



UNIVERSITI PUTRA MALAYSIA

***INTERRELATIONSHIP OF FARMERS' KNOWLEDGE, ATTITUDE, EASE
OF USE OF TECHNOLOGY, MOTIVATION AND WORK PERFORMANCE
IN FERTILIZER APPLICATION ON RICE IN BANGLADESH***

THAHAMINA BAGUM

FP 2022 50



**INTERRELATIONSHIP OF FARMERS' KNOWLEDGE, ATTITUDE, EASE
OF USE OF TECHNOLOGY, MOTIVATION AND WORK PERFORMANCE
IN FERTILIZER APPLICATION ON RICE IN BANGLADESH**

By

THAHAMINA BAGUM

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfillment of the Requirements for the Degree of Doctor of Philosophy**

August 2021

COPYRIGHT

All material contained within the thesis, including without limitation text, logos, icons, photographs, and all other artwork, is copyright material of Universiti Putra Malaysia unless otherwise stated. Use may be made of any material contained within the thesis for non-commercial purposes from the copyright holder. Commercial use of material may only be made with the express, prior, written permission of Universiti Putra Malaysia.

Copyright © Universiti Putra Malaysia



DEDICATION

*This thesis is dedicated to
My lovely Son Md. Tahmid Sumail
My beloved Husband A.N.M. Shamiul Moula
And my beloved Parents Rezia Karim & Late Md. Fazlul Karim*

*With love, respect and a bunch of memories
Indeed, we belong to Allah and indeed to Him we will return.*



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

INTERRELATIONSHIP OF FARMERS' KNOWLEDGE, ATTITUDE, EASE OF USE OF TECHNOLOGY, MOTIVATION AND WORK PERFORMANCE IN FERTILIZER APPLICATION ON RICE IN BANGLADESH

By

THAHAMINA BAGUM

August 2021

Chairman : Associate Professor Md. Kamal Uddin, PhD
Faculty : Agriculture

An enormous potential exists for increases in rice yield in Bangladesh. However, inefficient and imbalanced fertilizer use often impedes farmers from achieving expected yields. Farmers have resorted to applying fertilizers at inappropriate rates that do not match well with the nutrient requirement of certain crops. It is evident from past research that a majority of farmers hardly use the recommended rates for fertilizers. Therefore, this study aims to: (i) assess the level of knowledge, attitude, ease of use of technology, and motivation of farmers in fertilizer application on rice, (ii) determine the level of farmers' work performance in fertilizer application on rice, (iii) explore the relationships between knowledge, attitude, ease of use of technology and motivation of farmers with their work performance in fertilizer application on rice, and (iv) investigate the contribution of knowledge, attitude, ease of use of technology and motivation of farmers to their work performance in fertilizer application on rice.

The work performance theory, the Ability, Motivation, and Opportunity (AMO) model, and the Technology Acceptance Model (TAM) were used to develop the theoretical foundation for this work performance study. Besides, hypotheses were developed in light of these theories and the empirical findings of previous similar studies.

This research used a multistage sampling method to reach farmers from twenty one (21) rice production areas in Bangladesh. From a total of 3762 farmers, 355 rice farmers were selected using the simple random technique as sample for the study. A structured questionnaire was adapted to collect data from the respondents. A five (5) point Likert scale was used to measure the dependent as well as independent variables. Data were subjected to descriptive analysis (mean, standard deviation) to describe the level of selected variables. The Pearson correlation analysis was measured to explain the relationships between knowledge, attitude, ease of use of technology and motivation of

farmers with their work performance in fertilizer application on rice. A multiple linear regression analysis was deployed to identify the highest contributing factors towards farmers' work performance in fertilizer application on rice.

Results revealed that most of the farmers sampled had a moderate level of knowledge, favorable attitude, moderate level of ease of use of technology and a moderate level of motivation in fertilizer application on rice. About 45.9% of the farmers had a high level of work performance in fertilizer application. Knowledge, attitude, ease of use of technology and motivation of farmers had significant positive relationships with their work performance in fertilizer application on rice. Moreover, knowledge and motivation were found to be strongly related to farmers' work performance in fertilizer application, while ease of use of technology and attitude showed moderate and low relationship, respectively. The multiple linear regression analysis showed that knowledge, ease of use of technology and motivation of farmers significantly contributed to their work performance, while attitude insignificantly contributed to their work performance in fertilizer application. All the variables explained 56.1% of the variance in farmers' work performance in fertilizer application on rice. Motivation of farmers was found to be the highest contributing factor followed by knowledge and ease of use of technology influencing farmers' work performance in fertilizer application on rice.

Since majority of the farmers had a high level of work performance, the study concludes that there is still ample scope to improve the rest of farmers' work performance in fertilizer application to attain higher production of rice. Besides, knowledge, ease of use of technology, and motivation of farmers were found significant to their work performance. Therefore, these factors should be paid greater attention to improve the farmers' work performance in fertilizer application. The study recommended that the findings could be used as a reference for similar research in future. Moreover, the study findings will serve as a basis for formulating essential policies and procedures for field extension, supervision, guidance, counselling and training of farmers. This will in turn help inspire and ensure improvements in work performance, specifically towards the application of fertilizer on rice among other farmers in Bangladesh. Additionally, the findings can help the relevant authorities like the Department of Agriculture Extension (DAE) and Soil Resource Development Institute (SRDI) of Bangladesh to initiate more institutional approaches to equip farmers with the essential knowledge and motivation needed to strengthen their work performance as this will subsequently increase rice production.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**HUBUNGAN ANTARA PENGETAHUAN PETANI, SIKAP, KEMUDAHAN
PENGUNAAN TEKNOLOGI, MOTIVASI DAN PRESTASI KERJA
TERHADAP PENGGUNAAN BAJA PADI DI BANGLADESH**

Oleh

THAHAMINA BAGUM

Ogos 2021

Pengerusi : Profesor Madya Md. Kamal Uddin, PhD
Fakulti : Pertanian

Potensi besar wujud untuk meningkatkan hasil padi di Bangladesh. Walaubagaimanapun, penggunaan baja yang tidak cekap dan tidak seimbang sering menghalang petani daripada mencapai hasil yang diharapkan. Petani menggunakan baja pada kadar yang tidak sesuai dan tidak sepadan dengan keperluan nutrien tanaman. Terdapat bukti yang jelas dari kajian lepas bahawa majoriti petani tidak menggunakan kadar baja yang disyorkan. Oleh itu, kajian ini bertujuan untuk: (i) Menentukan tahap pengetahuan, sikap, kemudahan penggunaan teknologi, dan motivasi petani terhadap penggunaan baja ke atas padi, (ii) menentukan tahap prestasi kerja petani dalam penggunaan baja ke atas padi, (iii) menentukan hubungan antara pengetahuan, sikap, kemudahan penggunaan teknologi dan motivasi petani dengan prestasi kerja petani terhadap aplikasi baja ke atas padi, dan (iv) menilai sumbangan pengetahuan, sikap, kemudahan penggunaan teknologi dan motivasi petani terhadap prestasi kerja mereka ke arah penggunaan baja ke atas padi.

Teori prestasi kerja, model Keupayaan, Motivasi, dan Peluang (AMO), dan Model Penerimaan Teknologi (TAM) digunakan untuk membangunkan asas teori bagi kajian prestasi kerja ini. Selain itu, hipotesis telah dibangunkan berdasarkan teori-teori ini dan dapatan empirikal kajian terdahulu.

Kajian ini menggunakan kaedah persampelan pelbagai peringkat untuk mencapai petani daripada dua puluh satu (21) kawasan pengeluaran padi di Bangladesh. Daripada sejumlah 3,762 populasi, seramai 355 petani telah dipilih sebagai responden kajian menggunakan teknik rawak mudah. Soal selidik berstruktur yang diubahsuai telah digunakan untuk mengumpulkan data daripada responden. Lima (5) skala Likert telah digunakan untuk mengukur pembolehubah bersandar dan pembolehubah bebas. Data telah dianalisis menggunakan analisis deskriptif (min, sisihan piawai) untuk mengukur

tahap pembolehubah terlibat. Analisis korelasi Pearson telah digunakan untuk mengukur hubungan antara pengetahuan, sikap, kemudahan penggunaan teknologi dan motivasi petani dengan prestasi kerja mereka ke arah penggunaan baja ke atas padi. Analisis regresi pelbagai telah digunakan untuk menentukan faktor penyumbang tertinggi terhadap prestasi kerja petani dalam penggunaan baja ke atas padi.

Hasil kajian menunjukkan bahawa kebanyakan petani memiliki tahap pengetahuan yang sederhana, sikap yang baik, tahap kemudahan penggunaan teknologi yang sederhana dan tahap motivasi yang sederhana terhadap penerapan baja pada padi. Kira-kira 45.9% petani mempunyai prestasi kerja yang tinggi terhadap penggunaan baja. Pengetahuan, sikap, kemudahan penggunaan teknologi dan motivasi petani mempunyai hubungan yang positif dan signifikan dengan prestasi kerja mereka terhadap penggunaan baja padi. Selain itu, pengetahuan dan motivasi didapati mempunyai hubungan yang rapat dengan prestasi kerja petani, manakala kemudahan penggunaan teknologi dan sikap masing-masing menunjukkan hubungan yang sederhana dan rendah. Analisis regresi pelbagai menunjukkan bahawa pengetahuan, kemudahan penggunaan teknologi dan motivasi petani menyumbang secara ketara kepada prestasi kerja mereka, manakala sikap tidak menyumbang kepada prestasi kerja. Semua pembolehubah terlibat menjelaskan 56.1% daripada variasi prestasi kerja petani terhadap penggunaan baja ke atas padi. Motivasi petani didapati menjadi faktor penyumbang yang tertinggi diikuti oleh pengetahuan dan kemudahan penggunaan teknologi yang mempengaruhi prestasi kerja petani terhadap penggunaan baja ke atas padi.

Oleh kerana majoriti petani mempunyai prestasi kerja yang tinggi, kajian ini menyimpulkan bahawa masih ada banyak ruang untuk meningkatkan prestasi kerja petani yang lain terhadap aplikasi baja untuk mencapai hasil padi yang lebih tinggi. Selain itu, pengetahuan, kemudahan penggunaan teknologi, dan motivasi para petani terbukti signifikan terhadap prestasi kerja mereka. Oleh itu, faktor-faktor ini harus menjadi lebih perhatian untuk meningkatkan prestasi kerja petani terhadap penggunaan baja. Kajian ini mencadangkan agar dapatan ini boleh digunakan sebagai rujukan untuk penyelidikan yang serupa pada masa hadapan. Lebih-lebih lagi, dapatan kajian akan menjadi sebagai asas untuk merangka dasar penting dan prosedur untuk bidang pengembangan, pengawasan, dan melatih petani. Ini seterusnya akan membantu memberi inspirasi dan memastikan penambahbaikan dalam prestasi kerja, khusus ke arah penggunaan baja padi di kalangan petani lain di Bangladesh. Selain itu, hasil kajian ini boleh membantu pihak berkuasa yang berkaitan untuk memulakan lebih pendekatan untuk melengkapkan petani dengan pengetahuan dan motivasi yang diperlukan untuk mengukuhkan prestasi kerja mereka yang kemudiannya akan meningkatkan pengeluaran padi.

ACKNOWLEDGEMENTS

First and foremost, I am thankful to Almighty ALLAH who bestowed upon me His endless blessing and gave me the knowledge, patience, strength and ability to accomplish this mammoth task.

I am highly grateful to my supervisor Associate Professor Dr. Md. Kamal Uddin, who guided me the entire research period with patience. His guidance for this study was beyond measure. I would like to thank him for his precious advice, understanding and for finding solutions to every single problem during the preparation of this thesis. His consistent supervision, motivation, and critical comments helped me improve my work and complete it in time.

I would like to express my profound appreciation and gratitude to my co-supervisor Dr. Salim Hassan, for his constructive criticism and guideline for writing this thesis. I am incredibly grateful to my co-supervisor Associate Professor Dr. Nitty Hirawaty Kamarulzaman, for her cooperation and assistance during my study. I wish to express my warm and sincere thanks to my other co-supervisor Professor Dr. Md. Zulfikar Rahman from Bangladesh Agricultural University, Bangladesh, for his continuous support throughout my research.

My heartiest debt of gratitude goes to OWSD Postgraduate Training Fellowship by Organization for Women in Science for the Developing World (OWSD) and The Swedish International Development Cooperation Agency (SIDA), for financial assistance of this research work and Universiti Putra Malaysia (UPM) for selecting me as a student in the PhD Programme.

During this work, I have collaborated with many friends and colleagues for whom I have great regard. I wish to express special thanks to all staffs and students of the Department of Land resource management, UPM, for their all-round support and encouragement.

I would like to acknowledge the contributions and cooperation of the farmers who sacrificed their valuable time to answer the survey questions. I sincerely acknowledge the cooperation and the help of the Upazila Agriculture Officer (UAO), Sub Assistant Agriculture Officer (SAAO) and field staffs of the Gobindagonj, Palashbari and Sadullapur Upazila under Gaibandha district of Bangladesh, who assisted me actively in the field during data collection. Their valuable comments and suggestions were stimulating. Without their help, it would be harder for me to complete the study.

I am extremely grateful to Sher-e-Bangla Agricultural University (SAU), Dhaka, Bangladesh for granting study leave for my research period. I would like to express my sincere appreciation to Prof. Dr. Md. Mahbubul Alam for giving me support, attention and making him available to me at all times. I am highly indebted to Professor

Mohammad Hossain Bhuiyan, Professor M. Zahidul Haque, Professor Dr. Md. Rafiqueel Islam, Professor Dr. Md. Sekender Ali, Professor Dr. Muhammad Humayun Kabir, Professor Dr. Ranjan Roy and other lecturers and staffs of the Department of Agricultural Extension and Information System, SAU for their constant support.

Last but not least, I owe my loving thanks to my parents, siblings especially my elder sister Fatama Begum, my husband A. N. M. Shamiul Moula and my son Md. Tahmid Sumail who sacrificed their valuable time and lived overseas without me. Without their love, encouragement, faithful support and understanding, it would have been impossible for me to finish this study.



This thesis was submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfillment of the requirements for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

Md. Kamal Uddin, PhD

Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Salim bin Hassan, PhD

Senior Lecturer
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Nitty Hirawaty binti Kamarulzaman, PhD

Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Md. Zulfikar Rahman, PhD

Professor
Department of Agricultural Extension Education
Bangladesh Agricultural University
Bangladesh
(Member)

ZALILAH MOHD SHARIFF, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 20 January 2022

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) were adhered to.

Signature: _____

Name of Chairman
of Supervisory
Committee:

Associate Professor
Dr. Md. Kamal Uddin

Signature: _____

Name of Member
of Supervisory
Committee:

Dr. Salim bin Hassan

Signature: _____

Name of Member
of Supervisory
Committee:

Associate Professor
Dr. Nitty Hirawaty binti Kamarulzaman

Signature: _____

Name of Member
of Supervisory
Committee:

Professor
Dr. Md. Zulfikar Rahman

TABLE OF CONTENTS

	Page
ABSTRACT	i
ABSTRAK	iii
ACKNOWLEDGEMENTS	v
APPROVAL	vii
DECLARATION	ix
LIST OF TABLES	xiv
LIST OF FIGURES	xvi
LIST OF ABBREVIATIONS	xvii
CHAPTER	
1 INTRODUCTION	1
1.1 Background of the Study	1
1.1.1 Rice Statistics in Bangladesh	2
1.1.2 Nutrient Deficiency in Soils of Bangladesh	5
1.1.3 Fertilizer Utilization Scenario in Bangladesh	5
1.1.4 Agricultural Extension and Work Performance	8
1.1.5 Work Performance of Farmers	9
1.1.6 Selected Influential Factors of Work Performance	10
1.2 Problem Statement	12
1.3 Research Questions	14
1.4 Research Objectives	14
1.5 Significance of the Study	15
1.6 Scope of the Study	15
1.7 Assumptions	16
1.8 Definitions of Key Terms	17
1.9 Organization of Thesis	18
1.10 Summary	19
2 LITERATURE REVIEW	20
2.1 Rice Distribution and Production	20
2.2 Concept of Fertilizer	21
2.2.1 Impact of Fertilizer	21
2.3 Agricultural extension service in Bangladesh	22
2.4 Work Performance	23
2.4.1 Concept of Work Performance	23
2.4.2 Farmers' Work Performance	24
2.4.3 Dimensions of Work Performance	25
2.4.4 Work Performance Measurement	26
2.4.5 Determinants of Work Performance	27
2.4.6 Models of Performance	28
2.5 Theories of Performance	28
2.5.1 Work Performance Theory	29
2.5.2 Ability, Motivation and Opportunity (AMO) Model	30

2.5.3	Technology Acceptance Model (TAM)	31
2.6	Reviews Related to Independent Variables	31
2.6.1	Concept of Knowledge	32
2.6.2	Concept of Attitude	33
2.6.3	Concept of Ease of Use of Technology	33
2.6.4	Concept of Motivation	34
2.7	Empirical Literature and Hypothesis Development	35
2.7.1	Relationship between Knowledge and Work Performance	35
2.7.2	Relationship between Attitude and Work Performance	36
2.7.3	Relationship between Ease of Use of Technology and Work Performance	37
2.7.4	Relationship between Motivation and Work Performance	38
2.7.5	Influence of Knowledge, Attitude, Ease of Use of Technology and Motivation on Work Performance	39
2.8	Theoretical Underpinning	41
2.9	Research Framework of the Study	43
2.10	Research Hypotheses	46
2.11	Summary	46
3	METHODOLOGY	47
3.1	Research Design and Approach of the Study	47
3.2	Locale of the Study	48
3.3	Population of the Study	52
3.4	Sample Size and Sampling Procedure	52
3.5	Data Collection Instrument	55
3.6	Response Scale	56
3.7	Measurement of Variables	57
3.8	Pilot Survey	59
3.9	Data Collection Procedure	61
3.10	Data Analysis Procedure	62
3.10.1	Descriptive analysis	62
3.10.2	Pearson Correlation Analysis	63
3.10.3	Multiple Linear Regression Analysis	64
3.11	Ethical Issue	66
3.12	Summary	67
4	RESULTS AND DISCUSSION	69
4.1	Demographic Profile of Farmers	69
4.2	Farm Profiles	72
4.3	Level of Independent Variables	75
4.3.1	Knowledge of Farmers	76
4.3.2	Attitude of Farmers	76
4.3.3	Ease of Use of Technology	77
4.3.4	Motivation of Farmers	78
4.4	Level of Dependent Variable	81
4.4.1	Farmers' Work Performance in Fertilizer Application on Rice	81

4.5	Relationship between Independent and Dependent Variables of the Study	82
4.6	Contribution of Independent Variables on the Dependent Variable of the Study	88
4.7	Summary of the Major Findings	96
4.8	Summary	98
5	SUMMARY, CONCLUSION, AND IMPLICATION	99
5.1	Summary	99
	5.1.1 Background and Objectives of the Study	99
5.2	Conclusions	100
5.3	Implications	102
	5.3.1 Theoretical Implications	103
	5.3.2 Practical Implications	104
5.4	Limitations	106
5.5	Suggestions for Future Research	107
	REFERENCES	109
	APPENDICES	149
	BIODATA OF STUDENT	161
	LIST OF PUBLICATIONS	162

LIST OF TABLES

Table	Page
1.1 Present status of Aus, T. Aman and Boro season	4
3.1 Basic agricultural information of Gobindaganj, Palashbari and Sadullapur upazilas	52
3.2 The distribution of population and sample in twenty one (21) villages under three (3) Upazilas of Gainabdha district with a reserve list	54
3.3 Description of variables used in the analysis	58
3.4 Rules of thumb for reliability value	60
3.5 Reliability coefficient pre-test	61
3.6 Reliability coefficient of final test	62
3.7 Summary of the overall mean level of five-point Likert scale Instrument	63
3.8 The overall mean level of five-point Likert scale of farmers' attitude	63
3.9 Interpretation of strength or magnitude of the correlation coefficient	64
3.10 Summary of performed statistical analysis according to the objectives of the current study	67
4.1 Demographic profile of farmers	70
4.2 Farm profile of farmers	73
4.3 Distribution of the farmers according to their level of knowledge in fertilizer application on rice	76
4.4 Distribution of the farmers according to their level of attitude in fertilizer application on rice	77
4.5 Distribution of the farmers according to their level of ease of use of technology in fertilizer application on rice	77
4.6 Distribution of the farmers according to their level of motivation in fertilizer application on rice	78
4.7 Distribution of the farmers according to their level of work performance in fertilizer application	81

4.8	Pearson Correlations of knowledge, attitude, ease of use of technology and motivation of farmers with their work performance in fertilizer application on rice	83
4.9	Coefficients of multiple linear regression for farmers' work performance in fertilizer application on rice	89
4.10	Table of Analysis of variance (ANOVA)	92
4.11	Table of multiple linear regression model summary	92
4.12	Summary of the level of independent variables and the dependent variable of the study	96
4.13	Summary of testifying the research hypotheses of the study	97

LIST OF FIGURES

Figure		Page
1.1	Trends of rice production and rice cultivated area over time in Bangladesh	3
1.2	The actual farm yield and potential farm yield of clean rice in Bangladesh showing a yield gap of 0.83 t/ha or 20.7%	4
1.3	The percentage contribution of organic matter, fertilizer and soil for rice production	6
1.4	Trends of fertilizer use (000 ³ MT/Year) during 2007-08 to 2017-18	7
2.1	Dimensions of work performance	29
2.2	Ability, Motivation and Opportunity (AMO) Model	30
2.3	Technology Acceptance Model (TAM)	31
2.4	Theoretical Framework	43
2.5	A research framework for the study	44
3.1	Map of Bangladesh showing the study area	49
3.2	Map of Gaibadha district of Bangladesh showing sub-district (Upazilla)	50

LIST OF ABBREVIATIONS

AMO	Ability-Motivation-Opportunity
ANOVA	Analysis of Variance
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh Taka
BRI	Bangladesh Rice Research Institute
BTS	Bartlett's Test of Sphericity
DAE	Department of Agricultural Extension
EFA	Exploratory Factor Analysis
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FRG	Fertilizer Recommendation Guide
FY	Fiscal Year
GDP	Gross Domestic Product
GOs	Governmental Organizations
GRiSP	Global Rice Science Partnership
HRM	Human Resource Management
HYV	High Yielding Variety
IRRI	International Rice Research Institute
ISFM	Integrated Soil Fertility Management
KMO	Kaiser-Meyer-Olkin
LCC	Leaf Colour Chart

MADA	Muda Agricultural Development Authority
MIS	Management Information System
MoA	Ministry of Agriculture
MP	Muriate of Potash
NGOs	Non-governmental Organization
NPK	Nitrogen, Phosphorus, Potassium
OM	Organic Matter
PEU	Perceived Ease of Use
PU	Perceived Usefulness
R&D	Research and Development
SAAO	Sub Assistant Agriculture Officer
SAARC	South Asian Association for Regional Cooperation
SEM	Small and Medium Enterprises
SPSS	Statistical Package for the Social Sciences
SRDI	Soil Resources Development Institute
T. Aman	Transplant Aman
TAM	Technology Acceptance Model
TSP	Triple Super Phosphate
UAO	Upazila Agriculture Officer
USG	Urea Super Granule
VIF	Variance Inflation Factor

CHAPTER 1

INTRODUCTION

The justification for undertaking the study entitled 'Interrelationship of farmers' knowledge, attitude, ease of use of technology, motivation and work performance in fertilizer application on rice in Bangladesh' is described in this introductory chapter. It consists the background of the study, problem statement, research questions, and research objectives of this study. This section also highlights the scope, significance, assumptions, and organization of the thesis and chapter summary.

