an interview so that all data were included to facilitate coding and tabulation.

3.3.2 Coding and tabulation

The researcher consulted with the research supervisor and co-supervisor, made a detailed coding plan. All responses were given in numerical score. The respondent responses were transferred to a spread sheet of SPSS to facilitate tabulation. In accordance with the objectives of the research, all of the data were tabulated.

3.3.3 Categorization of data

For coding operation, the collected data were classified into various categories. These categories were developed for each of the variables. The procedures and categorization of a particular variable were further discussed in the chapter 4 in detail.

3.3.4 Statement of the hypothesis

As defined by Goode and Hatt (1952) “a hypothesis is a proposition, which can be put a test to determine its validity. It may observe contrary to, or in accordance with commonsense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test.” In studying the relationship between variables, research hypotheses are formulated which state the anticipated relationship between the variables. However, for statistical test it becomes necessary to formulate null hypothesis. A null hypothesis states that “there is no contribution on the selected characteristics of the farmers and their adoption of modern technologies of rice production.” If a null hypothesis is rejected on the basis of a statistical test, it is assumed that there is a contribution of the concerned variables. There was no contribution of the selected factors and farmers’ adoption of Swarna rice variety where selected characteristics were: age, education, farming experience, farm size, annual family income, relative advantage, ease of farm management, social influence, habit and knowledge in rice cultivation.

3.3.5 Method of data analysis

The data were analyzed in accordance with the objectives of the proposed research work. Qualitative responses were converted into quantitative data by means of suitable scoring technique wherever necessary. The statistical measures such as range, means, standard deviation, number and percentage distribution were used to describe the variables. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Sciences) computer program, version 20. In order to estimate the contribution of the selected characteristics of farmers in the adoption of Swarna rice cultivation, multiple regression analysis (B) was used. Throughout the study, ten percent (0.1) level of

significance 5% level was used as the basis for rejecting any null hypothesis. If the computed value of (β) was equal to or greater than the designated level of significance (p), the null hypothesis was rejected and it was concluded that there was a significant contribution between the concerned variable. Whenever the computed value of β was less than the designated level of significance (p), the null hypothesis was not rejected. Hence, it was concluded that there was no contribution of the concerned variables.

The model used for this analysis can be explained as follows:

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + b_{10}x_{10} + e;$$

Where, Y was the adoption of Swarna rice variety, of the independent variables, x_1 was the respondent's age, x_2 was education, x_3 was farming experience, x_4 was farm size, x_5 was the annual family income, x_6 was social influence, x_7 was habit, x_8 was knowledge in rice cultivation, x_9 was relative advantage, x_{10} was ease of farm management. $b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9,$ and b_{10} were regression coefficients of the corresponding independent variables, and e is random error, which was normally and independently distributed with zero mean and constant variance.

CHAPTER IV

RESULTS AND DISCUSSION

A consequential and detailed discussion on the findings of the scientific research study has been presented in this Chapter. This Chapter includes three sections. In the first section, independent variables i.e. characteristics of the respondents have been discussed. The second section dealt with dependent variable i.e., adoption of Swarna rice variety by the farmers and finally, the relationship between the dependent and independent variables have been discussed in the third section.

4.1 Selected Characteristics of the Farmers

Ten characteristics of the several types of rice growing farmers were selected to describe and to find out their relationships with their adoption of Swarna rice varieties by the farmers. These selected characteristics were age, education, farming experience, farm size, annual family income, relative advantage, ease of farm management, social influence, habit and knowledge in rice cultivation, and adoption of Swarna rice by the farmers.

4.1.1 Age

The age of the sample farmers ranged from 25 to 70 years with an average of 54.04 and standard deviation of 7.88. According to their age and based on the classification of Ministry of Youth and Sports, Peoples' Republic of Bangladesh, respondents were classified into three categories (Table 4.1).

Table 4.1 Distribution of the respondents according to their age

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
Young (up to 35yrs)	25-70	3	2.10	54.04	7.88
Middle (36-55yrs)		49	33.80		
Old (above 55)		93	64.10		
Total		145	100		

Data showing that the highest value of proportion 64.10 percent of the rice growers were old aged compared to 2.10 percent young and 33.80 percent being middle aged. According to Lionberger (1960) elderly farmers seem to be somewhat less motivated to adopt new farm practices than younger ones. Middle and old aged people generally show more favorable attitude towards trying new ideas. Table 3.1 shows that older aged farmers are more likely to cultivate Swarna than other rice varieties.