1.1 Background of the Study

Bangladesh is a very small country of 147570 square kilometres with a population of 162.7 million, however, only 8.0 million hectares are cultivable land (Bangladesh Bureau of Statistics, 2018). Agriculture is the dominant economic source and is considered the major source of Bangladesh economy. It plays prominent roles starting from food production, poverty reduction to sustainable development. The agriculture sector contributes about 14.23% to the total Gross Domestic Product (GDP) from which 10.66% comes from the crop sub-sector (Bangladesh Economic Review, 2018). Among the rural inhabitants, an overwhelming majority (87%) derive at least a portion of their income from agricultural activities (World Bank, 2016). Therefore, agriculture is considered as one of the dominant driving forces of its growth and development. The continuation of the growth of this sector is important to ensure food supply for its ever-increasing population and to provide income for the rural people of Bangladesh.

Rice cultivation has a long tradition in Bangladesh. Rice-based agriculture in the country is persistent because rice is the staple food. Bangladesh's food security largely depends on rice production. Rice plays the leading role by contributing 92% of total food grain production (Chowdhury *et al.*, 2015). Rice is cultivated throughout the country, with the exception of the hilly areas in the south-east part. The country's agro-climatic conditions are perfect for cultivating rice all year (Sultana *et al.*, 2015). However, the population growth rate in Bangladesh is 2 million per year. Hence, it is important to increase total rice production to feed the growing population of the country. Simultaneously, due to the development of roads, highways, factories and homes, the amount of arable land is decreasing at a rate of more than 1% per year (Shelley *et al.*, 2016). Moreover, rice-growing land needs to be share for cultivating new crops. Therefore, efforts are intensified to increase rice yield per unit area.

Apart from this, small farmers constitute a significant proportion (84%) of the farming community in Bangladesh, directly involved with crop production related activities (Mondal, 2010). However, owing to poor management practises, these farmers produce lower rice yields. The situation becomes complicated when the farmers apply inputs,

particularly expensive phosphorus (P) and potassium (K) fertilizers, at much lower rates than the recommended levels and ultimately lower the yield. Farmers would be able to achieve optimal yields if they follow recommended packages, such as applying balanced fertilizer at the appropriate time. The implementation of recommended production technology at the farm level has a lot of potential for increasing yield and net return. This can be ensured by using a balanced fertilizer to improve rice yields and minimise the yield gap that currently exists.

Furthermore, improved management practices like fertilizer and improved seeds resulted in farming households increased farm production and incomes (Rapsomanikis, 2015). It is critical that recommendations on the application of balanced fertilizers to rice not only be economic-efficient to farmers, but also fit into their knowledge systems and allow for sufficient experimentation and learning.

1.1.1 Rice Statistics in Bangladesh

Bangladesh is considered as the world's 4th largest country regarding rice cultivating area and production (FAO, 2018). Rice is the staple food for the people and continue to remain so in the future. It grows in all the three crop growing seasons of the year namely Aus (March-July), Aman (June-November) and Boro (November-May). Rice covers approximately 77% of the total cultivated area, including 84.67% of modern varieties and 15.33% of the local varieties (Salam *et al.*, 2014). Moreover, it solely contributes approximately 92% of the country's overall annual food crop. (Chowdhury *et al.*, 2015). Henceforward, rice becomes the leading crop sub-sector in agriculture. It contributes significantly to farmers' farm and non-farm profits. At present, the coverage of High Yielding Varieties (HYVs) and Hybrid varieties of rice increased from 2631 thousand hectares in 1983-84 to 9685 thousand hectares in 2015-16 (BBS, 2018). Total rice production has increased between the year 2008-09 and 2018-19 (Figure 1.1).

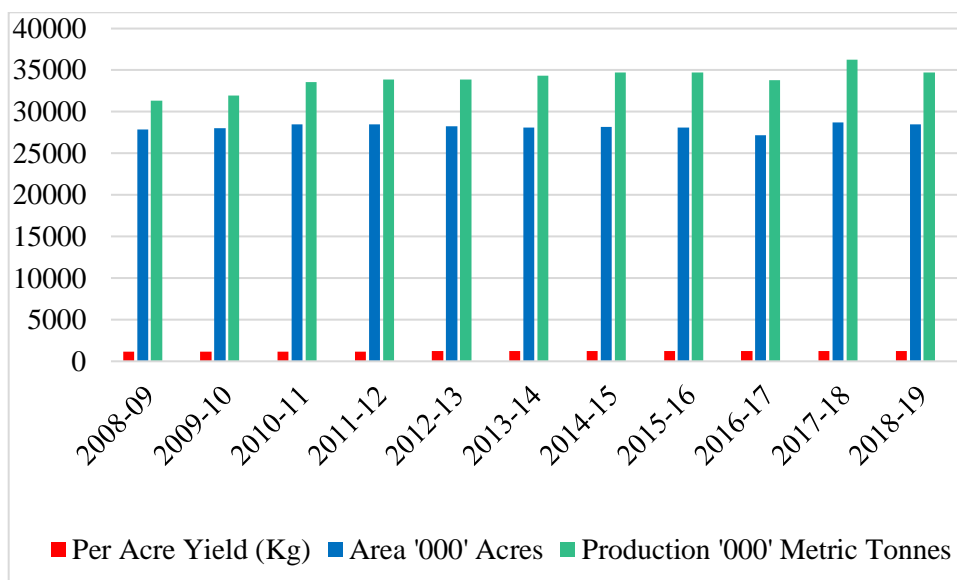


Figure 1.1 : Trends of rice production and rice cultivated area over time in Bangladesh
(Source: BBS 2020)

According to BBS (2020), the volume of rice production in Fiscal Year (FY) 2008-09 was 31317 '000' MT. Rice production gradually increased till FY 2017-18 was 36278 '000' metric tonnes. Increasing rice production is a collective effort of high yielding rice varieties of rice with large amounts of fertilizer application and a wide range of rice fields with adequate irrigation water (Naher *et al.*, 2015). However, the production of rice decreased to a level of 34718 '000' MT in FY2018-19.

At Present total area for Aus, Transplant (T.) for Aman and Boro is 11.52 million hectares. The total area for T. Aus is 1.11 million hectares, T. Aman area is 5.62 million hectares, and Boro area is 4.79 million hectares. The average yield of Aus is 2.29 t/ha and total Aus production 3.06 million ton. The average yield of T. Aman is 2.48 t/ha and total Aman production is 15.49 million ton. Moreover, the average yield of Boro is 4.07 t/ha and total Boro production is 21.56 million ton (Table 1.1).

Table 1.1 : Present status of Aus, T. Aman and Boro season

	Area (million ha)	Yield (ton/ha)	Production (million ton)	% of total production	% of total area
Aus	1.11	2.29	3.06	7	10
Aman	5.62	2.48	15.49	39	49
Boro	4.79	4.07	21.56	54	41
Total	11.52	3.11	40.11	100	100

(Source: BBS 2020)

Rice security is closely related to food security in Bangladesh (Brolley, 2015). The implementation of several approaches for improve the production of rice and achieve a high rice volume in the country. They practice quality seeds from modern cultivars instead of local varieties, improved cultivation technologies, coverage of rapid irrigation and fertilizer distribution along with developed infrastructures (Bangladesh Rice Knowledge Bank, 2017).

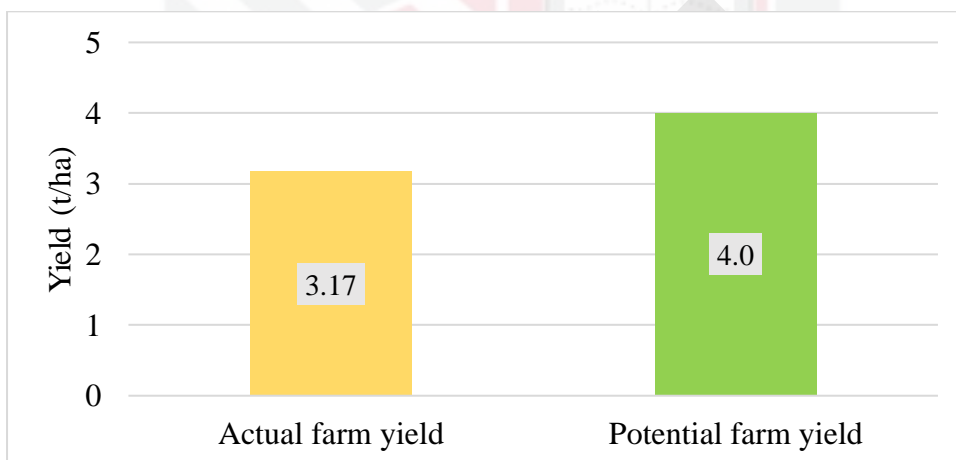


Figure 1.2 : The actual farm yield and potential farm yield of clean rice in Bangladesh showing a yield gap of 0.83 t/ha or 20.7%

(Source: Kabir *et al.* 2015)

However, there is a significant on-farm yield gap at the farmers' level (Kabir *et al.*, 2015) (Figure 1.2). The key cause for the present yield gap is lower soil fertility and poor fertilizer use (Maene & Bunoan-Olegario, 2015). Bangladesh's food security is critically dependent on adequate abundance and accessibility of rice all year round. Therefore, appropriate measures should be taken to enhance the yield of rice per unit area to ensure the supply of the necessary food for its increasing population.

1.1.2 Nutrient Deficiency in Soils of Bangladesh

Soil fertility is not a constant function. It varies depending on how the plant nutrients are used and the intensity of using the crop land. Moreover, intensified crop land use without adequate plant nutrient replenishment resulted in soil fertility degradation. In Bangladesh, the unbalanced fertilizer application accelerate nutrient deficiency. It also increases cropping intensity, depletion of soil organic matter, nutrient leaching and so on (Jahiruddin & Satter, 2010). The depletion of nutrients is estimated to affect about 65% of Bangladesh's agricultural land (SAARC Agriculture Centre, 2011).

In Bangladesh, six mineral elements such viz nitrogen, phosphorus, potassium, sulphur, zinc and boron are deficient in soils. The most common deficiency is nitrogen (N), which is present in almost all Bangladeshi soils. In Bangladesh, phosphorus is the second utmost essential nutrient (after nitrogen) limit the production of crops. Nitrogen and phosphorus deficiency are common in Bangladesh, with a high rate of deficiency in crop-growing areas (Islam & Muttaleb, 2016; Sultana *et al.*, 2015). Moreover, potassium level in Bangladesh soil is also alarming; as its reserve of any soil is certainly limited (Saha, *et al.*, 2009; Miah *et al.*, 2008).

Before the 1980s, the key problem in Bangladesh is the deficiency of NPK. However subsequently, sulphur and zinc deficiencies were frequently registered. (Sohela *et al.*, 2016; Haque & Jahiruddin, 1994). Deficiency of other nutrients like sulphur, zinc, and boron appear with an increase of cropping intensity throughout the country (Fertilizer Recommendation Guide, 2012). The micronutrients like zinc (64% decline) and boron (82% decline) depleted reaching their critical level during the period 1991 to 2012 and caused crop yield decline (Karim & Aktar, 2015). Besides, copper, molybdenum and manganese are deficient in crops sporadically (Sarker *et al.*, 2020; Ferdoush *et al.*, 2003). The deficiency of micronutrients is more apparent as cropping intensity and High Yielding Variety (HYV) crop production increase. Due to the traditional farming system, certain plant nutrients exceed at critical levels (Siddique *et al.*, 2014). A better quality of soil is important for farm productivity, and to address the constraints related to soil fertility in an integrated way is essential for achieving sustainable crop production. Therefore, to achieve a high yield of various crops in all growing seasons of Bangladesh, the proper application of fertilizers is implemented.

1.1.3 Fertilizer Utilization Scenario in Bangladesh

Balanced fertilization is a crucial factor for the sustainable production of a crop. It is a very imperative input for the production of rice intensively. The amounts of yield and required inputs determine the profit of rice production systems. Hence, to obtain maximum grain yield and to attain the highest profitability, it is essential to apply appropriate fertilizer into the soil (Khuang *et al.*, 2008). Fertilizer is the most important factor in crop production because it supplies soil nutrients (nitrogen, phosphorus, zinc and potassium). It contributes up to 75% of the overall production of food (Roberts & Tasistro, 2012). Moreover, approximately more than 75% of total fertilizers are used for

rice production (Basak *et al.*, 2015; Basak, 2010). Stewart *et al.*, (2005) stated that 27% decline in rice yield are observed due to the absence of nitrogenous fertilizer. Besides, the results of long-term experiments conducted by Aura, (2016) showed fertilizers increase output by 40-60% in grain production. Fertilizer alone added 43% to overall rice yield in Boro seasons and 26% in T. Aman seasons, Naher *et al.* (2011) obtained the results from their experiment (Figure 1.3). Apart from, Okoye *et al.* (2008) noticed that fertilizer is increasing the yield boundary that leading to higher rice productivity.

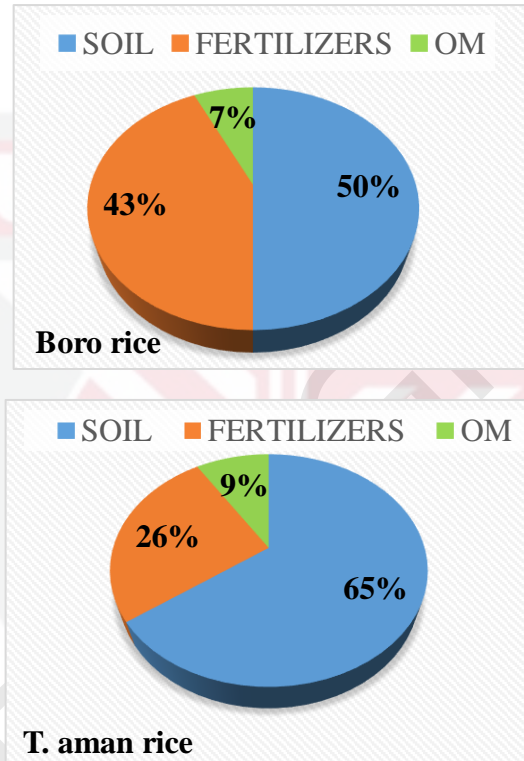


Figure 1.3 : The percentage contribution of organic matter, fertilizer and soil for rice production

(Source: Naher *et al.* 2011)

In Bangladesh, fertilizer is the key input of green revolution that signify the increase in rice production (Tomich *et al.*, 1995; Naher *et al.*, 2015). The most commonly used fertilizers in this country are Urea, Triple Super Phosphate (TSP) and Muriate of Potash (MP), of which urea constitutes about 75% of nutrient use (FRG, 2012). Nitrogen contributes significantly to the overall rice yield compare to phosphorus and potassium for the seasons of Boro and T. Aman rice. Furthermore, approximately 60% of the total annual fertilizer demand is utilized in the season of Boro rice which runs from January to March (Jahiruddin *et al.*, 2010). Also, the application of fertilizers in Bangladesh agriculture started with the application of urea and TSP in 1957-58 and Muriate of potash (MP) was included in the fertilizer schedule from 1960.

As time advanced, cropping intensity increases (195% at present). It is accompanied by the increasing cultivation of HYV crops. There is a growing demand for nutrients which was resulted in an increased nutrient deficiency in the crops. So, it is essential to apply nitrogen, phosphorus, and potassium in efficient way to achieve higher production of rice (Singh & Singh, 2017; Sisie & Mirshekari, 2011). Additionally, plant nutrients such as nitrogen, phosphorus, potassium, sulfur and zinc accounts for more than 92 % of the total rice production. As a result, fertilizer consumption increased is reflected in total consumption (Figure 1.4). The consumption was 3886 ‘000’mt in 2007-08, which decreased to a level of 2865.19 ‘000’mt in 2008-09 and then reached a maximum of about 5093.45 ‘000’mt in 2017-18 (Bangladesh Economic Review, 2018). Besides, along with urea, urea, phosphate and potash, the use of gypsum, zinc sulphate, and other micronutrients are also increased (Jaim & Akter, 2012).

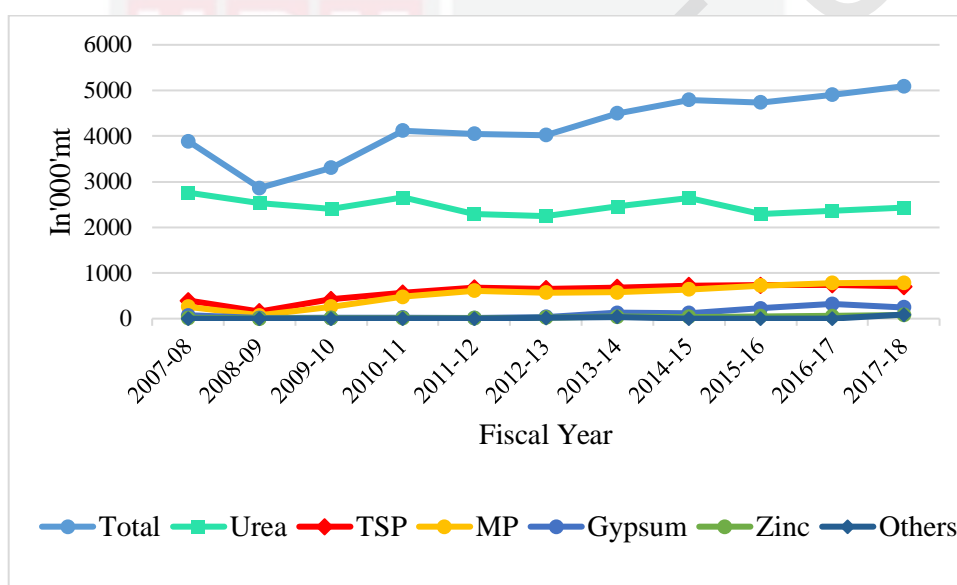


Figure 1.4 : Trends of fertilizer use (000'MT/Year) during 2007-08 to 2017-18
(Source: Bangladesh Economics Review 2018)

The high-yielding varieties demand for fertilizer application. It continues to grow in popularity with the increasing cropping intensity. However, the farmers of Bangladesh use only 179 kg of nutrients (N: 141, P: 13, K: 17 and S+ Zn+ B+ others: 8 kg)/ha/year, while the estimated removal is around 250-300 kg ha/year (Mostafa, 2014; Karim *et al.*, 1994). It creates an imbalance that becomes apparent at a national level. Additionally, Hidayah (2013) explained that 51% of farmers applied fertilizer as recommended whereas 47% less than the recommended and 2% of them not as recommended. Hence, till now, the actual rate of nitrogen fertilizer is less than the recommended rate. The gap between the actual rate and recommended rate is more significant for TSP and MP (Sultana *et al.*, 2015). This gap leads to a nutrient imbalance in the soil-plant system (Basak, 2010).

1.1.4 Agricultural Extension and Work Performance

Rice production plays a vital role in a nation's agricultural sector (Athukorala, 2017). Bangladesh needs to increase the growth in rice productivity (at least 20% greater than the current rice yield) to meet the demand of food-grain for the growing population (Rahaman *et al.*, 2019). There is a high level of inefficiency in rice production due to inefficient application of agricultural technology like fertilizer (Biswas *et al.*, 2021; Rahman, 2003). Despite extensive experience with fertilizers, farmers in Bangladesh are still struggling to use them effectively (Mottaleb *et al.*, 2019). In contrast, there is a possibility of increasing productivity through the application of appropriate technologies, the improvement of farmer performance, or a combination of both factors. (Adem & Gebregziabher, 2014; Parveen, 2010). Therefore, farmers need agricultural extension service to substantially influence the work performance of the farmers in applying appropriate technologies (Anik & Salam, 2017; Elias *et al.*, 2014).

Agricultural extension is a vital part of agriculture development. It improves farming knowledge to increase the production of crops and work performance. Farmers improve their limited ability through modern agricultural technologies, and the agricultural extension. Moreover, farmers require an agricultural extension to facilitate the increased of productivity and income. The farmers expedite the diffusion process of technologies such as fertilizer management to boost the productivity. (Athukorala, 2017; Birkhaeuser *et al.*, 1991).

The agricultural extension service provides consultation to promote productivity through its agents (Haile *et al.*, 2018). It utilizes modern technologies (Uddin, 2008). In this regards, extension agents play an important role in disseminating agricultural technologies among farmers and help them to make decisions about appropriate ways of farm management (Anesukanjanakul *et al.*, 2019). Extension workers are the front-line extension personnel who directly communicate with farmers and help them in solving different farm-related problems. They also motivate farmers to adopt improved agricultural technologies (Okwoche & Asogwa, 2012). They link agricultural policy, agricultural research, agricultural education and training to the non-governmental organizations (NGOs), farmer organizations and private sector stakeholders. Therefore, extension workers need the skill, knowledge, and technological understanding, skillset and ability to improve work performance among the farmers (Armstrong, 2006; Liles & Mustian, 2004).

A good performance of agricultural extension impact the farmers in improving their performance and boosting of farm production. Extension performance solves problems faced by the farmers in the farm activities. Development of agriculture depends on provision of quality extension services (Agholor *et al.*, 2013; Qamar, 2005). Moreover, in the less developed countries like Bangladesh, agricultural extension activities focus on the performance of the field extension agents (Athukorala, 2017).

Despite inadequate resources and lacking supports, agricultural extension of Bangladesh has the potential to improve agricultural productivity through transfer and facilitation of technologies, knowledge, and skills. Their determination ultimately improve farmers' technology application and work performance.

1.1.5 Work Performance of Farmers

Work performance means the level of success in performing a task and the capability of an individual in achieving previously set goals (Gibson, 2003). An individual's work performance is the extent to which duties and responsibilities are carried out (Ramawickrama *et al.*, 2017). Others added several highlighted elements to this concept and considered it as an individual behavior. People work performance is a particular behaviors that are observed and measured in terms of skills and abilities (Díaz-Vilela *et al.*, 2015; Campbell *et al.*, 1996). Outstanding performance requires an alignment of behavior with wisdom and science, skills, and competence to work effectively in a work activity (Armstrong, 2008). In other words, work performance includes actions and behaviours that are relevant to individual's goals and is measured as an individual's proficiency. Thus, work performance includes those behaviors that are relevant to achieve particular goal, are under individual control that can be observed and measured.

Moreover, work performance is the results achieved by roles within a defined period of time (Bernardin & Russell, 2013). To be specific, individual work performance is based on work behaviors but it must meet certain criteria (Ramawickrama *et al.*, 2017). It includes general work skills (Rani, 2015). Therefore, it can be said that work performance is the extent to which the respondent has shown his or her traits, engaged in behaviors and produced results which are appropriate to perform a particular task.

In case of farmers, work performance represents the ability of farmers in carrying out farm activities that effectively lead in production (Demba, 2017). In this context, farmers can add value either directly designing or implementing a part of its technological process such as creating poison pump himself, always asking a successful person, or indirectly by providing knowledge support about rice farming (Shah, 2016).

Fertilizer is a key component in the agricultural production systems of Bangladesh (Rahman, *et al.*, 2011). It is one of the critical inputs used in improving smallholder food and agricultural productivity (Burke *et al.*, 2019). Initially, the farmers are not aware of fertilizer use for production of crops as well as proper maintenance of soil fertility. Gradually, they are well acquainted with the need for fertilizer for crop nutrition (Rahman *et al.*, 2009). As a result, chemical fertilizers consists of more than 75 percent of total fertilizers used for rice production (Basak *et al.*, 2015; Basak, 2010).

Although intensive rice production depends on soil nutrient recapitalization; unbalanced use of fertilizers is the most crucial factor of fertilizer management issue in Bangladesh (Sultana *et al.*, 2015). The farmers have not utilized the fertilizer as recommended by agricultural production practices. The farmers have limited experiences with fertilizer. They started with nitrogen (i.e. urea), and were gradually exposed to phosphate fertilizer. They lack the knowledge using fertilizers. Moreover, they are not aware of the deficiency of micronutrients like Zinc (Zn), Sulphur (S) cause reduction of yield. They also neglect the expensive and high quality fertilizers such as MP, Zinc etc., although these fertilizer are required in small amounts compare to nitrogenous fertilizer.

This trend of fertilizer use is worrying because without significant application of fertilizers it is not possible for the production of food to keep up with demand from a rapidly growing population (Olagunju & Salimonu, 2010). The farmers' application rate for all three fertilizers (Urea, TSP and MP) is always lower than the recommendation, and farmers obtain lower level of yield. Dissatisfied yield is the result of poor management.

1.1.6 Selected Influential Factors of Work Performance

Work performance is mentioned as quantity and quality of the output of each individual who is working to achieve a specific goal (Ramawickrama *et al.*, 2017). This work performance is differently defined. It is measured in different disciplines in different ways due to its complexity. Koopmans *et al.* (2011) have conducted a study on individual work performance in different research fields, including occupational health, psychology and management. They proposed to conduct empirical studies for future researchers associating with different types of professions. Individual work performance is a key variable in work psychology. It works as an outcome or a consequence of many variables in many studies. Individual performance is mainly treated as a dependent variable (Philippaers, 2016; Muindi *et al.*, 2015; Hettiarachchi & Jayarathna, 2014). However, not many studies are conducted on work performance on the farming organization (Harif *et al.*, 2013; Sambodo, 2007).

Human behaviour like work performance is unpredictable. It differs from individual to individual, and on the part of same individual at different points of time (Ramawickrama *et al.*, 2017). Different studies found that no two farmers are the same, even from similar backgrounds and working on similar operations (Percy, 2012). Moreover, work performance is influenced by individual differences. It includes individual's abilities, personality and motivation (Rani, 2015).

A wide range of factors such as farmers' demographical, psychological, economic characteristics influence their performance behavior regarding agricultural practices (Zeweld *et al.*, 2017). Moreover, work performance is related to knowledge, skills, abilities, motivation, personality traits and other attributes (Ramawickrama *et al.*, 2017, Rani, 2015; Guzman, 2008). Due to the variation of those factors, work performance varies from person to person. Previous researchers identify a number of factors like

personality traits, commitment, job involvement, motivation, knowledge, satisfaction, farm management practices, socio-economic characteristics of the respondents as the predictors of individuals' work performance. However, farmers' cognitive (i.e., knowledge) and affective (i.e., attitude & motivation) responses and technological characteristics (i.e., ease of use) are essential factors that need to emphasize for applying agricultural technologies by the farming community.

Farmers' knowledge and attitude are essential for assessing their technology using behavior (Meijer *et al.*, 2015). Farmers with high-quality knowledge know what information they require, who to contact, and how to go about completing their chores (Lim *et al.*, 2013). Moreover, farmers' attitudes toward soils are critical when it comes to developing technologies and management treatments (Dawoe *et al.*, 2012). In addition, individuals' knowledge and attitude are treated as important determinants of performance (Rani, 2015; Pringle, 1994). Respondents' knowledge and their personal attitudes relevant to their tasks as are core factors that enhance their work performance (Oluikpe, 2012; Wauters *et al.*, 2010).

At the farm level, motivation is critical in the decision-making process by the farmers (Inwood *et al.*, 2013). Maintaining and improving individuals' motivation for a particular practice is a key topic for researchers, as motivation is ingrained in nearly every facet of performing a technology (Chiou, 2015; Kumarawadu, 2011). Adequate motivation is a crucial factor for higher performance (Choi, 2014). Additionally, motivation makes people to perform their work effectively (Ufuophu-Biri & Iwu, 2014).

Perceived attributes of certain practices such as easy to apply had the greatest influence on farmers' technology application decisions (Bwambale, 2015). The decision to use technologies is dependent on how farmers perceive technology. Farmers reject a technology that is not enough easy and not suited to their work environment (Sinjaa *et al.*, 2004). The perceived ease of use of technology is an important determinant for work performance (Kuo & Yen, 2009). Studies indicated that perceived ease of use is positively associated with continuance intention in the context of technology application (Chiu & Wang, 2008).

Moreover, to provide a theoretical basis for work performance, researcher employed the theory of work performance (Blumberg & Pringle, 1982), Ability, Motivation and Opportunity (AMO) model (Bailey, 1993) and Technology Acceptance Model (TAM) (Davis, 1985). According to the theory of work performance, people knowledge and attitude directly anticipates their work performance. While, Ability, Motivation and Opportunity (AMO) model explained that appropriate motivation is essential to perform better by the respondents. Moreover, the Technology Acceptance Model (TAM) is a comprehensive model for explaining work performance related to technology use like fertilizer application by the farmers. According to this model, perceived ease of use technology is critical for an individual's work performance when it comes to technology application, since it has a substantial impact on the individual's actual usage behavior (Kuo & Yen, 2009).

Hence, the researcher selected knowledge, attitude, ease of use of technology and motivation as influential factors for determining farmers' work performance in fertilizer application on rice. Moreover, prior studies considered farmers' knowledge, attitude, ease of use of technology and motivation in a single study rather examining their roles in separate studies, especially in the context of farmers.

In addition, the researcher believe that eliciting the extent of farmers' work performance in fertilizer application develop a better understanding of the types of policies to stimulate farmers' work performance regarding fertilizer application in the future. Previous researchers (Bagum *et al.*, 2019; Oluwatoyin, 2019; Demba, 2017; Shah, 2016) found the contributing factors on respondents' work performance and recommended guidelines to identify intensified areas to improve work performance of concerned people. Therefore, it is crucial to explore the factors that influence and strengthen the work performance of farmers in fertilizer application.

1.2 Problem Statement

The production of rice grains shapes the performance of the agriculture sector in Bangladesh. However, the national average rice yield (2.60 t/ha) is much lower than the potential national yield (5.40 t/ha) and compared to other rice-growing countries (Jahan *et al.*, 2015). The population of Bangladesh is 162.7 million. The populace will increase to 189.85 million by the year 2030, and thus, about 42.50 MT of rice is required for the people (BBS, 2016). Moreover, the rate of population growth and the level of rice consumption are relatively high. The current rice yield of 2.74 t/ha, needs to be increased to 3.74 t/ha (Bangladesh Rice Knowledge Bank, 2017), to keep the production of rice in line with the growing population of the country. However, a gap, ranging from 1 to 3 t/ha, exists in between yields currently obtained by farmers and what could be achieved with improved management practices (Kabir *et al.*, 2015). Rice farming faces challenges with stagnated overall production at a low level (Chen *et al.*, 2014; Pandey *et al.*, 2010).

Balanced fertilization is the key factor to enhance the production of rice. The development of high-yield rice is responsive to fertilizer (Masum *et al.*, 2018). Moreover, with appropriate fertilizer application technology, farmers can increase rice yields (Semeon *et al.*, 2013; Hu *et al.*, 2007). Therefore, the timely application of fertilizer by farmers at the recommended rate is essential for improving rice yield.

However, the current level of applying fertilizer is significantly lower than the recommended levels for almost all food crops. Farmers resort to apply imbalanced fertilization that does not well match the nutrients requirement and soil fertility rates (Yousaf *et al.*, 2017). About 51% of farmers applied fertilizer as recommended and the rest of them were used less than the recommended rate (Hidayah, 2013). Moreover, farmers often apply nitrogenous fertilizer at rates and times not well matched to the needs of the crop (Merkebu & Amsalu, 2018; Buresh & Timsina, 2008). At the farm level, a substantial gap exists between the actual and recommended rate of all major fertilizers applied in rice cultivation (Sultana *et al.*, 2015; Shah *et al.*, 2008). The gap between the

recommended rate and actual amount of fertilizer application is much higher for TSP and MP compared to Urea. The farmers' fertilizer applications contrast sharply with the extension recommendations. Furthermore, general farmers hardly use fertilizer based on the recommendation from the Soil Resource Development Institute (SRDI) and Department of Agriculture Extension (DAE) of Bangladesh (Sultana *et al.*, 2015).

As a result, the imbalance of soil nutrients increased, which is the major cause of the stagnation in rice yields. Inefficient use of inputs like fertilizer results in leading to soil degradation and lower productivity (Basak *et al.*, 2015). A deficit of some nutrient elements have a detrimental effect on crop performance and yield (Francini & Sebastian, 2019). Furthermore, the unbalanced use of fertilizers and inadequate attention given for soil improvement and maintenance made the situation difficult (Ali *et al.*, 2017).

A large potential exists to increase rice yield; however, inefficient and imbalance fertilizer use is one of the most limiting factors (Singh & Singh, 2017; Kashem & Faroque, 2011). Individual's performance towards efficient use of fertilizer application close the gap between actual and potential outputs (Bagum *et al.*, 2019; Amegnaglo, 2018; Audibert, 1997). Peoples' work performance is highly influenced by their ability to use knowledge and skills for a required task (Khan & Nawaz, 2016). Therefore, farmers' work performance signifies their ability to carry out farm activities that lead to higher production (Demba, 2017). Moreover, farmers can increase rice yields by improving the timing of fertilizer application (Islam, 2015). In addition, farmers need to apply the recommended rate of fertilizer, at the proper time and method to sustain agricultural production (Hameed & Sawicka, 2017). Hence, to gear up the production of rice, farmers are encouraged to improve their work performance to adopt and apply balanced fertilization on rice. The improvement of farmers' work performance in Bangladesh has become an emergency due to the rapid increase in population and food demand.

To benefit the farmers from agricultural research, it is crucial to consider the farmers' knowledge, needs and aspirations as a starting point (Altieri, 2002). Practically, farmers are habituated to apply imbalanced fertilization that cannot meet the demand for soil nutrients and yield of rice (Yousaf *et al.*, 2017). It implies that farmers' work performance to apply fertilizer is insufficient with the requirement of crops. Therefore, there is a gap between the actual rate and the recommended rate of fertilizer (Sultana *et al.*, 2015; Basak, 2010). Research on fertilizer issues is conducted (Cui *et al.*, 2010; Ladha *et al.*, 2005; Hite *et al.*, 2002); however, only a few research is conducted on farmers' work performance towards applying better technology (Demba, 2017; Nkari & Kibera, 2016; Hassan, 2015).

Moreover, knowledge, attitude, ease of use of technology, and motivation are crucial factors that are emphasized for the application of agricultural technologies by the farming community (Meijer *et al.*, 2015; Bwambale, 2015; Inwood, *et al.*, 2013). However, prior studies did not consider farmers' knowledge, attitude, ease of use of technology and motivation in a single study rather examined their roles in separate

studies, especially in the context of farmers. Therefore, the combined effect of those determinants is quite unknown.

Furthermore, the theory of work performance, Ability, Motivation, Opportunity (AMO) model and Technology Acceptance Model (TAM) are still rarely utilized for applying agricultural technology (Sharifuddin *et al.*, 2018; Janudin *et al.*, 2007). In addition, applying the theory of work performance, AMO model and TAM model all together to investigate farmers' work performance is very new. Apart from this, very few research is conducted on the extent of farmers' work performance in fertilizer application on rice and how various factors interact in the context of Bangladesh. To fill up the practice, research and theoretical gap, this study is formulated to determine the interrelationship of farmers' knowledge, attitude, ease of use of technology, motivation and work performance in fertilizer application on rice in Bangladesh.

1.3 Research Questions

The research questions for this study were:

- 1) What is the extent of farmers' work performance in fertilizer application on rice?
- 2) What are the factors that influence farmers' work performance in fertilizer application on rice?
- 3) What are the relationships between the selected factors of farmers and their work performance in fertilizer application on rice?
- 4) What is the contribution of the selected factors to farmers' work performance in fertilizer application on rice?

1.4 Research Objectives

The overall objective of the present study was to investigate the interrelationship of farmers' knowledge, attitude, ease of use of technology, motivation and work performance in fertilizer application on rice in Bangladesh. The specific objectives were:

- 1) To assess the level of knowledge, attitude, ease of use of technology and motivation of farmers in fertilizer application on rice in Bangladesh.
- 2) To determine the level of farmers' work performance in fertilizer application on rice in Bangladesh.
- 3) To explore the relationships of knowledge, attitude, ease of use of technology and motivation of farmers with their work performance in fertilizer application on rice in Bangladesh.
- 4) To investigate the contribution of knowledge, attitude, ease of use of technology and motivation of farmers to their work performance in fertilizer application on rice in Bangladesh.

1.5 Significance of the Study

It is often stated that the soils of Bangladesh are the most fertile in the world. However, the deficiencies of critical elements have arisen in rice and other crops because of intensive cultivation. There is a need to supplement the nutrients for high yields of rice. Fertilizer use leads to higher economic growth through increased output by 40-60% in grain production (Aura, 2016). On the contrary, the inefficient application of fertilizer causes soil degradation and lowers productivity (Basak *et al.*, 2015). Considering the above situation, it is logical and vital to understand farmers' work performance in fertilizer application on rice and to determine the factors that influence their work performance in applying fertilizer on rice in Bangladesh.

To know and seek field problems, the selection of farmers as a target population is noteworthy; since they are the direct spectators at the field level. They have many years of practical experience and have seen the changes that occur in the field of agriculture. Sustainability in agriculture remain a mirage unless farmers on the ground realize the problem correctly in time. Furthermore, farmers make a major contribution to reducing hunger and poverty by increasing their productivity and incomes.

The empirical study is significant because it determines the current level of farmers' work performance in fertilizer application and also involves the variable knowledge, attitude, ease of use of technology and motivation of farmers that so far have never been conducted previously in the context of Bangladeshi. Thus, this study provides new insights to fill the gaps of previous studies on farmers' work performance in fertilizer application. The study also contributes to the current literature regarding farmers' work performance in fertilizer application and their significance in rice farming locally and globally.

The findings are beneficial in a number of ways. At first, these could assist policymakers in designing more effective policies to increase the fertilizer application at optimal level by farmers on rice cultivation. Moreover, the findings can be helpful for the academicians and extension experts to improve their studies and extension activities. Additionally, the government's effort would be pointless, if the farmers do not apply the fertilizer extensively at an optimal level. Therefore, an understanding of farmers' work performance in fertilizer application is important. This study aims to fulfil this important task.

1.6 Scope of the Study

The scope of this study is investigating the interrelationship of farmers' knowledge, attitude, ease of use of technology, motivation and work performance in fertilizer application on rice in Bangladesh. Fertilizer is an essential element for improving rice yield. There is a requirement for more understanding of the current level of farmers' work performance in fertilizer application that enhances the country's rice production.

The scope of the study, therefore, obviously includes an investigation of several factors relevant to farmers' work performance in fertilizer application on rice.

This study is carried out in the district of Gaibandha, one of the most intense rice-growing area of Bangladesh. Identifying the factors that influence farmers' work performance in fertilizer application on rice is the main objective of this study. There are a number of factors that effect on the application of fertilizer. A factor that improves the application of a certain technology in one crop and location at one time impede or e insignificant to the work success of farmers using the same technology in a different crop or location at the same or different time. Consequently, it is challenging to recognize universal factors that hinder or improve the work performance of farmers in fertilizer application. Therefore, this study seems to be important to explore those contextual factors.

The findings are especially beneficial for farmers who grow rice. The study findings, however, may also have implication for other areas in Bangladesh as well as other countries where the socio-economic conditions of farmers, agricultural systems and geographical conditions are close to those in the study area.

1.7 Assumptions

The researcher considers the following assumptions while executing this study.