4.1.2 Education

The education score of the farmers ranged from 0-15, with an average of 2.803 and standard deviation of 4.12. The respondents were classified into five categories on the basis of their education (Table 4.2) following Hossain *et al.* (2011).

Table 4.2 Distribution of the farmers according to their education

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
No Education (0)	0-15	33	22.80	2.803	4.12
Can sign only (0.5)		71	49.0		
Primary Education (1-5)		7	4.80		
Secondary Education (6-10)		27	18.60		
Higher Secondary or above (Above 12)		7	4.80		
Total		145	100		

It is determined from the Table 4.2 that 18.60 percent comprised of secondary education, 4.80 percent comprised of primary education, 22.80 percent of the respondents were under can't read or sign, 49.0 percent can sign only and only 4.80 percent had above secondary education. Table 4.2 also showed that above 49.0 percent out of the selected respondents can sign only. Despite more than one-third of the respondents had literacy level however their overall schooling experience was not found satisfactory.

4.1.3 Farming experience in rice cultivation

The observed farming experience in rice cultivation scores of the farmers ranged from 2 to 35 with an average of 14.35 and standard deviation of 8.33. Depending on the experience (mean & SD) in rice cultivation, farmers were classified into three categories as shown in Table 4.3.

Table 4.3 Distribution of the farmers according to their farming experience in rice cultivation

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
Low experience (up to 6)	2-35	17	11.70	14.35	8.33
Medium experience (6-22)		101	69.70		
High experience (above 22)		27	18.60		
Total		145	100		

Data contained in Table 4.3 revealed that the highest proportion (69.70%) of the farmers had medium experience as compared to 11.70 percent had low and only 18.60 percent had high experience in rice cultivation. Thus, an overwhelming majority of the respondents (88.30%) had medium to high farming experience.

4.1.4 Farm size

Farm size varied from 0 to 2.42 ha with an average of 0.87 ha and standard deviation of 0.42. The respondents were classified into four categories on the basis of their farm size (Table 4.4) recommended by DAE (1995).

Table 4.4 Distribution of the farmers according to their farm size

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
Marginal (0-0.2)	0.10-2.42	6	4.10	0.87	0.42
Small (0.21-1.0)		100	69.00		
Medium (1.01-3.0)		39	26.90		
Large (above 3)		0	0		
Total		145	100		

Data in the Table 4.4 reveal that 69.00% of the total respondent had small farm where 26.90 percent had medium farm, 4.10 percent had marginal farm and no respondent had large farm size. The average farm size of the farmers of the study area (0.87 hectares) was higher than that of national average (0.60 hectare) of Bangladesh (BBS, 2014). Table 4.4 shows majority of the respondents of the study area were small to medium farmers.

4.1.5 Annual family income

The annual family income of the farmers ranges from 57 to 170 thousands taka with the mean and standard deviation of 102.95 and 20.985, respectively. According to their earning from rice cultivation and other sources, they were classified into three categories. The categories and distribution of the respondents were shown in Table 4.5.

Table 4.5 Distribution of the farmers according to their annual family income

Category	Observed range (TK 000')	Respondents		Mean	SD
		Number	Percent (%)		
Low income (up to 82)	57-170	22	15.20	102.95	20.985
Medium (82-122)		109	75.20		
High (above 122)		14	9.70		
Total		145	100		

Data in the Table 4.5 showed that 75.20 percent of the farmers had medium annual family income, 15.20 percent of the respondents had low annual family income and 9.70 percent had high annual family income. Islam (2002) also found almost similar findings in his study. The observations showed that the average income of the farmers was 102.95 that were a medium category income because the percent of medium category farmers were higher than other two categories and more than half of the farmers belonged to medium category farmers. The other reason might be due to the fact that most of the farmers of the study area were not only engaged in agriculture, but also they were engaged service, business etc. Farmers with the low income generally hesitate to adopt innovations in their own farms because of their lower risk bearing ability and their inability to make necessary financial investment.