1. The respondents chosen for the study were sufficiently capable to answer the questions made by the researcher.
2. The selected respondents were able to furnish suitable responses to the questions comprised in the questionnaire.
3. The opinions and outlooks provided by the selected farmers were the representative opinions and outlooks of other farmers in the field of study.
4. The data collected by the researcher from the respondents were free from biases.
5. The objects and scales used to measure the variables were fairly sufficient to represent the real views and opinions of the respondents.
6. The data for the study was valid and reliable.
7. The study findings were predicted to be helpful for planning and executing various extension programs for improving the efficient application of fertilizer by farmers and increasing rice production in the country.

1.8 Definitions of Key Terms

(a) Work Performance

Conceptual Definition: The work performance of an individual can be defined as the actual things of what people do and a series of events or activities towards achieving the ultimate goal (Campbell & Wiernik, 2015).

Operational Definition: The extent of farmers' aptitude in applying fertilizer effectively according to optimal rate, time and method to enhance the production of rice.

(b) Knowledge

Conceptual Definition: Knowledge refers to the aggregation of facts and information which is strengthened through experts' opinion, skills and experience (Semeon *et al.*, 2013).

Operational Definition: Knowledge refers to the extent of farmers' awareness (understanding) level based on the construct of fertilizer application method, rate time and other management practices in rice farming.

(c) Attitude

Conceptual Definition: An attitude is either a positive or negative sense of readiness learned and structured through experience, which then exerts an effect on the particular person's reaction to people, objects, and situations (Hettiararchchi & Jayarathna, 2014).

Operational Definition: Attitudes refers to the extent of a farmer's positive or negative feeling associated with the construct of fertilizer application method, rate, time and other management strategies in rice.

(d) Ease of Use of Technology

Conceptual Definition: The degree to which an innovation seems to be easy to understand or apply is considered as perceived ease of use (Zeithaml *et al.*, 2002).

Operational Definition: Ease of use refers to the degree to which a farmer believes that application of fertilizer according to recommended or optimal rate, time and method and other management practices in rice is easy for them.

(e) Motivation

Conceptual Definition: Motivation is defined as an internal drive that stimulates people into action and direction to behaviour (Romando, 2008).

Operational Definition: Motivation refers to the inner state to which farmers' intentionally chose to engage in the application of fertilizer according to the recommended or optimal rate, time and method and other management strategies in rice.

(f) Upazila

Upazila is an administrative region in Bangladesh. They function as sub-units of districts. In Bangladesh, every Upazila has an Upazila Agriculture Office. The office plays a role as a source of information, training centre and other agricultural activities as assigned to them from regional or national level.

(g) Technology

Technology means innovations developed by the researchers, which are intended to improve agricultural productivity for high quality and quantity yield gains (Nordin *et al.*, 2014). According to farmers, technology refers to crop varieties and what kind of fertilizers are suitable for the soil (Chi & Yamada, 2002). Hence, fertilizer is considered as a technology that increases the yield of crops remarkably, alleviate food insecurity and improve environmental services (Meijer *et al.*, 2015).

(h) Fertilizer

Fertilizer is generally defined as any substance (chemical, organic and microbial) added to the soil supply elements required for the nutrition of the plant (BARC, 2012).

1.9 Organization of Thesis

This thesis consists of five (5) main chapters. Chapter one (1) highlights the study background, problem statement, research questions, research objectives, scope, significance and assumptions of the study. Chapter two (2) presents a brief overview of rice production and the significance of fertilizer on crops as well as several kinds of literature related to farmers' work performance and other influencing factors. Chapter three (3) describes the study area, population and sampling technique, data collection procedures, measurement procedures of farmers' work performance level and statistical analysis techniques. Chapter four (4) explores the key findings and discussion of the findings. This chapter elaborately described the findings related to the level of farmers' work performance as well as other influencing factors. Moreover, the relation and contribution of influencing factors on farmers' work performance are also discussed.

Finally, Chapter five (5) highlights the conclusions based on key results of this study and possible implications of the findings.

1.10 Summary

The reasons for investigating of this study entitled ‘Interrelationship of farmers’ knowledge, attitude, ease of use of technology, motivation and work performance in fertilizer application on rice in Bangladesh’ are describe in this introductory chapter. It also highlights the scope, significance of the study, and the organization of the thesis.



REFERENCES

- Abdullah, A., Bilau, A. A., Enegbuma, W. I., Ajagbe, A. M., & Ali, K. N. (2011). Evaluation of job satisfaction and performance of employees in small and medium sized construction firms in Nigeria. *2nd International Conference on Construction and Project Management IPEDR*. Singapore.
- Abdullah, D., Jayaraman, K., Shariff, D. N., Bahari, K. A., & Nor, N. M. (2017). The effects of perceived interactivity, perceived ease of use and perceived usefulness on online hotel booking intention: A conceptual framework. *International Academic Research Journal of Social Science*, 3(1): 16-23.
- Abdullah, F. A., & Samah, B. A. (2013). Factors impinging farmers' use of agriculture technology. *Asian Social Science*; 9(3): 120-124.
- Abdullah, S. N. S. (2014). *The Characteristics of Majority Paddy Farmers in MADA, Kedah*. (Doctoral dissertation). Universiti Putra Malaysia, Malaysia.
- Abebe, W. (2007). *Determinants of adoption of improved box hive in Atsbi Wemberta District of Eastern Zone, Tigray Region*. (Doctoral dissertation). Haramaya University, Ethiopia.
- Adem, M., & Gebregziabher, K. (2014). The effect of agricultural extension program on technical efficiency of rural farm households' evidence from northern Ethiopia: stochastic frontier approach. *International Researchers*, 3(3): 13-31.
- Adrian, A. M. (2006). *Factors Influencing Adoption and Use of Precision Agriculture*. (Doctoral dissertation). Auburn University, Auburn, Alabama, United States.
- Afzal, N., & Ahmad, S. (2009). Agricultural input use efficiency in Pakistan: key issues and reform areas. *Managing Natural Resources for Sustaining Future Agriculture Research Briefings*, 1(3): 1-12.
- Agbejule, A., & Saarikoski, L. (2006). The effect of cost management knowledge on the relationship between budgetary participation and managerial performance. *The British Accounting Review*, 38(4): 427-440.
- Agholor, I. A., Monde, N., Obi, A., & Sunday, O. A. (2013). Quality of extension services: a case study of farmers in Amathole. *Journal of Agricultural Science*, 5(2): 204-212.
- Akinbile, L. A., Akinwale, J. A., & Ashimolowo, O. R. (2007). Determinants of productivity level among rice farmers in Obafemi-owode local government area of Ogun State, Nigeria. *Journal of New Seeds*, 8(4): 79-90.
- Akrani, G. (2010). Motivation Motivational Factors Incentives Theories of Motivation. Retrieved March, 19, 2015.

- Aksoy, Y., Ayranci, E., & Gozukara, E. (2016). A research on the relationship between knowledge sharing and employee performance: The moderating role of unethical behaviors in organizational level. *European Scientific Journal*, 12(4): 335-352.
- Albaraccín, D., Johnson, B. T., & Zanna, M. P. (2005). *The Handbook of Attitudes*. New Jersey: Lawrence Erlbaum Associates Inc.
- Alem, H., Lien, G., & Hardaker, J. B. (2018). Economic performance and efficiency determinants of crop-producing farms in Norway. *International Journal of Productivity and Performance Management*, 67(9): 1418-1434.
- Alessandri, G., & Vecchione, M. (2012). The higher-order factors of the Big Five as predictors of job performance. *Personality and Individual Differences*, 53(6): 779-784.
- Ali, A. S., Altarawneh, M., & Altahat, E. (2012). Effectiveness of agricultural extension activities. *American Journal of Agricultural and Biological Sciences*, 7(2): 194-200.
- Ali, M., Man, N., & Muharam, F. M. (2019). Perceptions of farmers about their motivation to manage agricultural risk in Malaysia. *Pakistan Journal of Agricultural Research*, 32(2): 282-286.
- Ali, S., Kashem, M. A., & Aziz, M. A. (2017). Soil Fertility, Fertilizer Use and Crop Productivity at Farmers' Level in the Haor Area of Sunamganj District. *Bangladesh Journal of Agriculture and Environment*, 13(1): 37-42.
- Ali, Y., Jahan, S., Islam, A., & Islam, M. A. (2015). Impact of socio-economic factors on production performance of small and medium-size broiler farming in Bangladesh. *Journal of new Sciences, Agriculture and Biotechnology*, 15(1): 479-487.
- Alimirzaei, E., & Asady, A. (2011). Individual factors affecting farmers' motivation to participate in date growers' organizations in Khuzestan. *Research Journal of Applied Sciences, Engineering and Technology*, 3(8): 725-730.
- Altieri, M. A. (2002). Agro-ecology: the science of natural resource management for poor farmers in marginal environments. *Agriculture, ecosystems & environment*, 93(1-3): 1-24.
- Alvi, M. H. (2014). A Manual for Basic Techniques of Data Analysis and Distribution. Retrieved from Munich Personal RePEc Archive: <https://mpra.ub.uni-muenchen.de/60138/> (Access on 19th January 2019).
- Alwadaei, S. A. (2010). Employee's perception of, and satisfaction with, performance appraisal System. *International Journal of Service Industry Management*, 14(2): 17-33.
- Amegnaglo, C. J. (2018). Determinants of maize farmers' performance in Benin, West Africa. *Kasetsart Journal of Social Sciences*, XXX: 1-7.

- Amin, M. K., & Li, J. (2014, June). Applying Farmer Technology Acceptance Model to Understand Farmer's Behavior Intention to use ICT Based Microfinance Platform: A Comparative analysis between Bangladesh and China. In *WHICEB* (p. 31).
- Amoako-Gyampah, K. (2007). Perceived usefulness, user involvement and behavioral intention: an empirical study of ERP implementation. *Computers in human behavior*, 23(3): 1232-1248.
- Anesukanjanakul, J., Banpot, K., & Jermsittiparsert, K. (2019). Factors that influence job performance of agricultural workers. *International Journal of Innovation, Creativity and Change*, 7(2): 71-86.
- Anik, A. R., & Salam, M. A. (2017). Assessing and explaining vegetable growers' efficiency in the south-eastern hilly districts of Bangladesh. *Journal of the Asia Pacific Economy*, 22(4): 680–695.
- Appelbaum, E., Bailey, T., Berg, P., Kalleberg, A. L., & Bailey, T. A. (2000). *Manufacturing advantage: Why high-performance work systems pay off*. Ithaca, New York, United States: Cornell University Press.
- Ariely, D., Gneezy, U., Loewenstein, G., & Mazar, N. (2009). Large stakes and big mistakes. *The Review of Economic Studies*, 76(2): 451-469.
- Armstrong, M. (2006). *A handbook of human resource management practice*. London and Sterling: Kogan Page Publishers.
- Armstrong, M. (2008). *Performance management: Key strategies and practical guidelines*. London: Kogan Page Publishers.
- Armstrong, M., & Taylor, S. (2014). *Armstrong's handbook of human resource management practice*. London: Kogan Page Limited Publishers.
- Arnold, J., Silvester, J., Cooper, C. L., Robertson, I. T., & Patterson, F. M. (2005). *Work psychology: Understanding human behaviour in the workplace*. Pearson Education.
- Ary, D., Jacobs, L. C., Razavieh, A., & Sorensen, C. (2009) *Introduction to research in education*. Boston, Massachusetts, United States: Wadsworth Publishing Company.
- Ary, D., Jacobs, L. C., Razavieh, A., & Sorensen, C. (2013). *Introduction to research in education* (9th Ed.). Boston, Massachusetts, United States: Wadsworth, Cengage Learning Publishing Company.
- Ashoori, D., Noorhosseini, S. A., & Alishiri, R. (2015). Perceived usefulness and perceived ease of use for adoption technology LCC card: case study paddy farmers northern Iran. *Biological Forum – An International Journal*, 7(1): 159-162.

- Asiamah, N., Mensah, H. K., & Oteng-Abayie, E. F. (2017). General, target, and accessible population: Demystifying the concepts for effective sampling. *The Qualitative Report*, 22(6): 1607-1621.
- Asika, N. (2000). *Research Methodology in the Behavioural Sciences* (4th Ed.). Lagos, Nigeria: Longman Nigeria Plc.
- Athukorala, W. (2017). Identifying the role of agricultural extension services in improving technical efficiency in the paddy farming sector in Sri Lanka. *Sri Lanka Journal of Economic Research*, 5: 63–78.
- Audibert, M. (1997). Technical inefficiency effects among paddy farmers in the villages of the ‘Office du Niger’, Mali, West Africa. *Journal of Productivity Analysis*, 8(4): 379-394.
- Aura, S. (2016). Determinants of the adoption of integrated soil fertility management technologies in Mbale division, Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, 16(1): 10697-10710.
- Austin, E. J., Deary, I. J., & Willock, J. (2001). Personality and intelligence as predictors of economic behaviour in Scottish farmers. *European Journal of Personality*, 15(S1): S123-S137.
- Aziri, B. (2011). Job satisfaction: a literature review. *Management Research & Practice*, 3(4): 77-86.
- Azman, A., D'Silva, J. L., Samah, B. A., Man, N., & Shaffril, H. A. M. (2013). Relationship between attitude, knowledge, and support towards the acceptance of sustainable agriculture among contract farmers in Malaysia. *Asian Social Science*, 9(2): 99-105.
- Babbie, E. (2015). *The Practice of Social Research* (International Ed.). Asia: Wadsworth, Cengage Learning Center.
- Badhan, A., Akanda, M. G. R., & Haque, A. S. (2017). Farmer's Level Motivation on Sunflower Cultivation in a Rice Based Cropping Pattern of Patuakhali District. *Asian Journal of Agricultural Extension, Economics & Sociology*, 18(2): 1-11.
- Bagum, T., Uddin, M. K., Hassan, S., Kamarulzaman, N. H., & Rahman, M. Z. (2019). Determinant factors of farmers' performance regarding fertilizer application: an overview from Bangladesh. *Asian Journal of Agricultural Extension, Economics & Sociology*, 34(2): 1-12.
- Bahramzadeh M. M., & Shokati, M. S. (2010) Cultural approach to IT: compliance evaluation based on UTAUT. In: *8th international conference on management*. Shenyang, China.

- Bailey, T. R. (1993). *Discretionary effort and the organization of work: Employee participation and work reform since Hawthorne*. Teachers College and Conservation of Human Resources, Columbia University, New York, United States.
- Bangladesh delta plan 2100 formulation project (BanDuDeltAS). (2015). Agriculture and Food Security, Baseline Study, Bangladesh.
- Bangladesh Economic Review. (2018). Ministry of Finance, Government of the People's Republic of Bangladesh, Bangladesh.
- Bangladesh Population & Housing Census 2011. (2012). *Socio-Economic and Demographic Report*. Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Bangladesh.
- Bangladesh Rice Knowledge Bank. (2017). *Bangladesh Rice Knowledge Bank*. Bangladesh Rice Research Institute, Government of the People's Republic of Bangladesh, Gazipur.
- BARC (Bangladesh Agricultural Research Council). (2012). *Fertilizer Recommendation Guide* (Pp. 84-264). Bangladesh Agricultural Research Council, Farmgate, Dhaka, Bangladesh.
- Basak, J. K. (2010). Fertilizer requirement for Boro rice production in Bangladesh. *The innovators, Bangladesh*, 3-13.
- Basak, J. K., Titumir, R. A. M., & Alam, K. (2015). Future fertilizer demand and role of organic fertilizer for sustainable rice production in Bangladesh. *Agriculture, Forestry and Fisheries*, 4: 200-208.
- Basak, N. C., & Pandit, J. C. (2011). Farmers' attitude towards the use of USG in rice cultivation in three selected villages of Netrakona district. *Journal of the Bangladesh Agricultural University*, 9(2): 179-185.
- BBS (Bangladesh Bureau of Statistics). (2015). *Yearbook of Agricultural Statistics of Bangladesh*. Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Bangladesh.
- BBS (Bangladesh Bureau of Statistics). (2016). *Yearbook of Agricultural Statistics of Bangladesh*, Bangladesh Bureau of Statistics: Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.
- BBS (Bangladesh Bureau of Statistics). (2017). *Yearbook of Agricultural Statistics of Bangladesh*, Bangladesh Bureau of Statistics: Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.
- BBS (Bangladesh Bureau of Statistics). (2018). *Yearbook of Agricultural Statistics of Bangladesh*, Bangladesh Bureau of Statistics: Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

- BBS (Bangladesh Bureau of Statistics). (2020). Yearbook of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics: Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.
- Bearden, W. O., Netmeyer, R. G., & Mobley, M. F. (1993). *Handbook of marketing scales: multi-item measures for marketing and consumer behavior research*. Newbury Park, CA: Sage Publishers.
- Beardwell, J., & Claydon, T. (2007). *Human Resource Management: A Contemporary Approach* (5th Ed). Harlow, UK: Pearson Education Limited.
- Bekele, A. Z., Shigutu, A. D., & Tensay, A. T. (2014). The effect of employees' perception of performance appraisal on their work outcomes. *International Journal of Management and Commerce Innovations*, 2(1): 136-173.
- Benzing, C., & Chu, H. M. (2009). A comparison of the motivations of small business owners in Africa. *Journal of small business and enterprise development*. 16(1): 60-77.
- Bernardin, H. J., & Russell, J. E. (2013). *Human resource management: An experiential approach*. New York: McGraw-Hill Publishers.
- Bhattacharjee, A. (2012). *Social Science Research: Principles, Methods, and Practices* (2nd Ed.). Florida: Creative Commons Attribution.
- Biber, H. (2005). *The Ethics of Social Research*. London: Pearson Longman.
- Birkhaeuser, D., Evenson, R. E., & Feder, G. (1991). The economic impact of agricultural extension: a review. *Economic Development and Cultural Change*, 39 (3): 607-650.
- Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J., & Benin, S. (2009). From best practice to best fit: a framework for designing and analyzing pluralistic agricultural advisory services worldwide. *Journal of agricultural education and extension*, 15(4): 341-355.
- Biswas, B., Mallick, B., Roy, A., & Sultana, Z. (2021). Impact of agriculture extension services on technical efficiency of rural paddy farmers in southwest Bangladesh. *Environmental Challenges*, 5: 100261.
- Blumberg, M., & Pringle, C. D. (1982). The missing opportunity in organizational research: Some implications for a theory of work performance. *Academy of management Review*, 7(4): 560-569.
- Boahene, K., Snijders, T. A., & Folmer, H. (1999). An integrated socioeconomic analysis of innovation adoption: the case of hybrid cocoa in Ghana. *Journal of Policy Modeling*, 21(2): 167-184.
- Bogner, W. C., & Bansal, P. (2007). Knowledge management as the basis of sustained high performance. *Journal of Management studies*, 44(1): 165-188.

- Bolarinwa, O. A. (2015). Principles and methods of validity and reliability testing of questionnaires used in social and health science researches. *Nigerian Postgraduate Medical Journal*, 22(4): 195-201.
- Boon, C., Belschak, F. D., Den Hartog, D. N., & Pijnenburg, M. (2014). Perceived human resource management practices: Their effect on employee absenteeism and time allocation at work. *Journal of Personnel Psychology*, 13(1): 21-33.
- Bora, M., Deka, M., Bharali, M., Bhuyan, S., Chakravarty, M., Ali, A., & Datta, H. S. (2018). Attitude and economic motivation of farmers towards farming for doubling farm income. *Journal of Community Mobilization and Sustainable Development*, 13(3): 426-430.
- Borges, J. A. R., Foletto, L., & Xavier, V. T. (2015). An interdisciplinary framework to study farmers decisions on adoption of innovation: Insights from Expected Utility Theory and Theory of Planned Behavior. *African Journal of Agricultural Research*, 10(29): 2814-2825.
- Borman, W. (1991). Handbook of industrial-organizational psychology. In M. D. Dunnette & L. M. Hough, (Eds.), *Job behavior, performance, and effectiveness*, (pp. 271-326). Palo Alto, Calif: Consulting Psychologists Press.
- Borman, W. C., & Motowidlo, S. J. (1997). Task performance and contextual performance: The meaning for personnel selection research. *Human Performance*, 10(2): 99-109.
- Borman, W.C., & Motowidlo, S.J. (1993). Expanding the criterion domain to include elements of contextual performance. In N. Schmitt, & W.C. Borman (Eds.), *Personnel Selection in Organizations* (pp.71-98). South Florida, US: Psychology Faculty Publications.
- Boselie, P., Dietz, G., & Boon, C. (2005). Commonalities and contradictions in HRM and performance research. *Human resource management journal*, 15(3): 67-94.
- Boudreau, J., Hopp, W., McClain, J. O., & Thomas, L. J. (2003). On the interface between operations and human resources management. *Manufacturing & Service Operations Management*, 5(3): 179-202.
- Bouranta, N., Chitiris, L., & John Paravantis, J. (2009). The relationship between internal and external service quality. *International Journal of Contemporary Hospitality Management*, 21(3): 275-293.
- Boxall, P., & Purcell, J. (2003). *Strategy and human resource management*. London: Palgrave Macmillan.
- Bradley, J. (2009). Handbook of research on contemporary theoretical models in information systems. In Y. K. Dwivedi, B. Lal, M. D. Williams, S. L. Schneberger & M. Wade (Eds.), *The technology acceptance model and other user acceptance theories* (pp. 277-294). Pennsylvania, US: IGI Global Publishers.