4.1.6 Relative advantage

The observed relative advantage scores of the farmers ranged from 23 to 29 with an average of 26.79 and standard deviation of 1.68. Depending on the relative advantage scores, the farmers were classified into three categories as shown in Table 4.6.

Table 4.6. Distribution of the farmers according to their relative advantage

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
Low (up to 24)	23-29	22	15.20	26.79	1.68
Medium (25-27)		72	49.70		
High (above 27)		51	35.20		
Total		145	100		

Data contained in Table 4.6 revealed that the highest proportion (49.70%) of the farmers had medium relative advantage as compared to 15.20 percent had low and only 35.20 percent had high relative advantage. It reveals that the majority of the farmers (84.90%) in the study area experienced high to medium relative advantage of cultivating Swarna rice variety.

4.1.7 Ease of farm management

The observed ease of farm management scores of the farmers ranged from 19 to 24 with an average of 21.77 and standard deviation of 1.62. Depending on the ease of farm management scores, the farmers were classified into three categories as shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their ease of farm management

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
Low (up to 19)	19-24	19	13.10	21.77	1.62
Medium (20-22)		70	48.30		
High (above 22)		56	38.60		
Total		145	100		

Data contained in Table 4.7 revealed that the highest proportion (48.30%) of the farmers perceived medium ease of farm management as compared to 13.10 percent were low and only 38.60 percent were experienced high ease of farm management. It reveals that the majority of the farmers (86.90%) perceived high to medium ease of farm management for Swarna rice cultivation.

4.1.8 Social influence

The social influence of the farmers ranges from 11 to 15 with the mean and standard deviation of 13.27 and 1.01, respectively. According to their social influence scores, they were classified into three categories. The categories and distribution of the respondents were shown in Table 4.5.

Table 4.8 Distribution of the farmers according to their social influence

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
Low (up to 11)	11-15	1	0.70	13.27	1.01
Medium (12-14)		126	86.90		
High (above 14)		18	12.40		
Total		145	100		

Data contained in Table 4.8 revealed that the highest proportion (86.90%) of the farmers had medium social influence as compared to 0.70 percent had low and only 12.40 percent had high social influence. Therefore, it can be concluded that most of the respondents (86.70%) experienced some sort social influence regarding Swarna rice cultivation.

4.1.9 Habit

The habit of the farmers ranges from 14 to 20 with the mean and standard deviation of 17.08 and 1.60, respectively. According to habit of Swarna rice adoption they were classified into three categories. The categories and distribution of the respondents were shown in Table 4.9.

Table 4.9 Distribution of the farmers according to their habit

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
Low (up to 15)	14-20	25	17.20	17.08	1.60
Medium (16-18)		91	62.80		
High (above 18)		29	20.00		
Total		145	100		

Data contained in Table 4.9 revealed that the highest proportion (62.80%) of the farmers had medium habit as compared to 17.20 percent had low and only 20.00 percent had high habit. Data furnish in Table 4.9 revealed that more than one-fifth of the respondents agreed that they regularly cultivated Swarna rice as part of their habit.

4.1.10 Knowledge in rice cultivation

Knowledge on rice cultivation scores of the respondents ranged from 15 to 32 with an average of 24.03 and standard deviation of 3.64. On the basis of rice cultivation knowledge scores, the respondents were classified into three categories, “poor knowledge (up to 21)”, “medium knowledge (21 to 27)” and “high knowledge (Above 27)”. The distribution of the respondents according to their knowledge on rice cultivation is shown in Table 4.10.

Table 4.10. Distribution of the farmers according to their rice cultivation knowledge

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
Low (up to 21)	15-32	28	19.30	24.03	3.64
Medium (21-27)		97	66.90		
High (above 27)		20	13.80		
Total		145	100		

Data in the Table 4.10 showed that more than half of the respondents (66.90%) had medium where 19.30 percent had low and only 13.80 percent had high knowledge in rice cultivation technologies. Thus, it may conclude that majority of the respondents (86.2%) moderate to less knowledgeable in modern rice production technologies.

4.2 Adoption of Swarna Rice by the farmers

The observed adoption of Swarna rice scores of the respondents ranged from 33 to 100. The average and standard deviation were 65.77 and 17.52, respectively. Based on the adoption scores, the respondents were classified into three categories as shown in Table 4.11.

Table 4.11 Distribution of the farmers according to their adoption of Swarna rice

Category	Observed range	Respondents		Mean	SD
		Number	Percent (%)		
Low (up to 48)	33-100	14	9.70	65.77	17.52
Medium (49-83)		105	72.40		
High (above 83)		26	17.90		
Total		145	100		

Data presented in Table 4.11 indicate that majority (72.40%) of the respondents had medium adoption as compared to 17.90 percent had high and only 9.70 percent had low adoption of Swarna rice variety. Hence, it was observed that more than overwhelming majority of the respondents (90.30%) had medium to high adoption of Swarna rice variety.

4.3 Contribution of the Selected Factors to the Farmers' Adoption of Swarna Rice

This section describes the contribution of the selected factors that influence a farmer's adoption decision regarding Swarna rice variety. Multiple Regression Co-efficient was computed to explore the contribution between variables as shown in Table 4.12.

Table 4.12 Multiple regression coefficients of contributing factors related to the adoption of Swarna rice variety

Dependent variable	Independent variables	Standardized partial 'b' Coefficients	Value of 't' with probability level	Sig. p	R ²	Adj. R ²	F
Adoption of Swarna rice by the farmers	Age	-0.093	-1.134	0.259	0.206	0.147	3.47
	Education	0.162	2.026	0.045*			
	Farming experience	0.230	2.393	0.018*			
	Farm size	0.097	0.932	0.353			
	Annual family income	-0.085	-0.854	0.395			
	Knowledge in rice cultivation	0.047	0.508	0.612			
	Relative advantage	-0.017	-0.171	0.865			
	Ease of farm management	0.291	3.035	.003**			
	Social influence	-0.060	-0.715	0.476			
	Habit	0.082	0.895	0.372			

**Significant at $p < 0.01$; *Significant at $p < 0.05$

The findings of the study revealed that the 10 factors were considered as independent variables together were effective in predicting farmers' adoption of Swarna rice by the farmers. The observed F ratio was significant at 0.01 level of significance which was an indication that the combinations of the independent variables in adoption was effective 20.6% ($R^2=0.206$) of the variation of respondents' adoption which can be attributed to their age, education, experience, farm size, annual family income, relative advantage, ease of farm management, social influence, habit, knowledge in rice cultivation.

However, each predictor may expound some of the variance in respondents' adoption condition simply by chance. The adjusted R^2 value penalizes the addition of external predictors in the model, but values of 0.147 still show that the variance in farmers' extent of adoption of Swarna rice can be attributed to the predictor variables rather than by chance and the F value indicate that the model was significant ($p < 0.01$). From Table 4.12, it was observed that education, farming experience and ease of farm management had significant contribution to farmers' adoption of Swarna rice. Data also showed that here

education and experience had most significant contribution at 5% ($p < 0.05$) level of significance on adoption of Swarna rice variety. It was also showed that ease of farm management had also significant contribution at ($p < 0.01$) 1% level of significance on adoption of Swarna rice variety.

4.3.1 Contribution of ease of farm management in adoption of Swarna rice variety

The contribution of ease of farm management on adoption of Swarna rice by the farmers was measured by testing the following null hypothesis; “there is no level of contribution of ease of farm management on adoption of Swarna rice variety”.

The adjusted p value of the concerned variable was found 0.003. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

- The contribution of ease of farm management was significant at 1% level. So the null hypothesis could be rejected.

Based on the above finding, it was concluded that a respondent had more ease of farm management increased the capabilities of adoption of Swarna rice variety. Ease of farm management enhances respondents’ motivation to adopt a farming practice more compared to other labor intensive agricultural management practices. A considerable number of prior researches have already proven the importance of ease of use of using a particular technology (Davis, 2003). Hence, ease of farm management was found to be the strongest predictor of Swarna rice adoption in the study area.

4.3.2 Contribution of education on adoption of Swarna rice variety

The contribution of education on adoption of Swarna rice variety was measured by testing the following null hypothesis; “there is no level of contribution of education on adoption of Swarna rice variety”.