- Brolley, M. (2015). Rice security is food security for much of the world. *Rice Today. International Rice Research Institute (IRRI), DAPO Box, 7777*: 30-32.
- Bryman, A., & Bell, E. (2007). *Business research methods*. New York: Oxford university press.
- Bukhari, T. Z., Khan, J., Shahzadi, I., & Khalid, A. (2014). Mediating role of motivation to learn in determining e-learning outcomes: A conceptual study. *Business and Management*, 6(2): 179-189.
- Buresh, R. J., & Timsina, J. (2008). Implementing field-specific nutrient management in rice-based cropping systems. *Bangladesh Journal of Agriculture and Environment*, 4: 39-49.
- Burke, W. J., Frossard, E., Kabwe, S., & Jayne, T. S. (2019). Understanding fertilizer adoption and effectiveness on maize in Zambia. *Food Policy*, 86: 1-12.
- Butler, A., Grice, P. E., & Reed, M. (2006). Delimiting knowledge transfer from training. *Education + Training*, 48(8): 627-641.
- Büyüköztürk, Ş. (2007). Sosyal Bilimler için Veri Analizi El Kitabı, Ankara: Pegem A Yayıncılık. *Elementary Education Online*, 7(1): 6-8.
- Bwambale, N. (2015). *Farmers' knowledge, perceptions, and socioeconomic factors influencing decision making for integrated soil fertility management practices in Masaka and Rakai Districts, Central Uganda*. (Doctoral dissertations). Iowa State University, Ames, United States.
- Callahan, T.C., (2011). Research Ethics, Associate VP of Academics and Research, Bastyr University, <http://depts.washington.edu/bioethx/topics/resrch.html>, accessed 07.03.2013.
- Campbell, J. P. (1994). Alternative methods of job performance and their implications for selection and classification. In M. G. Rumsey, C. B. Walker and J. H. Harris (Eds), *Personnel Selection and Classification* (pp. 33–51). Hillsdale, NJ: Erlbaum.
- Campbell, J. P., & Wiernik, B. M. (2015). The modeling and assessment of work performance. *Annual Review of Organizational Psychology and Organizational Behavior*, 2(1): 47-74.
- Campbell, J. P., Gasser, M. B., & Oswald, F. L. (1996). The substantive nature of job performance variability. *Individual Differences and Behavior in Organizations*, 258-299.
- Campbell, J. P., McCloy, R.A., Oppler, S. H. & Sager, C. E. (1993). A Theory of Performance. In N. Schmitt, & W. C. Borman (Eds.), *Personnel Selection in Organizations* (pp. 35-70). San Francisco: Jossey-Bass Publishers.

- Campbell, J. P., McCloy, R. A., Oppler, S. H., & Sager, C. E. (1993). A theory of performance. *Personnel selection in organizations*, 3570, 35-70.
- Chakrabarty, T., Akter, S., Saifullah, A. S. M., Sheikh, M. S., & Bhowmick, A. C. (2014). Use of fertilizer and pesticide for crop production in agrarian area of Tangail district, Bangladesh. *Environment and Ecology Research*, 2(6): 253-261.
- Chan, L. L., & Idris, N. (2017). Validity and reliability of the instrument using exploratory factor analysis and Cronbach's alpha. *International Journal of Academic Research in Business and Social Sciences*, 7(10): 400-410.
- Chen, L. D. (2008). A model of consumer acceptance of mobile payment. *International Journal of Mobile Communications*, 6(1): 32-52.
- Chen, M. (2009). Attitude toward organic foods among Taiwanese as related to health consciousness, environmental attitudes, and the mediating effects of a healthy lifestyle. *British Food Journal*, 111(2): 165-178.
- Chen, X., Zhenling C., Mingsheng F., Peter V., Ming Z., Wenqi M., Zhenlin W. (2014). Producing more grain with lower environmental costs. *Nature*, 514(7523): 486-489.
- Chi, H. K., Yeh, H. R., & Chen, Y. L. (2010). The mediating effect of knowledge management on customer orientation and job performance of salespeople. *Journal of Global Business Management*, 6(1): 1-10.
- Chi, T. T. N. (2008). Factors affecting technology adoption among rice farmers in the Mekong Delta through the lens of the local authorial managers: an analysis of qualitative data. *Omonrice*, 16: 107-112.
- Chi, T. T. N., & Yamada, R. (2002). Factors affecting farmers' adoption of technologies in farming system: A case study in Omon district, Can Tho province, Mekong Delta. *Omonrice*, 10: 94-100.
- Chiou, C. Y. (2015). *Motivation and Self-Regulation as Predictors of E-Learning Experience among Undergraduates in a Malaysian Public University*. (Master dissertation). Universiti Putra Malaysia, Malaysia.
- Chiu, C. M., & Wang, E. T. (2008). Understanding Web-based learning continuance intention: The role of subjective task value. *Information & Management*, 45(3): 194-201.
- Choi, J. H. (2014). The HR-performance link using two differently measured HR practices. *Asia Pacific Journal of Human Resources*, 52(3): 370-387.
- Chowdhury, I. U. A., & Khan, M. A. E. (2015). The impact of climate change on rice yield in Bangladesh: a time series analysis. *Russian Journal of Agricultural and Socio-Economic Sciences*, 40(4): 12-28.

- Christensen, C. M., & Raynor, M. E. (2003). *The Innovator's Solution: Creating and Sustaining Successful Growth*. Boston, Massachusetts, United States: Harvard Business Press.
- Christodoulou, E., Kalokairinou, A., Koukia, E., Intas, G., Apostolara, P., Daglas, A., & Zyga, S. (2015). The test-retest reliability and pilot testing of the new technology and nursing students' learning styles questionnaire. *International Journal of Caring Sciences*, 8(3): 567-576.
- Chua, X. H. J., Lim, S., Lim, F. P., Lim, Y. N. A., He, H. G., & Teng, G. G. (2018). Factors influencing medication adherence in patients with gout: A descriptive correlational study. *Journal of Clinical Nursing*, 27(1-2): e213-e222.
- Clark-Carter, D. (2010). *Quantitative psychological research: The complete student's companion* (3rd Ed.). USA: Psychology Press.
- Claudia, A. C. (2015). HRM - well-being at work relation. A case study. *Annals - Economy Series*, 4: 140-145.
- Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* (3rd Ed.). California: Sage Publications, Inc.
- Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16: 297-334.
- Cui, Z., Chen, X., & Zhang, F. (2010). Current nitrogen management status and measures to improve the intensive wheat–maize system in China. *Ambio*, 39(5): 376-384.
- Dabirian, S. (2008). *Effective Factors on Job Performance of Agricultural Extension Organization's Experts (Case Study in Hamedan)*. (Master's dissertation), University of Tehran, Iran.
- Damanhuri, J. A. (2005) Merealisasikan harapan, Kuala Lumpur: National Institute of Public Administration.
- Dana, L. P., Korot, L. & Tovstiga, G. (2007). A cross-national comparison of knowledge management practices. *International Journal of Manpower*, 26(1): 10-22.
- Datta, S. K. D. (1981). *Principles and practices of rice production*. International Rice Research Institute. Los Banos, Philippines.
- Dauda, S. Y., & Lee, J. (2015). Technology adoption: A conjoint analysis of consumers' preference on future online banking services. *Information Systems*, 53: 1-15.
- Davis, F. D. (1985). *A technology acceptance model for empirically testing new end-user information systems: Theory and results*. (Doctoral dissertation). Massachusetts Institute of Technology, United States.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly*, 319-340.

- Davis, F. D., & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: three experiments. *International Journal of Human-Computer Studies*, 45(1): 19-45.
- Davis, F. D., & Venkatesh, V. (2004). Toward preprototype user acceptance testing of new information systems: implications for software project management. *IEEE Transactions on Engineering Management*, 51(1): 31-46.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, 22(14): 1111-1132.
- Davis, J. A. (1971). *Elementary survey analysis*. Englewood Cliffs, NJ: Prentice-Hall.
- Dawes, J. (2008). Do data characteristics change according to the number of scale points used? An experiment using 5-point, 7-point and 10-point scales. *International Journal of Market Research*, 50(1): 61-104.
- Dawoe, E. K., Quashie-Sam, J., Isaac, M. E., & Opong, S. K. (2012). Exploring farmers' local knowledge and perceptions of soil fertility and management in the Ashanti Region of Ghana. *Geoderma*, 179: 96-103.
- Deadrick, D. L., and Gardner, D. G. (2000). Performance distributions: measuring employee performance using total quality management principles. *Journal of Quality Management*, 4(2): 225-241.
- Delamater, J. D., & Myers, D. J. (2010). *Social psychology*. United States: Wadsworth, Cengage Publications.
- Demba, S. (2017). *Personality Traits and Work Performance of Paddy Farmers in the Central River Region, Gambia*. (Master's dissertation). Universiti Putra Malaysia, Malaysia.
- Demortier, A. L., Delobbe, N., & El Akremi, A. (2014). Opening the black box of HR practices - performance relationship: testing a three pathways AMO model. *Academy of Management Annual Meeting Proceedings*, 1201-1206.
- Devlin, S. J., Dong, H. K., & Brown, M. (1993). Selecting a scale for measuring quality. *Marketing Research*, 5: 12-17.
- Díaz-Vilela, L. F., Rodríguez, N. D., Isla-Díaz, R., Díaz-Cabrera, D., Hernández-Fernaud, E., & Rosales-Sánchez, C. (2015). Relationships between contextual and task performance and interrater agreement: Are there any? *PloS one*, 10(10):1-13.
- Dimara, E., & Skuras, D. (1999). Importance and need for rural development instruments under the CAP: a survey of farmers' attitudes in marginal areas of Greece. *Journal of Agricultural Economics*, 50(2): 304-315.

- Dinpanah, G., & Vida Morzapour, V. (2015). Effective factors on job performance of agricultural extension experts in Iran. *Journal of Scientific Research and Development*, 2 (7): 264-269.
- District Statistics 2011, Gaibandha. (2013). Bangladesh Bureau of Statistics (Bbs), Statistics and Informatics Division (Sid), Ministry of Planning, Government of the People's Republic of Bangladesh.
- Djomo, R. F., Ndaghu, N. N., Ukpe, U. H., Innocent-Ene, E. O., & Onuigbo, I. (2017). Effect farm management practices on performance of smallholder rice farmers in Cameroon: A case of the west region of Cameroon. *Agricultural Research & Technology: Open Access Journal*, 6(3): 0046-0049.
- Dolnicar, S., Grün, B., & Leisch, F. (2016). Increasing sample size compensates for data problems in segmentation studies. *Journal of Business Research*, 69(2): 992-999.
- Dolnicar, S., Grun, B., Leisch, F., & Rossiter, J. (2011). *Three good reasons NOT to use five and seven-point Likert items*, Cauthe 2011: 21st CAUTHE National Conference, Adelaide, Australia, 8-11 February 2011.
- Domanović, V. (2013). The effectiveness of the performance measurement in terms of contemporary business environment. *Ekonomski horizonti*, 15(1): 31-44.
- Donate, M. J., & Canales, J. I. (2012). A new approach to the concept of knowledge strategy. *Journal of Knowledge Management*, 16(1): 22-44.
- Dooley, D. (2001). *Social Research Methods* (4th Ed.). University of California, Irvine: Pearson Education.
- Dvir, T., Eden, D., Avolio, B. J., & Shamir, B. (2002). Impact of transformational leadership on follower development and performance: A field experiment. *Academy of Management Journal*, 45(4): 735-744.
- Edwards-Jones, G. (2006). Modelling farmer decision-making: concepts, progress and challenges. *Animal Science*, 82(6): 783-790.
- Elias, A., Nohmi, M., Yasunobu, K., Ishida, A., & Alene, A.D. (2014). The effect of agricultural extension service on the technical efficiency of Teff (*Eragrostis tef*) producers. *American Journal of Applied Sciences*, 11 (2): 223-239.
- Elkaseh, A. M., Wong, K. W., & Fung, C. C. (2016). Perceived ease of use and perceived usefulness of social media for e-learning in Libyan higher education: A structural equation modeling analysis. *International Journal of Information and Education Technology*, 6(3): 192-199.
- Elvina, S. & Chao, L. Z. (2019). A Study on the relationship between employee motivation and work performance. *Journal of Business and Management*, 21 (3): 59-68.

- Fagan, M. H., Neill, S., & Wooldridge, B. R. (2008). Exploring the intention to use computers: An empirical investigation of the role of intrinsic motivation, extrinsic motivation, and perceived ease of use. *Journal of Computer Information Systems*, 48(3): 31-37.
- FAO (Food and Agriculture Organization). (2018). *FAO Rice Market Monitor (RMM)*. Volume, 16, Trade and Market Division, Food and Agriculture Organization of the United Nations, (pp. 1-36). Rome, Italy.
- FAOSTAT (Food and Agriculture Organization Corporate Statistical Database). (2017). Rome: Food and Agriculture Organization of the United Nations (FAO). Rome. Retrieved from <http://faostat3.fao.org>. (Access on 17th February 2018).
- FAOSTAT (Food and Agriculture Organization Corporate Statistical Database). (2014). Area, Production and Yield of Maize, Rice and Wheat. Retrieved from http://faostat3.fao.org/browse/Q/*E. (Access on June 15, 2015).
- FAOSTAT (Food and Agriculture Organization Corporate Statistical Database). (2012). Online Database. Retrieved from <http://faostat.fao.org/>. (Access on 9 September 2012).
- Far, S. T., & Rezaei-Moghaddam, K. (2017). Determinants of Iranian agricultural consultants' intentions toward precision agriculture: Integrating innovativeness to the technology acceptance model. *Journal of the Saudi Society of Agricultural Sciences*, 16(3): 280-286.
- Farahmita, A. (2017). Job satisfaction, cost management knowledge, budgetary participation, and their impact on performance. *International Research Journal of Business Studies*, 9(1): 15-29.
- Farouque, M. G., & Takeya, H. (2008). Resource-poor farmers' constraints regarding integrated soil fertility and nutrient management system practices: A study in rural Bangladesh. *International Journal of Agricultural Research*, 3: 188-195.
- Ferdoush, J. N., Jahiruddin, M., & Islam, M. R. (2003). Response of wheat to micronutrient in old Brahmaputra floodplain soil. *Bangladesh Journal of Seed Science and Technology*, 7(1&2): 35-38.
- Ferraresi, A. A., Quandt, C. O., dos Santos, S. A., & Frega, J. R. (2012). Knowledge management and strategic orientation: leveraging innovativeness and performance. *Journal of Knowledge Management*, 16(5): 688-701.
- Field, A. (2009). *Discovering Statistics Using Spss* (3rd Ed.). London: Sage Publications Ltd.
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th Ed.). London: Sage publications.

- Folorunso, O., & Ogunseye, S. O. (2008). Applying an enhanced technology acceptance model to knowledge management in agricultural extension services. *Data Science Journal*, 7: 31-45.
- Fowler, F.J. (1987). *Survey Research Methods*. London: Sage Publications.
- Fox, W. & Bayat, M.S. (2007). *A Guide to Managing Research*. Cape Town: Juta and company Ltd.
- Francini, A. & Sebastian, L. (2019). Abiotic stress effects on performance of horticultural crops. *Horticulturae*, 5(67): 1-4.
- Fertilizer Recommendation Guide (FRG). (2012). *Bangladesh Agricultural Research Council (BARC)*, (pp. 275). Farmgate, Dhaka, Bangladesh.
- Furahisha, E. H. (2013). *Farmers Adoption of Selected Recommended Rice Production Practices: A Case of Kilombero District of Morogoro Region, Tanzania*. (Master's dissertation). Sokoine University of Agriculture, Morogoro, Tanzania.
- Gautam, S., Schreinemachers, P., Uddin, M. N., & Srinivasan, R. (2017). Impact of training vegetable farmers in Bangladesh in integrated pest management (IPM). *Crop Protection*, 102: 161-169.
- Genty, K. I. (2016). *Moderating Role of Training Transfer in Determining Entrepreneurial Performance among Micro, Small and Medium Enterprises Owners In Lagos State, Nigeria*. (Doctoral dissertation). Universiti Putra Malaysia, Malaysia.
- George, D., & Mallery, P. (2010). *SPSS for Windows step by step: A simple study guide and reference* (10. Bask1). GEN, Boston, MA: Pearson Education, Inc.
- Ghosh, M. K., & Hasan, S. S. (2013). Farmers' attitude towards sustainable agricultural practices. *Bangladesh Research Publications Journal*, 8(4): 227-235.
- Ghosh, M., Swain, D. K., Jha, M. K., & Tewari, V. K. (2013). Precision nitrogen management using chlorophyll meter for improving growth, productivity and N use efficiency of rice in subtropical climate. *Journal of Agricultural Science*, 5(2): 253-266.
- Gibson, J. L. (2003). *Organizations: Behavior, structure, processes*. Boston (Mass.): McGraw- Hill Publisers.
- Glasman, L. R., & Albarraçín, D. (2006). Forming attitudes that predict future behavior: a meta-analysis of the attitude-behavior relation. *Psychological bulletin*, 132(5): 778-822.
- Gogtay, N. J., & Thatte, U. M. (2017). Principles of correlation analysis. *Journal of the Association of Physicians of India*, 65(3): 78-81.

- Gombe, S. Y. (2017). *Moderating Effect of Gender on Relationships between Extension Worker Availability, Individual Factors and Empowerment among Members of Self-Help Groups in North-Eastern Nigeria*. (Doctoral dissertation). Universiti Putra Malaysia, Malaysia.
- Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *Management Information Systems Quarterly*, 213-236.
- Goschin, Z., & Vatui, M. (2002). Statistică. In *Conf. univ. Dr. Zizi Goschin, conf. univ. Dr. Mihaela Vătui. București: ASE* (Vol. 414).
- Goven, J., & Morris, C. M. (2012). Regulating biopharming: the prism of farmer knowledge. *Science as Culture*, 21(4): 497-527.
- Gowri, V. (2015). *Sustainability Practices in Malaysian Grocery Retail Industry*. (Doctoral dissertation). Universiti Putra Malaysia, Malaysia.
- Global Rice Science Partnership (GRiSP). (2013). *Rice Almanac*. 4th Edition, International Rice Research Institute, Los Baños.
- Grist, D. H. (1986). *Rice* (6th Ed.). London: Longman.
- Gruhn, P., Goletti, F., & Yudelman, M. (2000). *Integrated Nutrient Management, Soil Fertility, and Sustainable Agriculture: Current Issues and Future Challenges*. International Food Policy Research Institute. 2033 K Street, N.W. Washington, D.C., U.S.A.
- GST (Glossary of statistical terms). (2016). Population"Statistics.com. Retrieved 22 February 2018.
- Guillemin, M., (2004) Ethics, Reflexivity and Ethically Important Moments in Research. *Qualitative Inquiry*, 10 (2):261-280.
- Guzman, J. J. (2008). *Measuring Job Performance Associated to the Direct Effect of the Global Context*. (Doctoral Dissertation). University of Regina, Canada.
- Haile, K., Haji, J., & Tegegne, B. (2018). Technical efficiency of sorghum production: the case of smallholder farmers in Konso district, southern Ethiopia. *Agricultural Development*, 3: 1–15.
- Hair, Jr. J.F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *Multivariate Data Analysis* (7th Ed.). Upper Saddle River: Prentice Hall.
- Hameed, T. S., & Sawicka, B. (2017). Farmers' knowledge of fertilizers' practices on their farms. *IX International Scientific Symposium. "Farm Machinery and Processes Management in Sustainable Agriculture"*, Lublin, Poland.
- Hamid, A. A., Razak, F. Z. A., Bakar, A. A., & Abdullah, W. S. W. (2016). The effects of perceived usefulness and perceived ease of use on continuance intention to use e-government. *Procedia Economics and Finance*, 35: 644-649.