The adjusted p value of the concerned variable was found 0.045. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

- The contribution of education was significance at 5% level. So the null hypothesis could be rejected.

Based on the above finding, it was concluded that a respondent had more education increased the capabilities of adoption of Swarna rice variety. Education enhances the

abilities of the respondents at a short time than others which transformed them to adopt of a technology. In fact, education broadens the horizon and an educated person is more capable of judging the pros and cons of adopting a technology. Therefore, they can make more consent decision regarding technology adoption.

4.3.3 Contribution of farming experience on adoption of Swarna rice by the farmers

The contribution of farming experience on adoption of Swarna rice by the farmers was measured by testing the following null hypothesis; “there is no level of contribution of farming experience on adoption of Swarna rice by the farmers”.

The adjusted p value of the concerned variable was found 0.018. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

- The contribution of experience was significant at 5% level. So, the null hypothesis could be rejected.

Based on the above finding, it was concluded that a respondent having more farming experience increased the capabilities of adoption of Swarna rice by the farmers. Experience enhances the abilities of the respondents and helps them to make right decision. Therefore, it concludes respondents having higher farming experience positively influence respondents’ adoption of Swarna rice variety.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents summary of findings, conclusions and recommendations of the study.

5.1 Summary of Findings

The major findings of the study are summarized below:

5.1.1 Selected factors that influence farmers' adoption of rice

Findings in respect of the 10 selected factors that influence farmers' adoption of Swarna rice variety are summarized below:

Age:

An overwhelming majority (35.90%) of the respondents was young to middle aged and 64.10% was old aged. The standard deviation was 7.88 and mean was 54.04.

Education:

Almost all of the farmers had different level of education. Among them 49.0% of the respondents were can sign only, 22.80% were no education, 4.80% were primary education and rest 4.80% were secondary to above education level.

Farming experience:

The farming experience of the farmers in the study area varied from 6 to 22. The average farming experience was 14.35 and standard deviation was 8.33. The highest proportion (69.7 percent) of the respondents belonged to medium farming experience, while 11.7 percent had low and 18.6 percent had highest proportion farming experience.

Farm size:

The farm size of the farmers in the study area varied from 0 to 3 (ha). The average farm size was .87 ha and standard deviation was .42. The highest proportion 69.00% of the total respondent had small farm where, 26.90 percent had medium farm, 4.10 percent had marginal farm.

Annual family income:

Annual family income from agriculture, livestock, poultry, fishery, business, services and others score of the respondents ranged from 82 to 122 thousand taka with the average of taka 102.95. The highest proportion (75.2 percent) of the respondents had medium income while 15.2 percent had low income and 9.7 percent had high income.

Relative advantage:

The highest proportion (49.70%) of the farmers had medium relative advantage as compared to 15.20 percent had low and only 35.20 percent had high relative advantage. It reveals that the majority of the farmers (64.90%) in the study area were in low to medium relative advantage.

Ease of farm management:

The highest proportion (48.30%) of the farmers had medium ease of farm management as compared to 13.10 percent had low and only 38.60 percent had high ease of farm management. Ease of farm management scores of the respondents were found to be varying from 19 to 23 with the average of 21.77 and standard deviation was 1.62. It reveals that the majority of the farmers (59.40%) in the study area were in low to medium ease of farm management category.

Social influence:

In social influence the highest proportion (86.90%) of the farmers had medium social influence as compared to 0.70 percent had low and only 12.40 percent had high social influence. It reveals that the majority of the farmers (86.70%) in the study area were in low to medium social influence in adoption of Swarna rice.

Habit:

The highest proportion (62.80%) of the farmers had medium habit as compared to 17.20 percent had low and only 20.00 percent had high habit.

Rice cultivation knowledge:

The majority (66.90%) of the respondents had medium knowledge compared to 19.30 percent felt in low knowledge changing and only 13.80 percent possesses high knowledge.

5.1.2 Adoption of Swarna rice by the farmers

The observed adoption of Swarna rice score of the respondents ranged from 48 to 84. The average and standard deviation were 65.77 and 17.52, respectively. The highest proportion (72.40 percent) of the farmers fell under the medium adoption category while 9.70 percent had low adoption and 17.90 percent had high adoption.

5.1.3 Contribution of the factors to farmers' adoption of Swarna rice variety

Multiple regression analysis revealed that ten (10) selected factors altogether explained 20.6% ($R^2 = .206$) of the variance of Farmers' extent of Swarna rice adoption. Among the factors, respondents' education, farming experience and ease of farm management were found to be positive and significantly contribute to their adoption of Swarna rice while rest of the factors were found to be non-significant.

5.2 Conclusions

Findings of the present study and the logical interpretation of other relevant facts prompted the researcher to draw the following conclusions:

- i. More than half of the respondents (72.40%) had medium adoption where 9.70 percent had low and 17.90 percent had high adoption of Swarna rice variety. The finding leads to the conclusion that there is still a scope to increase the adoption of Swarna rice variety in the study area.
- ii. Ease of use was found the highest contributor ($\beta=3.035$) to farmers' adoption of Swarna rice. Descriptive statistics also reveal that nearly half (48.3%) of the respondents perceived cultivation of Swarna rice required moderate effort in terms of farm management while more than one-third (38.60%) believed cultivation of Swarna rice variety was much easier compare to other varieties. Therefore, it may be concluded that farmers of the study area mostly cultivate Swarna rice for its less farm management requirements and better adaptability to climatic variation.
- iii. Farming experience was the second highest predictor ($\beta=2.393$) of Swarna rice cultivation and an overwhelming majority of the respondents (88.30%) had medium to high farming experience in rice cultivation. This means that with the increased of farming experience in rice cultivation, farmers' adoption of Swarna rice was also increased. Therefore, it may be concluded that more farming experienced farmers had more adoption of Swarna rice variety.

- iv. Education was found as one of significant predictors ($\beta=2.026$) of Swarna rice adoption (third highest). Therefore, it may be concluded that literate farmers tend to be more interested to continue adopt Swarna rice compared to farmers who had limited literacy.

5.3 Recommendations

5.3.1 Recommendations for policy implications

Based on the major findings of this study, the following recommendations are put forwarded.

- i. It was observed that farmers' adoption of Swarna rice was moderate to high in the study area. Being an exogenous variety Swarna was become popular among the farmers of some parts of northern districts of Bangladesh due to its less farm management requirement. Therefore, research organizations like Bangladesh Rice Research Institute (BRRI) should pay attention to develop and release variety with similar physiological characteristics. Department of Agriculture Extension (DAE) should develop programme to disseminate that technology at the farmers' level.
- ii. As farming experience was found an important predictor, Department of Agriculture Extension (DAE) may arrange more trainings on improved farm management practices in order to develop farmers' skills in rice cultivation.
- iii. Education of the respondent had significant contribution with the adoption of Swarna rice by the farmers. Therefore, it may be recommended that attempts should be taken to establish adult learning centers to increase educational level of the farmers as well as adoption of Swarna rice.

5.3.2 Recommendations for further study

- i. The study was conducted Nageswari upazila of Kurigram District. Similar studies should be conducted in other parts of the country to get a clear picture of the whole country which will be helpful for effective policy formulation.
- ii. It is difficult to determine actual adoption of Swarna rice by the farmers. Measurement of adoption of Swarna rice by the farmers is not free from questions. Therefore, more reliable measurement of concerned variable is necessary for further study.

- iii. The present study was undertaken to explore contribution of 10 selected factors to farmers' adoption of Swarna rice cultivation. Therefore, it could be recommended that further studies should be designed considering other agricultural and non-agricultural activities and including other characteristics of the farmers that might affect the adoption of Swarna rice cultivation.
- iv. In the present study education, farming experience, ease of farm management had significantly contribute to farmers' adoption of Swarna rice. In this connection, further verification is necessary for non-contributing characteristics.
- v. Research should also be undertaken to identify to other factors causing hindrance to high adoption of Swarna rice.

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Appendix-A

An English Version of Interview Schedule

Department of Agricultural Extension and Information System

Sher-e-Bangla Agriculture University, Dhaka-1207

An interview schedule for data collection of the research study entitled

Determinants of Farmers' Adoption of Swarna Rice Variety in Kurigram District of Bangladesh

Serial No.:

Name of the respondent:

Village:

Union:

Upazila:

District:

Cell:

Disclaimer:

Please provide the following information. Your information will be kept confidential and will be used for research purpose only.