- Hanna, A. S., & Brusoe, J. K. (1997). Study of performance evaluations in the electrical construction industry. *Journal of Management in Engineering*, 13(6): 66–74.
- Hansson, H. (2008). How can farmer managerial capacity contribute to improved farm performance? A study of dairy farms in Sweden. *Acta Agriculturae Scand Section C*, 5(1): 44-61.
- Hansson, H., Ferguson, R., & Olofsson, C. (2012). Psychological constructs underlying farmers' decisions to diversify or specialize their businesses—an application of theory of planned behaviour. *Journal of Agricultural Economics*, 63(2): 465-482.
- Haque, M. R. & Jahiruddin, M. (1994). Effects of single and multiple applications of sulphur and zinc on a continuous rice cropping pattern. *Indian Journal of Agricultural Research*, 28: 9-14.
- Harif, M. A. A. M., Hoe, C. H., and Ahmed, M. I. (2013). The Financial and nonfinancial performance indicators of paddy framers' organizations in Kedah. *World Review of Business Research*, 3(1): 80-102.
- Haris, N. B. M. (2013). *Influence of Decision Making Factorson Paddy Production of Farmers In Selected Integrated Agriculture Development Areas, Malaysia*. (Master's dissertation). Univesriti Putra Malaysia, Malaysia.
- Hartmann, A., Reymen, I. M., & Van Oosterom, G. (2008). Factors constituting the innovation adoption environment of public clients. *Building Research & Information*, 36(5): 436-449.
- Harun, Z. B. (2016). Knowledge, attitude and communication in relation to the goods and services tax compliance among wood product manufacturers in Peninsular Malaysia. (Doctoral dissertation). Univesriti Putra Malaysia, Malaysia.
- Hasan, S. S., Ghosh, M. K., Arefin, M. S., & Sultana, S. (2015). Farmers Attitude towards Using Agro-Chemicals in Rice Production: A Case in Laxmipur District of Bangladesh. *The Agriculturists*, 13(2): 105-112.
- Hassan, S. (2015). Personality traits for the majority of paddy farmers, in MADA, Kedah, Malaysia. *Faculty of Agriculture*, 2(1): 146–151.
- Heine, M. L., Grover, V., & Malhotra, M. K. (2003). The relationship between technology and performance: a meta-analysis of technology models. *Omega*, 31(3): 189-204.
- Herath, C. S. (2013). Does intention lead to behaviour? A case study of the Czech Republic farmers. *Agricultural Economics*, 59(3): 143-148.
- Herath, C. S. (2010). Motivation as a potential variable to explain farmer's behavioral change in agricultural technology adoption decisions. *Ekonomika A Management*, 3: 62-71.

- Hernandez, J. M. C., & Mazzon, J. A. (2007). Adoption of internet banking: proposition and implementation of an integrated methodology approach, *The International Journal of Bank Marketing*, 25 (2): 72-88.
- Hettiararchchi, H. A. H., & Jayarathna, S. M. D. Y. (2014). The effect of employee work related attitudes on employee job performance: A study of tertiary and vocational education sector in Sri Lanka. *IOSR journal of Business and management*, 16(4): 74-83.
- Hidayah, I. (2013). Farmers' behaviour in the implementation of component PTT (integrated plant and resource management) in irrigation paddy rice fields farming in Buru regency Maluku province Indonesia. *International Journal of Humanities and Social Science*, 3(12): 129-138.
- Hite, D., Hudson, D., & Intarapong, W. (2002). Willingness to pay for water quality improvements: The case of precision application technology. *Journal of Agricultural and resource Economics*, 433-449.
- Hong, S., Thong, J. Y., & Tam, K. Y. (2006). Understanding continued information technology usage behavior: A comparison of three models in the context of mobile internet. *Decision support systems*, 42(3): 1819-1834.
- Hothongcum, K., Suwunnamek, O., & Suwanmaneepong, S. (2014). Assessment of farmers' knowledge and attitudes towards the commercialization of tailor-made fertilisers in Thailand. *Asian Journal of Scientific Research*, 7(3): 354-365.
- Hu, R., Cao, J., Huang, J., Peng, S., Huang, J., Zhong, X., & Buresh, R. J. (2007). Farmer participatory testing of standard and modified site-specific nitrogen management for irrigated rice in China. *Agricultural Systems*, 94(2): 331-340.
- Huang, Z., & Karimanzira, T. T. P. (2018). Investigating key factors influencing farming decisions based on soil testing and fertilizer recommendation facilities (STFRF)—a case study on rural Bangladesh. *Sustainability*, 10(4331): 1-24.
- IBM. (2015). Factor Analysis: KMO and Bartlett's Test. IBM Corporation. Retrieved May 1, 2015.
- Ibnu, M. & Hutabarat, B. (2012). Predicting technology adoption in paddy cultivation at Sukoharjo and Wonokerto village of Sekampung Subdistrict in East Lampung District of Lampung Province, Indonesia. *Jurnal Agro Ekonomi*, 30(1): 59-79.
- Igbaria, M. (1991). Job performance of MIS professionals: An examination of the antecedents and consequences. *Journal of Engineering and Technology Management*, 8(2): 141-171.
- Im, I., Hong, S., & Kang, M. S. (2011). An international comparison of technology adoption: Testing the UTAUT model. *Information & Management*, 48(1): 1-8.

- Ingram, J., Gaskell, P., Mills, J., & Short, C. (2013). Incorporating agri-environment schemes into farm development pathways: A temporal analysis of farmer motivations. *Land Use Policy*, 31: 267-279.
- Inwood, S., Clark, J. K., & Bean, M. (2013). The differing values of multigeneration and first-generation farmers: Their influence on the structure of agriculture at the rural-urban interface. *Rural Sociology*, 78(3): 346-370.
- IRRI (International Rice Research Institute). (2012). *Annual Report for 2011*. Los Baños, Philippines.
- Ishak, N. I., Othman, M. H., & Omar, M. F. (2015). Students' perception towards the newly implemented Goods and Services Tax (GST) in Malaysia. *International Journal of Contemporary Applied Sciences*, 2(6): 80-99.
- Islam, A., & Muttaleb, A. (2016). Effect of potassium fertilization on yield and potassium nutrition of Boro rice in a wetland ecosystem of Bangladesh. *Archives of Agronomy and Soil Science*, 62: 1530–1540.
- Islam, F. (2010). *Institutionalization of Agricultural Knowledge Management System for Digital Marginalized Rural Farming Community*. ISDA 2010, Montpellier, June 28-30, 2010.
- Islam, M. (2015). *Essays on Development Economics*. (Doctoral dissertation). Harvard University, United States.
- Islam, M. A. (2019). *Challenges, Barriers and Coping Strategies Experienced by Women Leaders in Public Universities of Malaysia*. (Doctoral dissertation). Universiti Putra Malaysia, Malaysia.
- Islam, M. R., Islam, Z., Azad, M. J., Bagum, T., & Pk, M. K. H. (2014). Attitude of farmers towards modern jute cultivation technologies in Baliakandi upazilla under Rajbari district. *Journal of Experimental Bio-Science*, 5(2):75-78.
- Islam, M. R., & Rashid, S.M.M. (2016). Farmers' attitude towards e-agriculture in bangladesh. american journal of social and management sciences. *American Journal of Social and Management Sciences*, 7(1): 12-18.
- Jahan, M. S., Sarkar, M. A. R., Barma, N. C. D., Mondal, M. N. A., & Ferdousi, M. N. S. (2015). Grain yield, nutrient balance and economics of T. Aman rice cultivation as influenced by nutrients management. *Bangladesh Journal of Agricultural Research*, 40(1): 17-34.
- Jahangir, N., & Begum, N. (2008). The role of perceived usefulness, perceived ease of use, security and privacy, and customer attitude to engender customer adaptation in the context of electronic banking. *African Journal of Business Management*, 2(2): 032-040.

- Jahiruddin, M., & Satter, M. A. (2010). Agricultural research priority: Vision 2030 and beyond. *Final report. Sub-sector: land and soil resource management. Bangladesh: Bangladesh Agricultural Research Council and Bangladesh Agricultural University*, 56.
- Jahiruddin, M., Islam, M.R., & Miah, M.A.M. (2010). Constraints of Farmers' Access to Fertilizer for Food Production. Final Report CF # 3/08, National Food Policy Capacity Strengthening Programme; Department of Soil Science, Bangladesh Agricultural University, Bangladesh.
- Jaim, W. M. H., & Akter, S. (2012). *Seed, fertilizer and innovation in Bangladesh: industry and policy issues for the future*. Washington, DC: International Food Policy Research Institute (pp. 1-31).
- Jain, P. (2017). Impact of demographic factors: technology adoption in agriculture. *SCMS Journal of Indian Management*, 14(3): 93-102.
- Jankingthong, K., & Rurkkhum, S. (2012). Factors affecting job performance: A review of literature. *Silpakorn University Journal of Social Sciences, Humanities, and Arts*, 12(2): 115–127.
- Janudin, S. E., & Maelah, R. (2007). Theory of Work Performance in Education Setting: A Research Framework. Retrieved from <https://www.slideserve.com/ellema/theory-of-work-performance-in-education-setting-a-research-framework> (Access on 27th February 2018).
- Jayan, C. (2006). Emotional competence, personality and job attitudes as predictors of job performance. *Journal of the Indian Academy of Applied Psychology*, 32(2): 135-144.
- Jingjing, Z., Xiaoping, Z., Xiaoshuan, Z., & Zetian, F. (2010). Farmers' information acceptance behaviour in China. *African Journal of Agricultural Research*, 5(3): 217-221.
- Jinia, N. J. (2016). *Microcredit and Women's Empowerment Does microcredit promote the borrowers to participate in the household decision-making process in Bangladesh*. (Academic Dissertation). University of Tampere, Tampere.
- Johnson, M. (1989). Social Science Research. *Social Studies of Science*, 19(4): 759-762.
- Kabir, M. S., Salam, M. U., Chowdhury, A., Rahman, N. M. F., Iftekharuddaula, K. M., Rahman, M. Rashid, M., Dipti, S., Islam, A., Latif, M., Islam, A.S., Hossain, M., Nessa, B., Ansari, T., Ali, M., & Biswas, J. K. (2015). Rice vision for Bangladesh: 2050 and beyond. *Bangladesh Rice Journal*, 19(2): 1-18.
- Kabir, M.H. (2015). *Factors Influencing Adoption of Integrated Pest Management (IPM) By Vegetable Farmers of Narsingdi District, Bangladesh*. (Doctoral dissertation). Universiti Sains Malaysia, Malaysia.

- Kacmar, K.M, Andrews, M. C., Van Rooy, D. L., Chris Steilberg, R., & Cerrone, S. (2006). Sure everyone can be replaced... but at what cost? Turnover as a predictor of unit-level performance. *Academy of Management journal*, 49(1): 133-144.
- Kang, Y. J., Kim, S. E., & Chang, G. W. (2008). The impact of knowledge sharing on work performance: An empirical analysis of the public employees' perceptions in South Korea. *International Journal of Public Administration*, 31(14): 1548-1568.
- Karim, A. M. (2001). *Understanding social research (with applications)*. M.N. Mallick and Co, Dhaka, Bangladesh.
- Karim, R., & Aktar, A. (2015). Fertilizer use pattern on agriculture in Salua Area of Chougachha upazila, Jessore. *Bangladesh Journal of Bioscience and Agriculture Research*, 3(02): 96-103.
- Karim, Z., Miah, M. M. U., & Razia, S. (1994). Fertilizer in the National Economy and Sustainable Environmental Development. *Asia Pacific Journal of Environment and Development*, 4(2):48-67.
- Kashem, M. A., & Faroque, M. A. A. (2011). A country scenarios of food security and governance in Bangladesh. *Journal of Science Foundation*, 9(1-2): 41-50.
- Kenpro (2012). Sample Size Determination Using Krejcie and Morgan Table. Kenya Projects Organizations. Kenya Projects Organizations, Website. (<http://www.kenpro.org/sample-size-determination-using-krejcie-and-morgan-table/>).
- Keogh, M. (2016). The myth of the ageing Australian farmer? - Australian Farm Institute, Retrieved from <http://farminstitute.org.au/ag-forum/ageing-farmers-and-productivity> (Access on 29th January 2018).
- Khalil, A. H. O., Ismail, M., Suandi, T., & Silong, A. D. (2009). Human resource development competencies as predictors of agricultural extension agents' performance in Yemen. *Human Resource Development International*, 12(4): 429-447.
- Khalil, A. H., Ismail, M., Suandi, T., & Silong, A. D. (2008). Influence of leadership competencies on extension workers' performance in Yemen. *The Journal of Global Business Management*, 4(1): 388-394.
- Khan, I., & Nawaz, A. (2016). The leadership styles and the employees' performance: A review. *Gomal University Journal of Research*, 32(2): 144-150.
- Khan, I., Dongping, H., & Ghauri, T. A. (2014). Impact of attitude on employees' performance: a study of textile industry in Punjab, Pakistan. *World Applied Sciences Journal*, 30(1): 191-197.
- Khan, M. F. U. (2013). Role of performance appraisal system on employees' motivation. *IOSR Journal of Business and Management*, 8(4): 66-83.

- Khan, P., Aslam, M., Memon, M. Y., Imtiaz, M., Shah, J. A., & Depar, N. (2010). Determining the nutritional requirements of rice genotype JAJAI 25/A evolved at NIA, Tandojam, Pakistan. *Pakistan Journal of Botany*, 42(5): 3257-3263.
- Khuang, T. Q., Huan, T. T., & Hach, C. V. (2008). Study on fertilizer rates for getting maximum grain yield and profitability of rice production. *Omonrice*, 16: 93-99.
- Kim, K. Y., Pathak, S., & Werner, S. (2015). When do international human capital enhancing practices benefit the bottom line? An ability, motivation, and opportunity perspective. *Journal of International Business Studies*, 46(7): 784-805.
- Kinyangi, A. A. (2014). *Factors influencing the adoption of agricultural technology among smallholder farmers in Kakamega north sub-county, Kenya* (Doctoral dissertation). University of Nairobi, Kenya.
- Kombo, D. K., & Tromp, D. L. (2006). Proposal and thesis writing: An introduction. *Nairobi: Paulines Publications Africa*, 5(1): 814-30.
- Koopmans, L., Bernaards, C. M., Hildebrandt, V. H., de Vet, H. C., & van der Beek, A. J. (2014). Measuring individual work performance: Identifying and selecting indicators. *Work*, 48(2): 229-238.
- Koopmans, L., Bernaards, C. M., Hildebrandt, V. H., Schaufeli, W. B., De Vet Henrica, C. W., & Van Der Beek, A. J. (2011). Conceptual frameworks of individual work performance: A systematic review. *Journal of Occupational and Environmental Medicine*, 53(8): 856-866.
- Koppen, B. C., Parthasarathy, R., & Safiliou, C. (2002). *Poverty dimensions of irrigation management transfer in large-scale canal irrigation in Andhra Pradesh and Gujarat, India* (Vol. 61). International Water Management Institute: India.
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3): 607-610.
- Kumarawadu, P. (2001). Motivation of online learners: Review of practices & emerging trends. *Sri Lanka: Sri Lanka Institute of Information Technology. Lockwood*. Retrieved from <http://www2.uca.es/orgobierno/ordenacion/formacion/docs/jifpev5-doc5.pdf> (Access on January 22, 2010).
- Kuo, Y. F., & Yen, S. N. (2009). Towards an understanding of the behavioral intention to use 3G mobile value-added services. *Computers in Human Behavior*, 25(1): 103-110.
- Kutter, T., Tiemann, S., Siebert, R., & Fountas, S. (2011). The role of communication and co-operation in the adoption of precision farming. *Precision Agriculture*, 12(1): 2-17.

- Ladha, J. K., Pathak, H., Krupnik, T. J., Six, J., & van Kessel, C. (2005). Efficiency of fertilizer nitrogen in cereal production: retrospects and prospects. *Advances in Agronomy*, 87: 85-156.
- Latir, S. S. B. A. (2013). *Knowledge, Attitude, School Support, Motivation and Use of Contextual Teaching among Secondary School Agriculture Teachers in Malaysia*. (Master's dissertation). Universiti Putra Malaysia, Malaysia.
- Lee, C. C., & Yang, J. (2000). Knowledge value chain. *Journal of Management Development*, 19(9): 783-793.
- Lee, Y. C., & Lee, S. K. (2007). Capabilities, processes, and performance of knowledge management: a structural approach. *Human Factors and Ergonomics in Manufacturing & Service Industries*, 17(1): 21-41.
- Leech, N. L., Barrett, K. C., & Morgan, G. A. (2012). *IBM SPSS for intermediate statistics: Use and interpretation* (4th Ed.). New York, United States: Routledge.
- Li, X., Ganeshan, K., & Xu, G. (2012). The role of social networking sites in e-learning. In *2012 Frontiers in Education Conference Proceedings* (pp. 1-6). IEEE. Seattle, WA, United States.
- Liaghati, H., Veisi, H., Hematyar, H., & Ahmadzadeh, F. (2008). Assessing the student's attitudes towards sustainable agriculture. *American-Eurasian Journal of Agricultural & Environmental Sciences*, 3: 227-232.
- Liao, C. W., Lu, C. Y., Huang, C. K., & Chiang, T. L. (2012). Work values, work attitude and job performance of green energy industry employees in Taiwan. *African Journal of Business Management*, 6(15): 5299-5318.
- Liles, R. T., & Mustian, R. D. (2004). Core competencies: A systems approach for training and organizational development in extension. *The Journal of Agricultural Education and Extension*, 10(2): 77-82.
- Lim, R. A. J., Lee, S. H. A., & Tong-Ming Lim, T. (2013). A study on knowledge quality and job performance of knowledge workers by analyzing content of social network sites using sentiment network analysis. *Information Management and Business Review*, 5(11): 525-530.
- Lithourgidis, C. S., Stamatelatu, K., & Damalas, C. A. (2016). Farmers' attitudes towards common farming practices in northern Greece: implications for environmental pollution. *Nutrient Cycling in Agroecosystems*, 105(2): 103-116.
- Liu, L., & Grandon, E. E. (2003). How performance and self-efficacy influence the ease of use of object-orientation: The moderating effect of prior training. In *36th Annual Hawaii International Conference on System Sciences*. Hawaii, United States.

- Lobley, M., Baker, J. R., & Whitehead, I. (2010). Farm succession and retirement: some international comparisons. *Journal of Agriculture, Food Systems, and Community Development*, 1(1): 49-64.
- Luo, W., & Timothy, D. J. (2017). An assessment of farmers' satisfaction with land consolidation performance in China. *Land Use Policy*, 61: 501-510.
- Luthans, F. (2005). *Organisational Behaviour* (10th Ed). New York: McGraw-Hill Irwin.
- Luvanda, M. W. (2015). *Factors affecting the job performance of agricultural extension workers in Handeni District, Tanzania*. (Doctoral dissertation). Sokoine University of Agriculture, Tanzania.
- Lynda Burton, ScD. (2012). *How to Approach a Study: Concepts, Hypotheses, and Theoretical Frameworks*. Johns Hopkins Bloomberg School of Public Health, Johns Hopkins University.
- Ma, L., Feng, S., Reidsma, P., Qu, F., & Heerink, N. (2014). Identifying entry points to improve fertilizer use efficiency in Taihu Basin, China. *Land Use Policy*, 37: 52-59.
- Maat, S. M., Zakaria, E., Nordin, N. M., & Meerah, T. S. M. (2011). Confirmatory factor analysis of the mathematics teachers' teaching practices instrument. *World Applied Sciences Journal*, 12(11): 2092-2096.
- Maene, L. M., & Bunoan-Olegario, A. (2015). Fertilizer Use and Human Health. *Advances in Tropical Soil Science*, 3: 1-26.
- Malhotra, N. K. (2004). *Marketing research: An applied orientation* (4th Ed.). Upper Saddle River, New Jersey: Prentice Hall.
- Manor, U., & Desiana, P. M. (2018). Work-Life balance, motivation and personality of MSE owners on firm performance in greater Jakarta. *Pertanika Journal of Social Sciences and Humanities*, 26: 127-138.
- Marin-Garcia, J. A. (2013). What do we know about the relationship between High Involvement Work Practices and Performance? *WPOM-Working Papers on Operations Management*, 4(2): 01-15.
- Marín-García, J.A., & De Miguel, E. (2001). *La Gestión Participativa en las Grandes Empresas Industriales Españolas: Grado de Uso, Resultados Obtenidos y Comparación Internacional*. Universitat Politècnica de València, Valencia, Spain.
- Marton-Williams, J. (1986). Consumer Market Research Handbook. In J. Downham, & R. M. Worcester (Eds.), *Questionnaire design*. London: McGraw-Hill Book Company.

- Masa'deh, R., Gharaibeh, A., Maqableh, M., & Karajeh, H. (2013). An empirical study of antecedents and outcomes of knowledge sharing capability in Jordanian telecommunication firms: A structural equation modeling approach. *Life Science Journal*, 10(4): 2284-2296.
- Masa'deh, R., Shannak, R., Maqableh, M., & Tarhini, A. (2017). The impact of knowledge management on job performance in higher education: The case of the University of Jordan. *Journal of Enterprise Information Management*, 30(2): 244-262.
- Masum, M. F., Islam, M. M., Jannat, A., & Dhar, A. R. (2018). Economics of Boro rice production in Rangpur district of Bangladesh: Comparative assessment of urea super granule and traditional urea application. *Agricultural Research & Technology: Open Access Journal (ARTOAJ)*, 18(3): 136-146.
- Matsubara, K., Yamamoto, E., Kobayashi, N., Ishii, T., Tanaka, J., Tsunematsu, H., Yoshinaga, S., Matsumura, O., Yonemaru, J., Mizobuchi, R., Yamamoto, T., Kato, H., & Yano, M. (2016). Improvement of rice biomass yield through QTL-based selection. *PloS one*, 11(3): e0151830.
- Maxwell, J. A. (2012). *Qualitative research design: An interactive approach* (Volume 1). London: Sage publications.
- Meijer, S. S., Catacutan, D., Ajayi, O. C., Sileshi, G. W., & Nieuwenhuis, M. (2015). The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. *International Journal of Agricultural Sustainability*, 13(1): 40-54.
- Merkebu, G., & Amsalu, N. (2018). Nitrogen use efficiency of upland rice in the humid tropics of Southwest Ethiopia in response to split nitrogen application. *Journal of Agronomy*, 17(1): 68-76.
- Meyer, J. P., Paunonen, S. V., Gellatly, I. R., Goffin, R. D., & Jackson, D. N. (1989). Organizational commitment and job performance: It's the nature of the commitment that counts. *Journal of applied Psychology*, 74(1): 152-156.
- Miah, M. M., Saha, P. K., Islam, A., Hasan, M. N., & Nosov, V. (2008). Potassium fertilization in rice-rice and rice-wheat cropping system in Bangladesh. *Bangladesh Journal of Agriculture and Environment*, 4: 51-67.
- Michaelis, B., Wagner, J. D., & Schweizer, L. (2015). Knowledge as a key in the relationship between high-performance work systems and workforce productivity. *Journal of Business Research*, 68(5): 1035-1044.
- Minbaeva, D. B. (2013). Strategic HRM in building micro-foundations of organizational knowledge-based performance. *Human Resource Management Review*, 23(4): 378-390.
- Mondal, M. H. (2010). Crop agriculture of Bangladesh: Challenges and opportunities. *Bangladesh Journal of Agricultural Research*, 35(2): 235-245.

- Moore, D., Cheng, M. I., & Dainty, A. R. J. (2003). What makes a superior management performer: The identification of key behaviours in superior construction managers. *CIQ, Construction Paper*, 155: 6-9.
- Moore, K. D. (2009). *Effective Instructional Strategies: From Theory to Practice* (2nd Ed.). California: SAGE Publication.
- Mostafa, M.G. (2014). *Utilization of Endogenous Farming Resources by Resource-Poor Farmers towards Integrated Plant Nutrient System*. (Doctoral Dissertation). Bangladesh Agricultural University, Mymensingh, Bangladesh.
- Motowildo, S. J., Borman, W. C., & Schmit, M. J. (1997). A theory of individual differences in task and contextual performance. *Human performance*, 10(2): 71-83.
- Mottaleb, K. A., Rahut, D. B., & Erenstein, O. (2019). Small businesses, potentially large impacts: The role of fertilizer traders as agricultural extension agents in Bangladesh. *Journal of Agribusiness in Developing and Emerging Economies*, 9(2): 109-124.
- Moullin, M. (2007). Performance measurement definitions: Linking performance measurement and organizational excellence. *International Journal of Health Care Quality Assurance*, 20(3): 181-183.
- Moumouni, I. M., & Streiffeler, F. (2010). Understanding the motivation of farmers in financing agricultural research and extension in Benin. *Quarterly Journal of International Agriculture*, 49: 47-68.
- Mugenda, M., & Mugenda, A.G. (2003). *Research Methods: Quantitative and qualitative approaches*. African Centre of Technology Studies, Nairobi, Kenya.
- Mugwe, J., Mugendi, D., Mucheru-Muna, M., Merckx, R., Chianu, J., & Vanlauwe, B. (2009). Determinants of the decision to adopt integrated soil fertility management practices by smallholder farmers in the central highlands of Kenya. *Experimental agriculture*, 45(1): 61-75.
- Muindi, D.F. & K'Obonyo, P. (2015). Quality of work life, personality, job satisfaction, competence, and job performance: A critical review of literature. *European Scientific Journal*, 11(26): 223-240.
- Mullins, L.J. (2010). *Management and Organizational Behavior* (10th Ed.). Harlow, FT: Prentice Hall.
- Mun, Y. Y., Jackson, J. D., Park, J. S., & Probst, J. C. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view. *Information & Management*, 43(3):350-363.
- Munisamy, S. (2013). *Identifying Factors That Influences Job Performance amongst Employees in Oil Palm Plantation*. (Project Paper). Faculty of Applied Social Sciences, Open University Malaysia, Malaysia.

- Munteanu, A. (2014). What Means High Performance Work Practices for Human Resources in an organization. *Annals of the University of Petrosani, Economics*, 14(1): 243-250.
- Musa, A. H., Hayrol, A., D'Silva, J. L., Zobidah, O., & Jusang, B. (2011). Fishermen and ICT: towards creating knowledgeable fishermen in Malaysia. *Australian Journal of Basic and Applied Sciences*, 5(9): 457-469.
- Musser, W. N., Shortle, J. S., Krehling, K., Roach, B., Huang, W. C., Beegle, D. B., & Fox, R. H. (1995). An economic analysis of the pre-sidedress nitrogen test for Pennsylvania corn production. *Review of Agricultural Economics*, 25-35.
- Mustapha, M. C. (2004). *Management of rice production systems to increase productivity in the Gambia, West Africa*. (Doctor Dissertation). Cornell University, Ithaca, United States.
- Mustapha, S. B., Alkali, A., Shehu, H., and Ibrahim, A. K. (2017). Motivation strategies for improved performance of agricultural extension workers in Nigeria. *International Academic Journal of Organizational Behavior and Human Resource Management*, 4(1): 1-8.
- Muzari, W., Gatsi, W., & Muvhunzi, S. (2012). The impacts of technology adoption on smallholder agricultural productivity in sub-Saharan Africa: A review. *Journal of Sustainable Development*, 5(8): 69-77.
- Nag, R., & Gioia, D. A. (2012). From common to uncommon knowledge: Foundations of firm-specific use of knowledge as a resource. *Academy of Management Journal*, 55(2): 421-457.
- Naher, U. A., Othman, R., Shamsuddin, Z. H., Saud, H. M., Ismail, M. R., & Rahim, K. A. (2011). Effect of root exuded specific sugars on biological nitrogen fixation and growth promotion in rice (*Oryza sativa*). *Australian Journal of Crop Science*, 5(10): 1210-1217.
- Naher, U. A., Shah, A. L., Sarkar, M. I. U., Islam, S. M., Ahmed, M. N., Panhwa, Q. A., & Othman, R. (2015). Fertilizer consumption scenario and rice production in Bangladesh. *Advances in Tropical Soil Science*, 3: 81-98.
- Napier, T. L., Robinson, J., & Tucker, M. (2000). Adoption of precision farming within three Midwest watersheds. *Journal of Soil and Water Conservation*, 55(2): 135-141.
- Nasim, M., Shahidullah, S. M., Saha, A., Muttaleb, M. A., Aditya, T. L., Ali, M. A., & Kabir, M. S. (2017). Distribution of crops and cropping patterns in Bangladesh. *Bangladesh Rice Journal*, 21(2): 1-55.
- Nassazi, A. (2013). *Effects of Training on Employee Performance. Evidence from Uganda*. (Thesis Project). University of Applied Sciences, Uganda.

- Ndruru, R.E., Situmorang, M. & Tarigan, G. (2014). Analysis of factors that affect results of rice production in deli Serdang. *Saintia Matematika*, 2: 71-83.
- Newman, S., Steed, E., & Mulligan, K. (2008). *Chronic physical illness: self-management and behavioural interventions: self-management and behavioural interventions*. United Kingdom: McGraw-Hill Education.
- Ngima, W. M., & Kyongo, J. (2013). Contribution of motivational management to employee performance. *International Journal of Humanities and Social Science*, 3(14): 219-239.
- Ninsiima, D. (2015). *Factors Affecting Adoption of an Information Communications Technology System for Agriculture in Uganda*. (Master dissertation). Michigan State University, United States.
- Nkari, D. I. M., & Kibera, P. F. N. (2016). The influence of farmer characteristics on performance of commercial farmers in Kiambu County, Kenya. *European Journal of Business and Social Sciences*, 5(03): 63-78.
- Nonaka, I., & Von Krogh, G. (2009). Perspective—Tacit knowledge and knowledge conversion: Controversy and advancement in organizational knowledge creation theory. *Organization Science*, 20(3): 635-652.
- Nonaka, I., Toyama, R., & Nagata, A. (2000). A firm as a knowledge-creating entity: a new perspective on the theory of the firm. *Industrial and Corporate Change*, 9(1): 1-20.
- Nordin, S. M., Noor, S. M., & bin Md Saad, M. S. (2014). Innovation diffusion of new technologies in the Malaysian paddy fertilizer industry. *Procedia-Social and Behavioral Sciences*, 109: 768-778.
- Ntawuruhunga, D. (2016). *Farmers' Knowledge, Attitude and Practice towards African Indigenous Vegetables in Kenya*. (Master's dissertation), University of Agriculture and Technology, Nairobi, Kenya.
- Obilor, E. I., & Amadi, E. C. (2018). Test for significance of Pearson's correlation coefficient. *International Journal of Innovative Mathematics, Statistics & Energy Policies*, 6(1): 11-23.
- O'Boyle, I., & Hassan, D. (2014). Performance management and measurement in national-level non-profit sport organizations. *European Sport Management Quarterly*, 14(3): 299-314.
- Ochoga, A. E. (2007). *Perceptions of Fairness: Interpersonal Communication and Performance Appraisal in the Work Place*. (Master dissertation). Bowie State University, United States.
- Okoye, B. C., Onyenweaku, C. E., Ukoha, O. O., Asumugha, G. N., & Aniedu, O. C. (2008). Determinants of labour productivity on small-holder cocoyam farms in Anambra State, Nigeria. *Scientific Research and Essays*, 3(11): 559-561.

- Okwoche, V. A., & Asogwa, B. C. (2012). Analysis of determinants of job performance of extension workers as a leader to farmers in Nigeria. *British Journal of Economics, Finance and Management Sciences*, 5(2): 1-21.
- Olagunju, F. I., & Salimonu, K. K. (2010). Effect of Adoption Pattern of Fertilizer Technology on Small Scale Farmer's Productivity in Boluwaduro Local Government. *World Rural Observations*, 2(3): 23-33.
- O'Leary, Z. (2017). *The essential guide to doing your research project*. London: Sage Publishers.
- Oluikpe, P. (2012). Developing a corporate knowledge management strategy. *Journal of Knowledge Management*, 16(6): 862-878.
- Oluwatoyin, O. (2019). *Perceptions of Cocoa Growers in Malaysia on Relationship between Transfer of Technology Skills, Human Resource Development Skills and Extension Agents' Work Performance*. (Doctoral dissertation). Universiti Putra Malaysia, Malaysia.
- Omar, N., Munir, Z. A., Kaizan, F. Q., Noranee, S., & Malik, S. A. (2019). The impact of employees motivation, perceived usefulness and perceived ease of use on employee performance among selected public sector employees. *International Journal of Academic Research in Business and Social Sciences*, 9(6): 1128–1139.
- Omoro, P. A., Shitandi, A., Bitonga, R. O., & Basweti, E. (2014). Determination of farmer's choice of fertilizer application rate and its effect on the greenhouse technology performance in gusii highlands, Kenya. *International Journal of Agricultural Extension*, 2(1): 35-41.
- Onwuegbuzie, A. J., & Collins, K. M. T. (2007). A typology of mixed methods sampling designs in social science research. *The Qualitative Report*, 12(2): 281–316.
- Pallant, J. (2005). *SPSS survival manual. A step by step guide to data analysis using IBM SPSS* (5th Ed.). Berkshire: Open University Press.
- Pallant, J. (2007). *Survival manual A step by Step Guide to Data Analysis using SPSS for windows*. Berkshire: Open University Press.
- Pallant, J. (2010). *SPSS survival manual: A step by step guide to data analysis using the SPSS program* (4th Ed.). New York: McGraw Hill International Publishers.
- Palumbo, M. V., Miller, C. E., Shalin, V. L., & Steele-Johnson, D. (2005). The impact of job knowledge in the cognitive ability-performance relationship. *Applied HRM Research*, 10(1): 13-20.
- Pan, D. (2014). The impact of agricultural extension on farmer nutrient management behavior in Chinese rice production: A household-level analysis. *Sustainability*, 6(10): 6644-6665.

- Pandey, S., Byerlee, D. R., Dawe, D., Dobermann, A., Mohanty, S., Rozelle, S., & Hardy, B. (2010). *Rice in the global economy: strategic research and policy issues for food security* (No. 164488). IRRI Books, International Rice Research Institute (IRRI).
- Pardo, T. A., Cresswell, A. M., Thompson, F., & Zhang, J. (2006). Knowledge sharing in cross-boundary information system development in the public sector. *Information Technology and Management*, 7(4): 293-313.
- Park, J., Yang, S., & Lehto, X. (2007). Adoption of mobile technologies for Chinese consumers. *Journal of Electronic Commerce Research*, 8(3), 196-206.
- Park, N., Roman, R., Lee, S., & Chung, J. E. (2009). User acceptance of a digital library system in developing countries: An application of the Technology Acceptance Model. *International Journal of Information Management*, 29(3): 196-209.
- Parveen, S. (2010). Rice farmers' knowledge about the effects of pesticides on environmental pollution in Bangladesh. *Bangladesh Research Publications Journal*, 3: 1214-1227.
- Pearcy, R. A. (2012). *Identifying Factors for Farmers to Adopt New Farming Techniques*. (Master's dissertation). University of Illinois at Urbana – Champaign, Champaign, United States.
- Perveen, F. (2016). Crop monitoring system in Bangladesh, main challenges, recent initiatives and prospects. In *Dhaka: Department of Agricultural Extension (DAE), Ministry of Agriculture, Bangladesh*. Available from URL: http://www.fao.org/fileadmin/templates/rap/files/meetings/2016/160524_AMISCM_4 (Vol. 1).
- Peshin, R., Vasanthakumar, J., & Kalra, R. (2009). Diffusion of innovation theory and integrated pest management. In R. Peshin & A. K. Dhawan (Ed.), *Integrated pest management: Dissemination and impact* (pp. 1-29). Dordrecht, Berlin, Germany: Springer.
- Peter, A. Y. (2016). *Building Sustainable Green Practices among Malaysian E&E Manufacturing SMEs*. (Doctoral dissertation). Open University Malaysia, Malaysia.
- Peter, J. P. (1979). Reliability: A review of psychometric basics and recent marketing practices. *Journal of Marketing Research*, 16(1): 6-17.
- Philippaers, K., De Cuyper, N., Forrier, A., Vander Elst, T., & De Witte, H. (2016). Perceived employability in relation to job performance: A cross-lagged study accounting for a negative path via reduced commitment. *Scandinavian Journal of Work and Organizational Psychology*, 1(1): 1-15.
- Pierpaoli, E., Carli, G., Pignatti, E., & Canavari, M. (2013). Drivers of precision agriculture technologies adoption: a literature review. *Procedia Technology*, 8: 61-69.

- Powel, N. J. (1999). Research Principle used in developing assessments in occupational therapy. In: B.J. Hemphill- Pearson (Ed.), *Assessments in occupational therapy mental health: An integrative approach*. Thorofare, NJ: SLACK Inc.
- Power, E. F., Kelly, D. L., & Stout, J. C. (2013). Impacts of organic and conventional dairy farmer attitude, behaviour and knowledge on farm biodiversity in Ireland. *Journal for Nature Conservation*, 21(5): 272-278.
- Prat, N. (2006). A hierarchical model for knowledge management. *Encyclopedia of Knowledge Management*, 211-220.
- Pringle, C. D. (1994). An initial test of a theory of individual performance. *Psychological Reports*, 74(3): 963-973.
- Pulakos, E. D., Arad, S., Donovan, M. A., & Plamondon, K. E. (2000). Adaptability in the workplace: Development of a taxonomy of adaptive performance. *Journal of Applied Psychology*, 85(4): 612-624.
- Qamar, M. K. (2005). *Modernizing National Agricultural Extension Systems: A Practical Guide for Policy-makers of Developing Countries*. Rome: FAO.
- Rahaman, M. S., Haque, S., Sarkar, M. A. R., Sarker, M. R., & Siddique, M. A. B. (2019). The role of training, extension and education facilities on production efficiency of rice growers in Dinajpur district of Bangladesh. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems*, 9(2):91-98.
- Rahim, M.S. (2010). Kompetensi pembangunansumberdaya manusia dan pemedahan teknologi dan kaitannya dengan prestasi kerja agen pendidikan pengembangan. *Akademika*, 79: 127-137.
- Rahman, M.H., Islam, M. R., Jahiruddin, M., & Haque, M. Q. (2011). Economics of fertilizer use in the Maize-Mungbean/Dhaincha-T.aman rice cropping pattern. *Journal of Bangladesh Agricultural University*, 9(1): 37-42.
- Rahman, M.S., Ahmed, M.U., Rahman, M.M., Islam, M.R., & Zafar, A. (2009). Effect of different levels of sulphur on the growth and yield of BRRI DHAN 41. *Bangladesh Research Publications Journal*, 3(1): 846-852.
- Raidén, A.B., Dainty, A.R.J., & Neale, R.H. (2006). Balancing employee needs, project requirements and organizational priorities in team deployment. *Construction Management and Economics*, 24(8): 883-895.
- Ramawickrama, J., H. H. D. N. P. Opatha & PushpaKumari, M. D. (2017). A synthesis towards the construct of job performance. *International Business Research*, 10 (10): 66-81.
- Ramle, B. K. P. (2012). *Contribution of Group Dynamics Factors to Technology Adoption among Malaysia Cocoa Farmers' Clusters*. (Doctoral dissertation). Universiti Putra Malaysia, Malaysia.

- Rani, A. (2014). Consumption of chemical fertilizers in Haryana: An empirical study. *Zenith International Journal of Business Economics & Management Research*, 4(7): 105-112.
- Rani, A. B. A. (2015). *Influence of Spiritual Intelligence, Age and Tenure on Work Performance of Nurses in Selected Hospitals, Peninsular Malaysia*. (Doctoral dissertation). Universiti Putra Malaysia, Malaysia.
- Rapsomanikis, G. (2015). *The economic lives of smallholder farmers: An analysis based on household data from nine countries*. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Reimer, A. P., Weinkauff, D. K., & Prokopy, L. S. (2012). The influence of perceptions of practice characteristics: An examination of agricultural best management practice adoption in two Indiana watersheds. *Journal of Rural Studies*, 28(1): 118-128.
- Revilla, M. A., Saris, W. E., & Krosnick, J. A. (2014). Choosing the number of categories in agree–disagree scales. *Sociological Methods & Research*, 43(1): 73-97.
- Riketta, M. (2008). The causal relation between job attitudes and performance: a meta-analysis of panel studies. *Journal of Applied Psychology*, 93(2): 472-481.
- Robbins, S. P. (2003). *Organizational behavior: global and Southern African perspectives*. Cape Town: Pearson Education.
- Robbins, S.P. & Judge, T.A. (2013). *Organizational Behavior* (15th Ed.). Boston, MA: Pearson Education.
- Roberts, T.L., & Tasistro, A.S. (2012). The Role of Plant Nutrition in Supporting Food Security in Fertilizing Crops to Improve Human Health: A Scientific Review. *International Plant Nutrition Institute, the USA and the International Fertilizer Industry Association, France*.
- Rogers E.M. (1962). *Diffusion of Innovations* (1st Ed.). New York: Free Press.
- Rogers, E.M. (2003). *Diffusion of innovations* (5th Ed.). New York, United States: Free Press.
- Rogstadius, J., Kostakos, V., Kittur, A., Smus, B., Laredo, J., & Vukovic, M. (2011). An assessment of intrinsic and extrinsic motivation on task performance in crowdsourcing markets. In *Proceedings of the International AAAI Conference on Web and Social Media*, 5(11): 17-21.
- Romando, R (2008). Define Motivation. Retrieved from <http://www.212articles.com/articles/38/1/Define-Motivation/Page1.htm>. (Access on Mar 8, 2010).

- Rotenberry F., & Moberg, J. (2007). Assessing the impact of job involvement on performance. *Management Research News*, 30(3): 203-215.
- Rotundo, M., & Sackett, P. R. (2002). The relative importance of task, citizenship, and counterproductive performance to global ratings of job performance: A policy-capturing approach. *Journal of Applied Psychology*, 87(1): 66-80.
- Ryan, R.L., Erickson, D.L., De Young, R. (2003). Farmers' motivations for adopting conservation practices along Riparian zones in a mid-western agricultural watershed. *Journal of Environment Planning and Management*, 46: 19–37.
- Ryen, A., (2004). Ethical Issues. In: (eds.) C. Seale, G. Gobo, J. F. Gubrium, & D. Silverman (Ed.), *Qualitative Research Practice*. London: Sage Publications.
- Sa'ari, J. R., Jabar, J., Tahir, M. N. H., & Mahpoth, M. H. (2017). Farmer's acceptance towards sustainable farming technology. *International Journal of Advanced and Applied Sciences*, 4(12): 220-225.
- SAARC Agriculture Centre. (2011). *Strategies for Arresting Land Degradation in South Asian Countries*. SAARC Agriculture Centre (SAC), BARC Complex: Dhaka, Bangladesh.
- Sabherwal, R., & Becerra-Fernandez, I. (2003). An empirical study of the effect of knowledge management processes at individual, group, and organizational levels. *Decision Sciences*, 34(2):225-260.
- Sachdev, S. B., & Verma, H. V. (2004). Relative importance of service quality dimensions: A multisectoral study. *Journal of Services Research*, 4(1): 1-25.
- Sackett, P. R. (2002). The structure of counterproductive work behaviors: Dimensionality and relationships with facets of job performance. *International journal of selection and assessment*, 10(1-2): 5-11.
- Sadati, S. A., Shaabanali Fami, H., Asadi, A., & Sadati, S. A. (2010). Farmer's attitude on sustainable agriculture and its determinants: A case study in Behbahan County of Iran. *Research Journal of Applied Sciences, Engineering and Technology*, 2(5): 422-427.
- Saha, P. K., Miah, M. A. M., Hossain, A. T. M. S., Rahman, F., & Saleque, M. A. (2009). Contribution of rice straw to potassium supply in rice-fallow-rice cropping pattern. *Bangladesh Journal of Agricultural Research*, 34: 633–643.
- Said, H. B. M., Izharuddin, A. F. B., Idris, I. B., & Othman, H. B. (2018). Examining the relationships between perceived usefulness, perceived ease of use, enjoyment and self-efficacy on employees' behavioral intention towards adopting online technology application at workplace: A case in Malaysia. *American Journal of Social Sciences and Humanities*, 3(1): 29-39.

- Said, H., Badru, B. B., & Shahid, M. (2011). Confirmatory factor analysis (CFA) for testing validity and reliability instrument in the study of education. *Australian Journal of Basic and Applied Sciences*, 5(12): 1098-1103.
- Sajjadi, N. A., & Omidi, A. R. (2007). Effective factors on job performance of headquarters in Physical Education Organization, *Harekat Journal*, 38: 81-93.
- Salam, M. A., Iftekharuddaula, K. M., Siddique, A. B., Rashid, M. A., Rashid, M. H., Momin, M. S. I., Kabir, M. S. & Biswas, J. K. (2014). Strategic plan for increasing Aus and Aman rice cultivation in Bangladesh. In *Workshop on BRRRI* (pp. 1-17), Gazipur, Bangladesh.
- Samal, P., & Babu, S. (2018). The shape of rice agriculture towards 2050. *International Association of Agricultural Economists (IAAE) > 2018 Conference, July 28-August 2, 2018*, Vancouver, British Columbia.
- Sambodo, L.A.A.T. (2007). *The decision making processes of Semi-commercial farmers: a case study of technology adoption in Indonesia*. [Unpublished Doctoral Thesis.] Lincoln University, New Zealand.
- Saqib, S. E., Ahmad, M. M., & Panezai, S. (2016). Landholding size and farmers' access to credit and its utilization in Pakistan. *Development in Practice*, 26(8): 1060-1071.
- Sarker, M. A., Itohara, Y., & Hoque, M. (2009). Determinants of adoption decisions: The case of organic farming (OF) in Bangladesh. *Extension Farming Systems Journal*, 5(2): 39-46.
- Sarker, M. M. H., Jahiruddin, M., Moslehuddin, A. Z. M., & Islam, M. R. (2020). Changing dynamics of micronutrients in piedmont soil of Bangladesh. *Eurasian Journal of Soil Science*, 9(1): 43-51.
- Saunders, M., Lewis, P., & Thornhill, A. (2007). *Research Methods for Business Students* (4th Ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Schimansky, S. (2014). *The Effect of a High-Commitment Work System on Innovative Behavior of Employees*. (Bachelor Thesis). University of Twente, Enschede, the Netherlands.
- Schmidt, F. L., & Hunter, J. E. (1992). Development of a causal model of processes determining job performance. *Current Direction in Psychological Science*, 1(3): 89-92.
- Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation coefficients: appropriate use and interpretation. *Anesthesia & Analgesia*, 126(5), 1763-1768.
- Schreiber-Gregory, D. N. (2018). Logistic and Linear Regression Assumptions: Violation Recognition and Control. *Henry M Jackson Foundation*, Skybridge Towers, United States.

- Sclifos, I. (2016). *Management Motivation According to Key Performance Indicators in Agriculture*. (Master's dissertation). State Agrarian University of Moldova, Moldova.
- Sehai, E. (2006). Knowledge Management in Ethiopian Agriculture. *14th Annual Conference, Ethiopian Society of Animal Production*, Ethiopia.
- Sekaran, U. (2003). *Research methods for business: A skill building approach*. New York: John Wiley and Sons Inc.
- Semeon, G., Garfield, M., Meshesha, M., & Dessa, D. (2013, August). Agricultural knowledge Management systems in practice: The ability to support Wereda knowledge centers in Ethiopia. In *19th Americas Conference on information System*, United States.
- Setiawaty, A. E. (2002). Pengaruh Motivasi terhadap Keefektifan Penganggaran Partisipatif dalam Peningkatan Kinerja Manajerial, Tesis. *Magister Akuntansi, Fakultas Ekonomi Universitas Indonesia*. Tidak dipublikasikan
- Shafique, M. N., Ahmad, N., Abbas, H., & Hussain, A. (2015). The impact of customer relationship management capabilities on organizational performance; moderating role of competition intensity. *Arabian Journal of Business and Management Review*, 3(3): 28-47.
- Shah, A. L., Rahman, M. S., & Aziz, M. A. (2008). Outlook for fertilizer consumption and food production in Bangladesh. *Bangladesh Journal of Agriculture and Environment*, 4: 9-26.
- Shah, K. & Shah, P.J. (2010). Motivation. Available online at: <http://scribd.com/doc/6564596/motivation> (Access on November 8th, 2010).
- Shah, S. B. S. K. (2016). *Relationship between Personality Traits and Work Performance among Potential Paddy Farmers in Malaysian Granary Areas*. (Master dissertation). Universiti Putra Malaysia, Malaysia.
- Sharifuddin, A. J., Mohammed, Z., & Terano, R. (2018). Paddy farmer's perception and factors influencing attitude and intention on adoption of organic rice farming. *International Food Research Journal*, 25(2): 135-145.
- Sharma, N., & Sharma, A. (2017). Relationship between employee motivation and performance of the employees working in retail sector In Jaipur. *Journal of Management Engineering and Information Technology*, 4(2): 10-17.
- Shekari, G., Monshizadeh, M., & Ansari, M. (2014). Investigating the relationship between quality of working life (based on Walton's model) and employees' performance (based on annual performance evaluation scores) in Water and Wastewater Office, KhorasanRazavi. *Interdisciplinary Journal of Contemporary Research in Business*, 6(1): 254-268.

- Shelley, I. J., Takahashi-Nosaka, M., Kano-Nakata, M., Haque, M. S., & Inukai, Y. (2016). Rice cultivation in Bangladesh: present scenario, problems, and prospects. *Journal of International Cooperation for Agricultural Development*, 14(4): 20-29.
- Shew, A. M., Durand-Morat, A., Putman, B., Nalley, L. L., & Ghosh, A. (2019). Rice intensification in Bangladesh improves economic and environmental welfare. *Environmental Science & Policy*, 95: 46-57.
- Shields, J., Brown, M., Kaine, S., Dolle-Samuel, C., North-Samardzic, A., McLean, P., Johns, R., O'Leary, P., & Plimmer, G. (2015). *Managing employee performance & reward: Concepts, practices, strategies*. Cambridge, England: Cambridge University Press.
- Siddique, M. N. A., Halim, M. A., Kamaruzzaman, M., Karim, D. & Sultana, J. (2014). Comparative insights for investigation of soil fertility degradation in a piedmont area which cover the Anjamkhor union of Baliadangi upazila, Thakurgoan, Bangladesh. *Journal of Environmental Science, Toxicology and Food Technology*, 8(4):82-87.
- Siddiquee, A.H., Sammy, H.M., & Hasan, M.R. (2018). Profitability of Paddy Production in Bogura and Gaibandha Districts of Bangladesh. Conference: *Bangladesh Agricultural Economist Association*, 16th National Conference, April 2018, Dhaka, Bangladesh.
- Siemens, E., Roth, A. V., & Balasubramanian, S. (2008). How motivation, opportunity, and ability drive knowledge sharing: The constraining-factor model. *Journal of Operations Management*, 26(3): 426-445.
- Simão, Pedro. (2014). Re: How can I explain why I am using the five Likert scale for my questionnaires? Retrieved from: https://www.researchgate.net/post/How_can_I_explain_why_I_am_using_five_likert_scale_for_my_questionnaires/533d56d2d039b1d71e8b459d/citation/download. (Access on November 12, 2019).
- Singh, B., & Singh, V. K. (2017). Fertilizer management in rice. In B. S. Chauhan, K. Jabran, & G. Mahajan (Ed.), *Rice production worldwide* (pp. 217-253). Cham, Switzerland: Springer.
- Singh, H., & Solanki, R. S. (2014). Factors influencing the use of fertilizers in agriculture of Madhya Pradesh in India. *International Journal of Scientific Research in Mathematical and Statistical Sciences*, 1: 18-40.
- Sinja, J., Karugia, J. I., Baltenweck, I., Waithaka, M., Miano, M.D., Nyikal, R., & Romney, D. (2004). *African Association of Agricultural Economists. Shaping the Future of African Agriculture for Development: The Role of Social Scientists*. Proceedings of the *Inaugural Symposium*, 6 to 8 December 2004, Grand Regency Hotel, Nairobi, Kenya.

- Sinja, J., Karugia, J. T., Baltenweck, I., Waithaka, M. M., Miano, M. D., Nyikal, R. A., & Romney, D. (2004). *Farmer Perception of Technology and its Impact on Technology Uptake: The Case of Fodder Legume in Central Kenya Highlands* (No. 306-2016-4861).
- Sisie, S. A., & Mirshekari, B. (2011). Effect of phosphorus fertilization and seed biofertilization on harvest index and phosphorus use efficiency of wheat cultivars. *Journal of Food, Agriculture & Environment*, 9: 388-391.
- Sjakir, M., Azima, A. M., Hussain, M. Y., & Zaimah, R. (2015). Learning and technology adoption impacts on farmer's productivity. *Mediterranean Journal of Social Sciences*, 6(4): 126-136.
- Sohela, M. H., Sarkera, A., Razzakb, M. A., & Hashemc, M. A. (2016). Integrated use of organic and inorganic fertilizers on the growth and yield of Boro rice (cv. BRRI Dhan 29). *Journal of Bioscience and Agriculture Research*, 10(1): 857-865.
- Sonnentag, S. (2003). *Psychological management of individual performance*. New Jersey: John Wiley & Sons Publishers.
- Sonnentag, S., & Frese, M. (2002). Performance concepts and performance theory. *Psychological management of Individual Performance*, 23(1): 3-25.
- Sonnentag, S., Volmer, J., & Spychala, A. (2008). The SAGE Handbook of Organizational Behavior: Volume I - Micro Approaches. In J. Barling, C. L. Cooper, & S. Clegg (Eds.), *Job performance* (pp. 427-450). Los Angeles; London: SAGE.
- Stangor, C. (2011). *Research methods for the behavioral sciences* (4th Ed.). Australia, Belmont, CA: Wadsworth Cengage Learning.
- Stewart, W. M., Dibb, D. W., Johnston, A. E., & Smyth, T. J. (2005). The contribution of commercial fertilizer nutrients to food production. *Agronomy Journal*, 97(1): 1-6.
- Sultana, J., Siddique, M. N. A., & Abdullah, M. R. (2015). Fertilizer recommendation for agriculture: practice, practicalities and adaptation in Bangladesh and Netherlands. *International Journal of Business, Management and Social Research*, 1(1): 21-40.
- Susanty, A., Miradipta, R., & Jie, F. (2013). Analysis of the effect of attitude toward works, organizational commitment, and job satisfaction, on employee's job performance. *European journal of Business and Social Sciences*, 1(10): 15-24.
- Swanson, R.A. & Holton, E.F. (2001). *Foundations of Human Resource Development*. San Francisco, California, United States: Berret-Koehler Publishers.
- Tabachnick, B. G., & Fidell, L. S., (2007). *Using multivariate statistics* (5th Ed.). Boston, Massachusetts, United States: Pearson Education, Inc.

- Tajali, M., & Baharvand, M. (2014). Relationship between knowledge management with employees' performance and innovation. *Kuwait Chapter of the Arabian Journal of Business and Management Review*, 3(11): 59-63.
- Tan, T. H., & Waheed, A. (2011). Herzberg's motivation-hygiene theory and job satisfaction in the Malaysian retail sector: The mediating effect of love of money. *Asian Academy of Management Journal*, 16(1): 73-94.
- Tandon H.L.S., & Narayan P. (1990). *Fertilizer in Indian Agriculture—past, present and future* (1950-2000). FDCO, New Delhi, India.
- Tankersley, M. K., (2015). *A Descriptive Correlational Study Examining the Relationship of Emergency Department Contextual Factors and Transfer Interval to an Intermediate Unit*. (Master dissertation). Cedarville University, Cedarville, USA.
- Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, 2: 53-55.
- Taylor-Powell, E. & Herman, C. (2000). *Collecting evaluation data surveys*. University of Wisconsin-Extension. Madison. Wisconsin.
- Teo, T. (2009). Modelling technology acceptance in education: A study of pre-service teachers. *Computers & Education*, 52(2): 302-312.
- Teo, T., Lee, C. B., Chai, C. S., & Wong, S. L. (2009). Assessing the intention to use technology among pre-service teachers in Singapore and Malaysia: A multigroup invariance analysis of the Technology Acceptance Model (TAM). *Computers & Education*, 53(3): 1000-1009.
- Teodorescu, N., Stancioiu, A. F., Anghel, L. D., & Vranceanu, D. M. (2007). Qualitative versus quantitative marketing research. *Management & Marketing*, 2(3): 1-8.
- Tiraieyari, N. (2009). *Relationships between Extension Workers' Competencies and Job Performance in Implementing the Good Agricultural Practices Programme in Malaysia* (Doctoral dissertation). Universiti Putra Malaysia, Malaysia.
- Tiraieyari, N., Idris, K., Hamzah, A., & Jegak Uli, J. (2010). Teaching method competencies used by extensionists in transferring the good agricultural practices to Malaysian farmers. *Australian Journal of Basic and Applied Sciences*, 4(10): 5379-5387.
- Tomich, T.P., Kilby, & Johnson, B. (1995). *Transforming agrarian economies: opportunities seized*. Cornell University Press, Ithaca, New York, United States.
- Turiman, S. (2017). *DCE 5900 Research Methods Lecture*. Department of Professional Development and Continuing Education, Faculty of Educational Studies, Universiti Putra Malaysia, Malaysia.

- Tustin, D. H., Ligthelm, A. A., Martins, J. H., & Van Wyk, HdeJ. (2005). *Marketing research in practice*. Pretoria: Unisa Press.
- Tyre, M. J., & Hauptman, O. (1992). Effectiveness of organizational responses to technological change in the production process. *Organization Science*, 3(3): 301-320.
- Uddin, M. N. (2008). Agricultural extension services in Bangladesh: a review study. Department of Agricultural Extension Education Bangladesh Agricultural University, Bangladesh, 5: 119–130.
- Ufuophu-Biri, E., & Iwu, C. G. (2014). Job Motivation, Job Performance and Gender Relations in the Broadcast Sector in Nigeria. *Mediterranean Journal of Social Sciences*, 5(16): 191-198.
- Umar, S., Man, N., Shuaibu, H., & Saleh, J. M. (2018). The role of competency dimensions and organizational support in climate change advisory service delivery. *PEOPLE: International Journal of Social Sciences*, 3(3): 1076-1091.
- University of Minnesota Libraries Publishing. (2015). *Principles of Management* (2015 Ed.). Minneapolis, MN: University of Minnesota Libraries Publishing.
- Upadhaya, B., Munir, R., & Blount, Y. (2014). Association between performance measurement systems and organizational effectiveness. *International Journal of Operations and Production Management*, 34(7): 853–875.
- Usop, A. M., Askandar, D. K., Kadtong, M. L., & Usop, D. A., S., O. (2013). Work performance and job satisfaction among teachers. *International Journal of Humanities and Social Science*, 3(5).
- Uyanık, G. K., & Güler, N. (2013). A study on multiple linear regression analysis. *Procedia-Social and Behavioral Sciences*, 106: 234-240.
- Van Dyne, L., & LePine, J. A. (1998). Helping and voice extra-role behaviors: Evidence of construct and predictive validity. *Academy of Management Journal*, 41(1): 108-119.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science*, 46(2): 186-204.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *Management Information Systems Quarterly*, 425-478.
- Venkatesh, V., Speier, C., & Morris, M. G. (2002). User acceptance enablers in individual decision making about technology: Toward an integrated model. *Decision sciences*, 33(2): 297-316.

- Vignaswaran, R. (2005). The relationship between performance appraisal satisfaction and employee outcomes: A study conducted in peninsular Malaysia. Retrieved from http://dspace.fsktm.um.edu.my/bitstream/1812/729/1/MBA_Research_Project.pdf. (Access on January 22, 2020).
- Viswesvaran, C. & Ones, D.S. (2005). Handbook of personnel selection, Malden. In A. Evers, N. Anderson, & O. Voskuij (Eds.), *Job performance: Assessment issues in personnel selection* (pp. 354-375). Hoboken, New Jersey, United States: Blackwell Publishing.
- Viswesvaran, C., & Ones, D. S. (2000). Perspectives on models of job performance. *International Journal of Selection and Assessment*, 8(4): 216-226.
- Viteles, M. S. (1953). *Motivation and morale in industry*. New York: Norton Publishers.
- Wakeyo, M. B., & Gardebroek, C. (2013). Does water harvesting induce fertilizer use among smallholders? Evidence from Ethiopia. *Agricultural Systems*, 114: 54-63.
- Wang, H. K. (2007). A study on the relationships among knowledge management, situational factors, professionals' core competencies and job performance – taking the vocational training centers and employment service centers as example. *The Journal of Human Resource and Adult Learning*, 3(2): 117-127.
- Wang, Y. S., & Shih, Y. W. (2009). Why do people use information kiosks? A validation of the Unified Theory of Acceptance and Use of Technology. *Government information quarterly*, 26(1): 158-165.
- Wang, Z., & Wang, N. (2012). Knowledge sharing, innovation and firm performance. *Expert systems with applications*, 39(10): 8899-8908.
- Wauters, E., Bienders, C., Poesen, J., Govers, G., & Mathijs, E. (2010). Adoption of soil conservation practices in Belgium: An examination of the theory of planned behaviour in the agri-environmental domain. *Land Use Policy*, 27(1): 86-94.
- Wei, W. C., & Chu, S. H. (2008). Empirical study on the correlation among personality traits, work attitudes, service quality, job performances and customers' satisfaction—a financial holding company in Taiwan. *International Journal Lisrel*, 1(2): 1-24.
- Wikipedia. (2020). https://en.wikipedia.org/wiki/Gaibandha_District (Access 25th January, 2020).
- Woldegebrail, Z., Huylenbroeck, C. V., Tesfay, G., & Speelman, S. (2017). Smallholder farmers' behavioral intentions towards sustainable agricultural practices. *Journal of Environmental Management*, 187:71-81.
- World Bank. (2016). *Dynamics of Rural Growth in Bangladesh. Sustaining Poverty Reduction*. World Bank, Washington D.C., United States.

- Wright, A., & Ammari, S. (2015). *Literature Review*. University of Portsmouth. Pay Modernization Project December 2015.
- Wu, Y., Balasubramanian, S., & Mahajan, V. (2004). When is a preannounced new product likely to be delayed? *Journal of Marketing*, 68(2): 101-113.
- Yousaf, M., Li, J., Lu, J., Ren, T., Cong, R., Fahad, S., & Li, X. (2017). Effects of fertilization on crop production and nutrient-supplying capacity under rice-oilseed rape rotation system. *Scientific Reports*, 7(1): 1-9.
- Yusof, M. H. (2006). *Penilaian terhadap Perancangan dan Pelaksanaan Program Pembelajaran Kontekstual di Sekolah-Sekolah Menengah Teknik di Malaysia*. (Doctoral dissertation). Universiti Kebangsaan Malaysia, Malaysia.
- Yusof, R. (2003). *Penyelidikan Sains Sosial (Social Science Research)* Pahang, Malaysia.
- Zaied, A. N. H., Hussein, G. S., & Hassan, M. M. (2012). The role of knowledge management in enhancing organizational performance. *International Journal of Information Engineering and Electronic Business*, 4(5): 27-35.
- Zainudin, H.A. (2012). *Research methodology and data analysis* (2nd Ed.). Kuala Lumpur, Malaysia: UiTM Press.
- Zaman, M. A. U., Pramanik, S., Parvin, N., & Khatun, A. (2017). Crop Diversification in Rangpur Region. *Bangladesh Rice Journal*, 21(2): 255-271.
- Zeithaml, V. A., Parasuraman, A., & Malhotra, A. (2002). Service quality delivery through web sites: a critical review of extant knowledge. *Journal of the Academy of Marketing Science*, 30(4): 362-375.
- Zeweld, W., Van Huylenbroeck, G., Tesfay, G., & Speelman, S. (2017). Smallholder farmers' behavioural intentions towards sustainable agricultural practices. *Journal of environmental management*, 187: 71-81.
- Zhou, Q., Hu, J., & Gao, S. (2010). Chemistry teachers' attitude towards ICT in Xi'an. *Procedia-Social and Behavioral Sciences*, 2(2): 4629-4637.