- 1. Age:** How old are you?years.
- 2. Level of education:** Please mention your level of education.
 - a. I can't read and write ()
 - b. I can sign only ()
 - c. I have passed upto.....class
- 3. Farming experience in rice cultivation:** How many years have you been engaged with rice cultivationyears.
- 4. Farm size:** What is your total farm size?

Sl. No.	Use of land	Land possession	
		Local unit	Hectare
i.	Homestead area (A_1)		
ii.	Own land own cultivation (A_2)		
iii.	Land taken from others on borga system (A_3)		
iv.	Land given to others on borga system (A_4)		
v.	Land taken from others on lease(A_5)		
Total			

$$\text{Total farm size} = A_1 + A_2 + 1/2(A_3 + A_4) + A_5$$

5. Annual family income: Please furnish your annual family income from different sources in the last year.

Sl. No.	Sources of income	Annual income (TK.)
i.	Agriculture	
ii.	Livestock	
iii.	Poultry	
iv.	Fishery	
v.	Business	
vi.	Services	
vii.	Labor wage	
viii.	Remittance	
ix.	Others	
Total		

6. Relative advantage: Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
i.	Quality of Swarna rice grain is very fine, tasty for consumption than other available varieties.					
ii.	Market value of Swarna rice is relatively higher than other available varieties.					
iii.	Consumption demand for this rice grain is relatively higher than other available varieties.					
iv.	Production cost is relatively less compare to other available varieties.					
v.	Irrigation requirement is relatively less compare to other available varieties.					
vi.	Fertilizer requirement is relatively less compared to other available varieties.					

7. Ease of farm management: Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
i.	The variety is more environment friendly.					
ii.	It is more resistant to the lodging problems.					
iii.	It is more resistant to disease.					
iv.	It is more resistant to pest.					
v.	Land and environmental condition is favorable for this variety cultivation.					

8. Social influence: Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
i.	My family think that I should cultivate this variety.					
ii.	My friends and relatives think that I should cultivate this variety.					
iii.	Other farmers of my community influence me to cultivate this variety.					

9. Habit: Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
i.	Cultivating this variety is our family tradition.					
ii.	My family has been involved in cultivating this variety since long.					
iii.	We are habituated to cultivate this variety.					
iv.	Cultivating this variety is obvious for us.					

10. Knowledge in rice cultivation: Please answer the following questions.

Sl. No.	Questions	Score	
		Weighted	Obtained
i.	How do you prepare the land for rice cultivation?	2	
ii.	Mention two local varieties of rice.	2	
iii.	Mention two HYV varieties of rice.	2	
iv.	Distinguish between local variety and HYV rice?	2	
v.	Mention the two qualities of good seeds?	2	
vi.	Mention the name of two insecticides for controlling insect pest of rice field?	2	
vii.	What are the doses of fertilizer applied for Swarna rice variety?	2	
viii.	Mention the irrigation time of Swarna rice variety.	2	
ix.	Name two beneficial insects for rice.	2	
x.	How do you control insects at your rice field?	2	
xi.	Mention two harmful insects in the rice field.	2	
xii.	Mention any technology needed for rice cultivation?	2	
xiii.	Which soil is best for rice cultivation?	2	
xiv.	Mention the name of two insecticides for controlling insect pests of rice field?	2	
xv.	What precautions should need to be followed at the time of pesticide application?	2	
xvi.	What should be done for rice seed storage?	2	
xvii.	What is the control measure of rat in the field?	2	
Total		34	

11. Adoption of Swarna Rice Variety: Please mention the potential and used area of your farm for Swarna rice cultivation in the last three cropping seasons.

Year	Potential area (ha)	Used area (ha)	Adoption Score
1			
2			
3			

$$\text{Adoption (in year)} = \frac{\text{Used area (ha)}}{\text{Potential area (ha)}} \times 100$$

$$\text{Adoption (overall)} = \frac{\text{year 1} + \text{year 2} + \text{year 3}}{\text{No. of years (here, 3)}}$$

Thank you for your kind co-operation.

Signature of the interviewer:

Date: