



Management of Environmental Quality: An International Journal

Resilience, adaptation and expected support for food security among the Malaysian east coast poor households
Md. Mahmudul Alam, Abu N.M. Wahid, Chamhuri Siwar,

Article information:

To cite this document:

Md. Mahmudul Alam, Abu N.M. Wahid, Chamhuri Siwar, (2018) "Resilience, adaptation and expected support for food security among the Malaysian east coast poor households", Management of Environmental Quality: An International Journal, Vol. 29 Issue: 5, pp.877-902, <https://doi.org/10.1108/MEQ-01-2018-0013>

Permanent link to this document:

<https://doi.org/10.1108/MEQ-01-2018-0013>

Downloaded on: 16 February 2019, At: 23:19 (PT)

References: this document contains references to 80 other documents.

To copy this document: permissions@emeraldinsight.com

The fulltext of this document has been downloaded 124 times since 2018*

Users who downloaded this article also downloaded:

(2016), "Climate change and food security of the Malaysian east coast poor: a path modeling approach", Journal of Economic Studies, Vol. 43 Iss 3 pp. 458-474 <<https://doi.org/10.1108/JES-10-2014-0169>>

(2017), "Climatic changes and vulnerability of household food accessibility: A study on Malaysian East Coast Economic Region", International Journal of Climate Change Strategies and Management, Vol. 9 Iss 3 pp. 387-401 <<https://doi.org/10.1108/IJCCSM-06-2016-0075>>



Perpustakaan
Sultanah Bahiyah
SULTANAH BAHYAH LIBRARY

Universiti Utara Malaysia

Access to this document was granted through an Emerald subscription provided by emerald-srm:394654 []

For Authors

If you would like to write for this, or any other Emerald publication, then please use our Emerald for Authors service information about how to choose which publication to write for and submission guidelines are available for all. Please visit www.emeraldinsight.com/authors for more information.

About Emerald www.emeraldinsight.com

Emerald is a global publisher linking research and practice to the benefit of society. The company manages a portfolio of more than 290 journals and over 2,350 books and book series volumes, as well as providing an extensive range of online products and additional customer resources and services.

Emerald is both COUNTER 4 and TRANSFER compliant. The organization is a partner of the Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for digital archive preservation.

*Related content and download information correct at time of download.

Resilience, adaptation and expected support for food security among the Malaysian east coast poor households

Malaysian east coast poor households

877

Md. Mahmudul Alam
Universiti Utara Malaysia, Sintok, Malaysia

Abu N.M. Wahid
Tennessee State University, Nashville, Tennessee, USA, and

Chamhuri Siwar
*Institute for Environment and Development (LESTARI),
National University of Malaysia, Bangi, Malaysia*

Received 9 January 2018
Revised 4 April 2018
Accepted 6 April 2018

Abstract

Purpose – Sustainable food security at the household level is one of the emerging issues for all nations. It is expected that the patterns of household resilience factors and adaptation practices have a strong linkage with household food security. The purpose of this paper is to seek an effective technique of adaptation for food security and the required types of support for adaptation to food insecurity among the poor and low-income households in Malaysia.

Design/methodology/approach – This study was based on primary data that were collected in July-October 2012 through a questionnaire survey among 460 poor and low-income households from the Pahang, Kelantan, and Terengganu states of Malaysia. The samples were selected from E-Kasih poor household database based on a two-stage cluster random sampling technique. The study considered household food security as household food availability and food accessibility, and ran ordinal regressions to find out the linkages of household food security with household resilience factors, adaptation practices, and expected support for adaptation to food security.

Findings – The study concludes that several resilience factors and adaptation practices were statistically significant to household food security, and several external supports were statistically and significantly needed to ensure household food security. Therefore, to ensure sustainable household food security in Malaysia, the food security programs need to be integrated with sustainable development goals (SDGs) and climatic changes adaptation programs, and the involvement of relevant stakeholders are crucial.

Originality/value – This study is a pioneer work based on primary data that empirically measured the linkages of household food security with household resilience factors, adaptation practices, and expected support for adaptation to food security in Malaysia. This study also discussed some issues related to the climate change linkage, which would help future climate change research. The findings of the study will be beneficial for all the stakeholders, including policy makers related to the food security and climate change adaptation.

Keywords Malaysia, Adaptation, Poverty, Climate change, Household food security, Sustainable development goals (SDG)

Paper type Research paper

1. Introduction

Food security is a critical aspect of individual and household well-being regardless of whether it is viewed globally, locally, or communally. Hunger and food insecurity are detrimental to the basic rights of a human being and are a prelude to the problems of health, nutrition, and development. The main challenges to food security are political, economic, social, infrastructural, demographic, livelihood strategies, etc. (Frankenberger, 1992; Cristofar and Basiotis, 1992; Nyariki and Wiggins, 1997; Smith, 1998; Lovendal and Knowles, 2006;



FAO, 2003, 2008; Alam, Talib, Siwar, and Wahid, 2016). However, nowadays, changes in the climatic factors and their outcomes, such as natural calamities, are also considered another challenge to sustainable food security (Alam, Talib, Siwar, and Wahid, 2016, 2017).

People facing food insecurity are mostly from the poor communities who are also vulnerable to the potential effects of climate changes and have the least capability to adapt to these situations (FAO, 2009; Siwar *et al.*, 2009). Moreover, a study from World Bank (2012) states that the major portion of poor people's income is spent on food. On the other hand, there are still 836 million people in the world living in extreme poverty (UN, 2015), and at least 70 percent of the very poor live in rural areas; most of them depend partly or completely on agriculture for their livelihoods (IFAD, 2011). Since, FAO (2016) estimates that, to satisfy the growing demand driven by population growth and diet changes, food production will have to be increased by at least 60 percent in the next decades. However, world hunger is on the rise; the estimated number of undernourished people has increased from 777 million in 2015 to 815 million in 2016 (FAO, 2017). Poor people who suffer from food insecurity and low-income households are economically deprived groups in the society as well as frequently more exposed to natural disasters; in addition, they are exposed to highly reliant resources that are climate sensitive, and they have limited resources in terms of technology and economy. Their adaptability to climatic and non-climatic food insecurity is dependent on adaptation strategies that are based on socioeconomic and cultural factors, such as household composition, gender, and household asset distribution, and from external institutions (FAO, 2006).

Strategies for adaptation to climate changes to establish food security could be planned or autonomous. Planned adaptation includes the growth in adaptive capability by utilizing policies and institutions to set up or strengthen favorable situations for effective adaptation and new technologies and infrastructure investment (Yohe *et al.*, 2007). Autonomous adaptation involves the continuous implementation of current technology, knowledge, and adaptability in responding to the level of food insecurity (Easterling *et al.*, 2007). In most cases, autonomous adaptations are used by households, but they are insufficient to deal with food insecurity; as a result, planned, strategic measures are required.

Strategies for adaptation to climatic or non-climatic food insecurity at household level are complicated and frequently limited. According to Maxwell *et al.* (1999), in urban and rural settings, there are four categories of coping strategies linked to food-search behaviors, dietary change, household rationing, and structure that are normal methods adopted by households facing food insufficiency. However, but the particular coping strategy inside each category might differ across various settings. Based on various environmental situations (such as rural vs urban culture, cost of living, employment status of women and education), the low-income urban households may use various specific mechanisms to cope with food insufficiency and income compared to rural households. Likewise, Davies (1996) points out that different features of coping behaviors (sequence of importance or intensity, definition, short-term and long-term changes) might vary between locations (e.g. rural vs urban) and inside a particular location (agricultural vs fishing community in rural areas).

According to Shariff and Khor (2008), low-income rural households utilize food-related coping strategies (borrowing money to buy food and cook whatever food is available at home) when they face food insecurity. Dore *et al.* (2003) suggested that using cheaper food and eating at home were common coping strategies among Russian low-income households to protect the children's dietary intakes. Reduced quantity and frequency of food intake, affected diet and food quality; food preference and food substitution, food store changes, borrowing food or money and sale of assets were the strategies used by Javanese families during the economic crisis in 1998 in Indonesia (Studdert *et al.*, 2001). Diversifying or changing livelihood is also utilized for adaptation, such as via migration to search for additional income sources or in some cases forcible sales of assets (Devereux, 2001; Ellis, 1998). Having access to

healthcare is also a major concern in managing and controlling diseases related to food security (Makinen *et al.*, 2000).

Malaysia is a fast growing developing country. Therefore, there are scopes of frequent changes in the macrovariables and policies that would affect food security (Alam, Siwar, Jaafar, and Talib, 2016). Moreover, the climatic factors are changing rapidly in Malaysia and have been exerting having adverse impacts on food production (Alam *et al.*, 2010, 2011, Alam, Siwar, Molla, Talib and Mohd Ekhwan, 2012). In this country, carbon dioxide (CO₂) emissions have increased by 290.7 percent during the period of 1990-2011 (IEA, 2013) and is included in the list of 30 largest greenhouse gas emitters. Moreover, in 2016, CO₂ emissions per capita for Malaysia was 8.53 metric tons with an annual growth rate of 3.09 percent, and Malaysia is ranked 28th in the world (BP, 2018). Alam, Talib, Siwar, and Wahid (2016) also found significant direct and indirect impacts of climatic factors on household food security. In the case of level of food security, among the low-income rural communities, 50 percent or more of the households face some level of food insecurity, reporting with 34.5 percent of child hunger (Shariff and Khor, 2008). Studies also show different rates for urban and rural households with food insecurity in Malaysia, such as the rate among the urban low-income households, which is, at 66.6 percent (Zalilah, 1998) and 65.7 percent (Zalilah and Ang, 2001), and the rate among rural low-income households at 58 percent (Shariff and Khor, 2008).

Therefore, understanding the adaptation ability of households to food insecurity, effectiveness of the current strategies of adaptation to food insecurity, and determining the required supports for adaptation to food insecurity are essential to offer a valuable tool for planning and evaluating the achievement of *Vision 2020*. The understanding and the determination would help Malaysia to become a fully developed nation by the year of 2020 with a view to increasing and improving food security and removing poverty and hunger in Malaysia. Hence, this study is an attempt to conduct an in depth assessment on the available resilience factors and the adaptation practices carried out by poor and low-income households in East Coast Economic Region (ECER) to adapt to food insecurity, and the expected support for adaptation to food insecurity.

2. Methodology

2.1 Study area

For the empirical assessment, this study mostly relied on primary data collected through an extensive questionnaire survey at the household level in the ECER in Malaysia. This study selected the ECER as the study area because the ECER encompasses more than half of the Peninsular Malaysia with the area of about 66,000 sq kilometers that covers the states of Kelantan, Terengganu, Pahang, and the district of Mersing in Johor (Figure 1). The ECER is crucial for two major reasons: ECER is the most vulnerable area in Malaysia due to climatic changes; and (b) the income level in this region is low, and the poverty rate is high, which is a hindrance to achieving *Vision 2020* (Alam, Morshed, Siwar and Murad, 2012; ECER Master Plan, 2007, 2008). The population of ECER was about 3.95 million, which represented 14.8 percent of the total population of Malaysia in 2005. In 2004, the incidences of poverty were 10.6, 4, and 15.4 percent in Kelantan, Pahang, and Terengganu, respectively, whereas for overall Malaysia, it was 5.7 percent. At the same time, the incidences of hardcore poverty were 1.3, 1.0, and 4.4 percent in Kelantan, Pahang, and Terengganu, respectively, whereas for overall Malaysia, it was 1.2 percent. Moreover, there were about 45,000 paddy farmers in the ECER, and the average productivity per worker was RM 11,915 whereas the national agriculture productivity per worker was RM 15,355 (ECER Master Plan, 2007, 2008).

ECER is mainly an agricultural region; as of 2004, all crops production covered a total area of 2.22 million ha in the ECER (34.8 percent of Peninsular Malaysia). However, in 2008,



Figure 1.
Location of study area
(ECER-Malaysia)

Source: Alam, Morshed, Siwar and Murad (2012)

the government had officially launched a large development project, ECER Development Project, to develop five key areas – manufacturing, oil, gas and petrochemicals, tourism, agriculture, and human capital development. With the objective of fast-forwarding the inflow of Foreign Direct Investment (FDI) and industrialization in the region, ECER Special Economic Zone (ECER SEZ) and Malaysia-China Kuantan Industrial Park were initiated in this area. Therefore, the ECER was expected to implement projects worth an estimated RM 112 billion in value by the year 2020. The ECER Special Economic Zone (SEZ) was expected to generate up to RM 90 billion in investments and contribute RM 23 billion to the national Gross Domestic Product (GDP), as well as create 220,000 new jobs out of the 560,000 jobs identified (ECER Master Plan, 2007, 2008).

2.2 Data collection

The study followed the two-stage cluster random sampling technique. Initially the samples were clustered by location and then by poverty category. Finally, from each category, samples were picked randomly from the E-Kasih database, which is an integrated database system that enlists poor households at the national level to plan, implement, and monitor poverty programs. The urban area of Kuantan and the rural area of Pekan were selected from the Pahang state. The urban area of Kota Bharu and the rural area of Tumpat were selected from the Kelantan state. The urban area of Kuala Terengganu and rural area of Marang were selected from the Terengganu state.

Based on the formula of required size of samples (Yamane, 1967, p. 886), first, 400 samples were selected according to the proportion of population distribution. However, to ensure a good number of observations for each group, which was needed for sound statistical analysis for any particular group, another 100 households were added to the sample. However, while targeting the sample size to be 500, after collecting and validating the data, finally, 460 households retained in the sample.

A structured interview based on a questionnaire was used to collect data; the respondents provided the answers and the enumerators filled-up the questionnaires. The regular enumerators of the implementation coordination unit agency from Pahang, Kelantan, and Terengganu conducted the survey in July-October 2012.

2.3 Identification of variables

There are four dimensions of food security, such as availability of food, stability of supply, accessibility to food, and utilization of food (FAO, 2005, 2008). The availability of food means sufficient quantities of quality food that is available at household level. The accessibility of food means a household's access to sufficient resources, including a set of all commodity bundles that an individual can gain access to on the basis of the legal, economic, political, and social arrangement of a community, where they live for getting quality foods for a nutritious meal. Food utilization shows the significance of non-food inputs in food security, such as proper diet, clean water, healthcare, and sanitation to gain nutritional well-being by which all physiological requirements are met. Food system stability refers to a household having access to sufficient food at all times so that they should not risk losing access to food as a result of a sudden crisis, such as an economic or climatic change crisis or cyclical occurrence, like as seasonal food insecurities.

In this study, the household status of food accessibility and household food availability were considered as the dependent variables. Household food availability was based on the measurement of the direct perception of the household, and household status of food accessibility measurement was based on the frequency of calculation. To measure the status of household food availability, households were asked about their food status in the previous month of interview (see Table II), and to measure the status of household food accessibility, this study followed the direct measuring questionnaire-based techniques developed by Coates *et al* (2007) for USAID, which is known as the Household Food Insecurity Access (HFIA) (Table I).

HFIA was calculated for each household by assigning a code 1-4, where 4 = food secure access, 3 = mildly food insecure access, 2 = moderately food insecure access, and 1 = severely food insecure access. Initially, the data were coded as frequency-of-occurrence as 0 for all cases where the answer to the corresponding occurrence question was "no" (i.e. if Q1 = 0 then Q1a = 0, etc.). Then, the intensities of the occurrence of nine questions were

HFIA measurement issues	Category of food insecurity (access)		
	Rarely (1-2 times per month)	Sometimes (3-10 times)	Often (10+ times per month)
Q1 Worry about food			
Q2 Unable to eat preferred food			
Q3 Eat just a few kinds of foods			
Q4 Eat foods they really do not want to eat			
Q5 Eat a smaller meal			
Q6 Eat fewer meals in a day			
Q7 No food of any kind in the household			
Q8 Go to sleep hungry			
Q9 Spend whole day and night without eating			
	Mildly food insecure	Moderately food insecure	Severely food insecure
	Food secure access		

Sources: Coates *et al*. (2007); Alam, Talib, Siwar and Wahid (2016)

Table I. Measurement of household food insecurity access scale

measured in three frequencies – rarely (1-2 times per month) or sometimes (3-10 times) or often (10+ times per month) – indicated from Q1a to Q9a (Table I). Finally, the four food accessibility categories were created sequentially, to ensure that households were classified according to their most severe response:

- Category = 4 if ((Q1 = 0 or Q1 = 1) and Q2 = 0 and Q3 = 0 and Q4 = 0 and Q5 = 0 and Q6 = 0 and Q7 = 0 and Q8 = 0 and Q9 = 0).
- Category = 3 if ((Q1a = 2 or Q1a = 3 or Q2a = 1 or Q2a = 2 or Q2a = 3 or Q3a = 1 or Q4a = 1) and Q5 = 0 and Q6 = 0 and Q7 = 0 and Q8 = 0 and Q9 = 0).
- Category = 2 if ((Q3a = 2 or Q3a = 3 or Q4a = 2 or Q4a = 3 or Q5a = 1 or Q5a = 2 or Q6a = 1 or Q6a = 2) and Q7 = 0 and Q8 = 0 and Q9 = 0).
- Category = 1 if (Q5a = 3 or Q6a = 3 or Q7a = 1 or Q7a = 2 or Q7a = 3 or Q8a = 1 or Q8a = 2 or Q8a = 3 or Q9a = 1 or Q9a = 2 or Q9a = 3).

The following table illustrates the above four categorizations, where every household was placed in a single, unique category based on the set of responses (Table I).

In the present study, resilience refers to the household's ability or strength to cope with stress and hardship in case of actual or expected food insecurity. Household resilience factors are categorized as socioeconomic, physical assets, and livelihood strategy and behavior. Adaptation practices refer to actions or adjustments in ecological, social, or economic systems in response to actual or expected food insecurity. Factors of adaptation practices and expected support are categorized as climatic and non-climatic factors.

There are very few studies available to get a standardized list of resilience and adaptation variables relevant to household food security. However, literature shows different types of factors related to food security, such as political, economic and natural indicators, infrastructure, security (Lovendal and Knowles, 2006; Nyariki and Wiggins, 1997); hygiene, sanitation, unsafe water supply (Makinen *et al.*, 2000); isolation from markets (Webb *et al.*, 1992; Negatu, 2006); demography (Baer and Madrigal, 1993; Lino, 1996; Iram and Butt, 2004; Piaseu, 2006); health and nutrition (Myntti, 1993; Pfeiffer *et al.*, 2001; Hindin, 2006; Fartahun *et al.*, 2007); food budget, savings (Cristofar and Basiotis, 1992; Rose *et al.*, 1995; Olson *et al.*, 1997); locality (Maxwell *et al.*, 1999); technology (Nyariki and Wiggins, 1997; Negatu, 2006); access to land, land tenure system, land productively (ECA, 2004); transportation and unemployment (Negatu, 2006); etc. Interestingly, studies also show that many low-income households have food security and many households above the poverty line present indications of food insecurity (Olson *et al.*, 1997; Rose, 1999). Thus, this study used a list of variables that were collected based on the literature related to the four dimensions of food security and conducted an initial pilot survey. The list of the independent variables of the study consisted of different resilience factors of a household (X1-X18), adaptation practices of a household (X19-X46), and the expected external support for adaptation to food security (X47-X58). The measurements of all of the variables are given in Appendix 1.

2.4 Model specification

To check the relationship between household status for food security and their resilience factors, the following ordinal regressions was done based on the logit model:

$$\begin{aligned} Z_i &= f(X_i) \\ Z_i &= (Y1, Y2) \\ X_i &= (X1, \dots, X18) \end{aligned} \tag{1}$$

To check the relationship between household status of food security and their adaptation practices to food insecurity, the following ordinal regressions were carried out based on the logit model:

$$\begin{aligned} Z_i &= f(X_i) \\ Z_i &= (Y1, Y2) \\ X_i &= (X19, \dots, X46) \end{aligned} \tag{2}$$

Further, to find out the relationship between household status of food security and types of expected support to adapt to food insecurity, the following ordinal regressions were conducted based on the logit model:

$$\begin{aligned} Z_i &= f(X_i) \\ Z_i &= (Y1, Y2) \\ X_i &= (X47, \dots, X58) \end{aligned} \tag{3}$$

Finally, a correlation analysis was conducted in order to find out the relationship among the relevant variables and to check the multicollinearity problem.

3. Results and analysis

3.1 Status of household food security

In terms of household food availability, 14.8 percent respondents said that they had enough food according to their likings but the majority (41.1 percent) of the households mentioned that they always did have enough of the food they liked. In total, 9.1 percent of the households mentioned that they frequently stayed hungry (Table II).

Based on the HFIA category, this study found that 52.8 percent of the households were under the category of “food secure” (Table III). Among the surveyed households, 23.3 percent faced mild food insecurity (access); out of them, many of them were worried about not having enough food sometimes or often, and/or unable to eat preferred foods, and/or rarely ate a more monotonous diet than desired and/or also rarely ate some undesirable foods.

Food status in the family	No. of households	% of total
Enough of the kinds of food you want to eat	68	14.8
Enough but not always the kinds of food you want	189	41.1
Sometimes not enough to eat	100	21.7
Often not enough to eat	61	13.3
Frequently stay hungry	42	9.1
Total	460	100

Table II.
Family food status in the previous month of interview

HFIA category	HFIA prevalence	% of HFIA prevalence
4 = Food secure access	243	52.8
3 = Mildly food insecure access	107	23.3
2 = Moderately food insecure access	66	14.3
1 = severely food insecure access	44	9.6
Total	460	100.0

Table III.
Distribution of household food insecurity access

Among the households, the result showed that 14.3 percent felt moderately food insecurity. These households frequently sacrificed quality of food by eating a monotonous diet or undesirable food sometimes or often, and/or reduced eating the quantity of food rarely or sometimes. There were 9.6 percent of households that felt severely food insecurity; in addition, they graduated to cutting back on meal size or number of meals often, and/or experienced any of the three most severe conditions. These conditions included running out of food, going to bed hungry, or going a whole day and night without eating – even as infrequently as rarely or at least once in the previous month.

3.2 Household status of food security and resilience factors

The regression models based on Equation (1) show that some of the resilience factors have a statistically significant relationship with household food availability and food accessibility (Table IV). The *p*-values of the likelihood ratio (LR) statistics for both models shown below are 0.0000001, which suggests a good fit of the models. The pseudo *R*² are 0.12 for food availability and 0.15 for the food accessibility models.

Among the socioeconomic resilience factors, improvement of household economic conditions, increase of the ratio of earning family members to the total family members, and availability of savings have been found to be statistically significant, and this indicates more food availability and accessibility at the household level. On the other hand, the higher the number of school going children the lower the food security in the household with both statistical and significant indication. For a one-unit increase in the number of school going children, the odds of food availability and accessibility at the household are decreased by 25.4 percent (1 – 0.746) and 26.7 percent (1 – 0.733), respectively.

Variable	Odds ratio	<i>p</i> -value	Odds ratio	<i>p</i> -value
<i>Household resilience factors: socioeconomic</i>				
X1	1.058	0.643	0.992	0.954
X2	0.746*	0.000	0.733*	0.000
X3	1.504*	0.000	1.344*	0.001
X4	1.280	0.376	1.589	0.161
X5	0.747	0.328	0.689	0.235
X6	1.403*	0.002	1.704*	0.000
X7	2.687*	0.000	2.922*	0.000
<i>Household resilience factors: physical assets</i>				
X8	0.979	0.912	1.162	0.478
X9	1.122	0.632	1.361	0.230
X10	0.956	0.714	1.012	0.931
X11	1.607**	0.029	1.989*	0.003
<i>Household resilience factors: livelihood strategy and behavior</i>				
X12	1.253	0.272	1.081	0.730
X13	1.100	0.409	1.120	0.370
X14	1.022	0.859	1.022	0.867
X15	1.485***	0.010	1.531*	0.009
X16	1.161	0.223	1.257***	0.092
X17	0.917	0.542	0.846	0.282
X18	1.036	0.595	0.984	0.821

Table IV.
The relationship between household food security and resilience factors

Dependent variable	Y1		Y2
Pseudo <i>R</i> ²	0.123		0.15
<i>p</i> -value (LR statistic)	< 0.0000001		< 0.0000001

Notes: *, **, ***Significant at 1, 5, and 10 percent significance level, respectively

As a physical asset of household, availability of transport for buying food has been found to be statistically significant, and this indicates more about food availability and accessibility at the household level. The odds of household food availability and accessibility were 61 and 99 percent higher for those who have transportation. Furthermore, among the livelihood strategy and behavior under resilience factors, households managing waste properly was also statistically significant, indicating more food availability and accessibility in the household. Households that had knowledge about maintaining the nutrition level and had a good sense of hygiene were found to be statistically significant to cause food accessibility at the household level.

3.3 Household status of food security and adaptation practices

The regression models based on Equation (2) suggest that some of the adaptation approach from both climatic and non-climatic factors had a statistical and significant relationship with household food availability and accessibility (Table V). The *p*-values of the LR statistics for both models were below 0.0000001, which shows a very good fit of the models. The pseudo *R*² were 0.18 for food availability and 0.22 for the food accessibility models.

Variable	Odds ratio	<i>p</i> -value	Odds ratio	<i>p</i> -value
<i>Adaptation approaches: non-climatic factors</i>				
X19	1.214	0.122	1.158	0.270
X20	1.662***	0.086	1.504	0.191
X21	1.106	0.763	0.860	0.675
X22	0.943	0.835	0.804	0.443
X23	0.676	0.157	0.669	0.169
X24	1.084	0.767	1.663***	0.074
X25	0.724	0.259	0.711	0.266
X26	1.635***	0.079	1.663***	0.092
X27	0.548**	0.040	0.521**	0.033
X28	0.909	0.748	1.020	0.948
X29	0.505**	0.016	0.554**	0.047
X30	1.723	0.067	1.762***	0.065
X31	0.665	0.163	0.537**	0.043
X32	1.598	0.125	2.188**	0.015
<i>Adaptation approaches: climatic factors</i>				
X33	0.841**	0.173	0.930	0.590
X34	2.352*	0.005	1.670***	0.098
X35	1.345	0.314	0.844	0.584
X36	0.765	0.375	0.688	0.212
X37	0.539**	0.021	0.535**	0.023
X38	1.122	0.708	1.592	0.142
X39	0.960	0.870	1.059	0.829
X40	0.545**	0.019	0.494*	0.009
X41	0.831	0.503	0.947	0.851
X42	0.560***	0.100	0.639	0.206
X43	1.006	0.987	1.154	0.706
X44	0.732	0.286	0.872	0.657
X45	1.216	0.517	1.013	0.967
X46	1.693	0.110	1.452	0.264
Dependent variable		Y1		Y2
Pseudo <i>R</i> ²	0.06		0.07	
<i>p</i> -value (LR statistic)	< 0.0000001		< 0.0000001	

Notes: *, **, ***Significant at 1, 5, 10 percent significance level, respectively

Table V.
The relationship between household food security and adaptation practices

Among the non-climatic approach of adaptation, it was found that reducing food variation explained statistically and significantly both food availability and accessibility at the household level. However, reducing fruit and vegetable consumption as well as taking cheap medical treatment for adaptation did not statistically and significantly indicate food availability and accessibility at the household level. Moreover, households that applied the technique of changing the food processing system held 66 percent more odds in food availability in the household. Moreover, the adaptation techniques of cooking whatever food available and delaying medical treatments as well as migrating to other places statistically and significantly indicated household food accessibility, but engaging supplementary job as an adaptation approach statistically and significantly did not indicate to have food accessibility at the household level.

Among the climatic approach of adaptation, applying the technique of changing food processing system was found to be statistically significant to explain both food availability and accessibility at the household level. However, reducing the number of meals and food variation did not statistically and significantly indicate food availability and accessibility at the household level. In addition, households reducing spending on children's education for adaptation to climatic food insecurity did not statistically and significantly indicate gaining food availability.

3.4 Household status for food security and expected supports

There are a few external agencies, such as the district office, department of social welfare, health clinic, farmer's association, NGO, political parties, *zakah* board, and social support program, etc., that provide a few services. Among these services, a few households mentioned about receiving RM 500 from the Malaysia fund and Rancangan Makanan Tambahan or food supplement program, RM 200 from the fish development board, RM 300 as well as kitchen staff (e.g. stove, cooking pot, etc.) valued at RM150 from the department of social welfare, RM 4800 for children's aid from the Department of Social Welfare (JKM), RM 200 every month from the farmer's association, and a few funds from charity or *zakah*. Among the households, 67.8 percent mentioned that the external services were are satisfactory and 63.9 percent followed the recommendation and guidelines provided by these agencies. However, households mentioned that the support was not adequate, and they expected more support.

Among the expected support, 65 percent of the households mentioned the necessity for overall external support to adapt to food insecurity (Table VI). Among the climatic relevant supports, 63.5 percent expected support for climatic related subsidies or rationing for food. It is also found that 94.3 percent expected support from food aids for emergency time; 93 percent expected support for providing emergency services for a time of disaster, and 90.9 percent expected support for special food distribution arrangements in emergency times. Among the relevant general support, 81.7 percent expected support for income increasing program or incentive; 84.1 percent expected support for road and transport infrastructure improvement; 85.9 percent expected support for improving drinking water services; 87.6 percent expected support for improving health and medical services; 79.3 percent expected support for updating the food distribution channel; 90.4 percent expected support for monitoring and adjustment in price at the local market, and 68.7 percent expected support for improving agriculture and other agency services.

The regression models based on Equation (3) shows some of the expected support related to both climatic and non-climatic factors that have a statistically significant relationship with household food availability and accessibility (Table VII). The *p*-values of the LR statistics for both models are below 0.0000001, which suggests a very good fit of the models. The pseudo R^2 are 0.02 for food availability and 0.022 for the food accessibility models.

New supports for adaptation	Observation scale*					Average value of the score	SD	Proportion of needed (4 and 5) observation (%)	Proportion of not needed (1 and 2) observation (%)
	1	2	3	4	5				
<i>Climatic and non-climatic common factors</i>									
X47	37	5	119	220	79	3.65	1.04	65.0	9.1
<i>Non-climatic factors</i>									
X48	17	1	66	234	142	4.05	0.89	81.7	3.9
X49	21	17	35	244	143	4.02	0.97	84.1	8.3
X50	15	16	34	187	208	4.21	0.96	85.9	6.7
X51	16	8	33	159	244	4.32	0.94	87.6	5.2
X52	15	6	74	219	146	4.03	0.91	79.3	4.6
X53	15	3	26	243	173	4.21	0.84	90.4	3.9
X54	77	12	55	195	121	3.59	1.35	68.7	19.3
<i>Climatic factors</i>									
X55	43	75	50	175	117	3.54	1.28	63.5	25.7
X56	15	2	9	207	227	4.37	0.83	94.3	3.7
X57	13	1	18	172	256	4.43	0.82	93.0	3.0
X58	13	5	24	229	189	4.25	0.84	90.9	3.9

Table VI.
Expected support to
adapt to food
insecurity

Notes: *Scale: 1 = Strongly not needed; 2 = not needed; 3 = not sure; 4 = needed; 5 = strongly needed

Variable	Odds ratio	<i>p</i> -value	Odds ratio	<i>p</i> -value
<i>Expected supports: related to both climatic and non-climatic factors</i>				
X47	0.749*	0.017	0.762*	0.034
<i>Expected supports: related to non-climatic factors</i>				
X48	0.826	0.215	0.933	0.669
X49	1.023	0.871	0.935	0.666
X50	0.958	0.781	0.984	0.919
X51	1.389**	0.058	1.460*	0.036
X52	0.968	0.854	0.915	0.636
X53	1.243	0.251	1.355	0.133
X54	1.011	0.911	0.932	0.471
<i>Expected supports: related to climatic factors</i>				
X55	0.914	0.334	0.985	0.877
X56	0.963	0.827	0.887	0.495
X57	0.747	0.136	0.686**	0.071
X58	1.559*	0.033	1.706*	0.015
Dependent variable		Y1		Y2
Pseudo R^2	0.020		0.022	
<i>p</i> -value (LR statistic)	0.006		0.022	

Table VII.
The relationship
between household
status of food security
and types of expected
support

Notes: *,**Significant at 5 and 10 percent significance level, respectively

Among different types of expected support, the statistically significant support related to both climatic and non-climatic factors was the overall support to ensure food security. Non-climatic factors improved the health and medical services whereas the climatic factors provided emergency services for disaster time and special food distribution arrangements in times of emergency.

The statistically significant odds ratio values indicate that the support to improve health and medical services and the support for special food distribution arrangements in emergency times were the expectations of the food available and accessible households. Holding other things constant, for a unit increase in the expectation of support for improving health and medical services, the odds in favor of food availability and accessibility in the household increased by 38.9 and 46 percent, respectively. Similarly, there was a 55.9 and 70.6 percent increase of odds to food availability and accessibility in the household for a one-unit increase in the expectation of support for special food distribution arrangements in emergency times.

However, the overall support to ensure household food security is the common expectation of the food unavailable and inaccessible households. There was a 25 and 24 percent decrease of odds to food availability and accessibility in households for a one-unit increase in the expectation of overall support to ensure household food security. Moreover, households that did not have access to food also expected to get support by providing emergency services for disaster times. This means that holding other things constant, for a unit increase in the expectation of support for providing emergency services for disaster times, the odds in favor of household food accessibility decreased by 31.4 percent.

3.5 Model efficiency test

When two variables are considered highly correlated to each other and explain the dependent variable, it may cause a multicollinearity problem. Multicollinearity problem occurs when the correlation values are considered 0.8 or above (Field, 2000, pp. 2, 44-322). To identify if there are any multicollinearity problems present among the variables, the Pearson Correlation tests were performed in the study. The result shows that the correlation values among the variables for resilience factors (Table AI), adaptation approaches (Table AII), and expected support (Table AIII) fell below 0.8, which indicates that multicollinearity was absent among the variables.

4. Discussion

This study found several resilience factors, adaptation approaches, and expected external support to be statistically significant to explain household status of food security. However, these variables also differed between food secure and insecure groups. Results show that at the household level, the food insecure households needed to be more focused on the adaptation techniques that were significantly applied by the food secured group. Moreover, the findings of this study are supported by other studies around the world. For instance, a study from Smith and Frankenberger (2018) during the flood in 2014 found some suggestive evidence that resilience (e.g. social capital, human capital, exposure to information, asset holdings, livelihood diversity, safety nets, access to markets and services, women's empowerment, governance, and psycho-social capabilities) reduced the negative impact of the flooding on household food security for Bangladesh.

At the local scale, research on food systems resilience has mostly focused on disaster response case studies and detailed evaluations of infrastructure, governance, and social networks (Bene, Arthur, Norbury, Allison, Beveridge, Bush, Campling, Little, Leschen, Squires, Thilsted, Troell, and Williams, 2016; Bene, Headey, Haddad, and von Grebmer, 2016). At the global level, resilience research has a different focus, evaluating economic patterns and relationships rather than food security for individuals or households by tracking how shocks to the food system propagate internationally (Marchand *et al.*, 2016). However, this study also found several support needed to be ensured, such as increased income, encouragement to generate and develop savings related programs, arrangement of transportation and infrastructure facilities, provision of better health and medical

services, special food distribution arrangements, and availability of emergency services for disaster times. They are related to both the climatic and non-climatic factors.

As ensuring food security requires food production and distribution systems function throughout disruptions (Seekell *et al.*, 2017), to reduce food insecurity among the poor and low-income households in Malaysia, involvements of relevant stakeholders are very important (Smit and Skinner, 2002). Therefore, national governments should play a major role in addressing the challenging food security issues via budgets, policies, and by having legislative guidelines with efforts focused on adaptation by other interested parties. Private sector can also engage in the adaptation process in various ways, including and creating their opportunities for business. They can ensure availability of food during times of shortfall in production, and availability of inputs from agriculture as well as provision of credit against labor, harvests, etc. Banks and insurance organizations can offer different savings, credit facilities, and insurance schemes to seasonal food insecure groups. Community-based organizations (CBOs) in risk management can also contribute when there is no formal set up yet. Relying on the social capital, CBOs can help the poor and low-income Malaysian households in controlling and coping with risks as well as preventing risks, such as being the co-sponsor of local plans for infrastructure development.

Moreover, climate change affects the groups that have always been at risk of food insecurity, and it also affects new groups who become vulnerable to regional weather changing conditions (Intergovernmental Panel on Climate Change (IPCC), 2007). Additionally, farmers have to deal with changing weather patterns and rising frequency and intensity of extreme weather events, resulting in making farming even more risky (IPCC, 2012). Malaysia is also adversely affected by climatic issues (Alam *et al.*, 2010, 2011). Furthermore, changes in climate factors are likely to affect adversely the agriculture production and consequently food security of the country (Alam *et al.*, 2017). For example, rice production in Malaysia is extremely vulnerable to weather changes and extreme conditions, such as drought and flooding. The results, of a study by Vaghefi *et al.* (2016), showed that during the main and off growing seasons, increase in temperature and changes rainfall pattern could be expected to reduce the rice yield by 12 and 31.3 percent, respectively, until the year 2030. A study from Bangladesh, by Farzana *et al.* (2017), showed that households suffering from moderate and severe food insecurity were more likely to adopt both financial and food compromise coping strategies. Moreover, another study from Douxchamps *et al.* (2016) found that adaptation strategies improved the food security status of most households in four West African countries (Burkina Faso, Ghana, and Senegal).

Therefore, the design of food security programs in Malaysia must be integrated with climate change in adaptation programs. The local, national, and regional administrations and resources need to be ensured for capacity building in communities that are particularly at risk for food insecurity as well as climate change. Furthermore, sustainable development goals might be integrated with them too. Moreover, Malaysia is stepping up its efforts to improve self-sufficiency levels (SSL) in food production and preparing for the impacts of climate-related disasters to ensure food security. To achieve SDG goal 2, sustainable agriculture development is guided by the National Agrofood Policy 2011-2020 and National Commodity Policy 2011-2020 of Malaysia, which includes the use of quality seeds, breeds and fries, wider adoption of effective technologies among farmers, and establishment of new large scale food production areas (EPU, 2017). Malaysia also has been proactive in maintaining genetic diversity and undertaking research in climate-resistant crops and farmed animals.

Through the improvement of SSL of Malaysia on various agricultural product, Malaysia is still relying on imports from foreign countries in various food commodities, such as rice, fruits, dairy milk, and beef. Moreover, with growing population growth, demand for food that is expected to increase from 70 to 100 percent by 2050 will pose a threat to food security to Malaysia. In 2015, food import bills alone hit almost RM45.4

billion while exports of only RM 27 billion left the deficit of more than RM18 billion. If this situation persists, Malaysia will likely to face the food crisis in the future (UPM, 2017). Recent studies have shown that low-income rural people are more susceptible to food crises due to the larger family size, the number of school children and unemployed mothers (Paul, 2013; Selamat *et al.*, 2015), and the findings of Paul (2013) and Selamat *et al.* (2015) support this study.

To adequately deal with the effects of climate changes on food security, plans have to be initiated with a good analysis of the groups that are already particularly marginal at present. In vulnerable places where people are affected by both food insecurity and climate changes effects, increasingly adopting an integrated method that takes into account risk reduction, the resilient livelihoods, and the underlying causes of food insecurity and vulnerability is the best option (Alam, Siwar, Molla, Talib and Mohd Ekhwan, 2012). Adaptation methods that influence various groups in various ways also need to be checked carefully (Stern, 2007; Pielke *et al.*, 2007). Several adaptation methods lower some groups' vulnerability, but may increase the vulnerability in other groups instead. For an example, the devaluation of currency improves the domestic prices of food and trading goods, benefits the farmers to produce surpluses of tradable products, but that affects producers of non-tradable products negatively, such as unskilled landless laborers or subsistence farmers (FAO, 1997).

As this study found that expected supports from other institutions were very crucial in terms of reducing food insecurity, and this aspect is absent in the study areas. There are many supporting literature on this. For example, an estimated 85.7 percent of American households were food secure throughout the entire year in 2013; out of which 62 percent of all food insecure households participated in one or more of the three largest Federal food and nutrition assistance programs. Moreover, many studies have found significant relation between food security and support from different institutions (Bene, Arthur, Norbury, Allison, Beveridge, Bush, Campling, Little, Leschen, Squires, Thilsted, Troell, and Williams, 2016; Bene, Headey, Haddad, and von Grebmer, 2016; Fabinyi *et al.*, 2017; Rezai *et al.*, 2016; Thi *et al.*, 2015; Qureshi *et al.*, 2015).

5. Conclusions

Households need to apply the technique of changing food processing and storage system, gaining knowledge about maintaining nutrition level and good sense of hygiene, find alternative scope for migration, ensure savings, reducing food variation, and enough income opportunity for adaptation to food insecurity. Some prominent storage systems are canning, freezing, freeze-drying, vacuum packing, storage in gases, drying etc. (Hammond *et al.*, 2015).

Furthermore, Malaysia should reduce its import dependency on food. Moreover, Malaysia should boost up its SSL to ensure food security for future population. Additionally, expected support from other institution, such as NGOs, government agencies should increase toward poor community of Malaysia. At the same time, in the long run, climate change mitigation methods should be designed to curb nutritional challenges and food security issues due to changes in the climate. People who are vulnerable should be empowered and encouraged to adapt to climate changes by developing resilience via investments in health, social protection, education, etc.

Finally, the researchers suggest that new additional studies need to be undertaken to validate or reject the overall findings of the current study. This study found the important adaptation techniques and supports for the food insecure group. The findings of the study are empirically very new. Furthermore, the result might change over the time and based on situation. Therefore, there are huge scopes to further explore the issues discussed in this paper. The results of this study can be investigated further and validated against other socioeconomic and demographic factors, different locations, different economic groups, and the level of food security and also by measuring in different ways.

References

- Alam, M.M., Siwar, C. and Al-Amin, A.Q. (2010), "Climate change adaptation policy guidelines for agricultural sector in Malaysia", *Asian Journal of Environmental and Disaster Management*, Vol. 2 No. 4, pp. 463-469.
- Alam, M.M., Morshed, G., Siwar, C. and Murad, M.W. (2012), "Initiatives and challenges of agricultural crop sector in ECER development projects in Malaysia", *American-Eurasian Journal of Agricultural & Environmental Science*, Vol. 12 No. 7, pp. 922-931.
- Alam, M.M., Siwar, C., Jaafar, A.H. and Talib, B. (2016), "Climatic changes and vulnerability of household food availability in Malaysian east coast economic region", *Journal of Developing Areas*, Vol. 50 No. 5, pp. 143-155.
- Alam, M.M., Siwar, C., Murad, M.W. and Mohd Ekhwan, T. (2011), "Farm level assessment of climate change, agriculture and food security issues in Malaysia", *World Applied Sciences Journal*, Vol. 14 No. 3, pp. 431-442.
- Alam, M.M., Siwar, C., Talib, B. and Wahid, A.N.M. (2017), "Climatic changes and vulnerability of household food accessibility in Malaysian east coast economic region", *International Journal of Climate Change Strategies and Management*, Vol. 9 No. 3, pp. 387-401.
- Alam, M.M., Siwar, C., Wahid, A.N.M. and Talib, B. (2016), "Food security and low-income households in the Malaysian east coast economic region: an empirical analysis", *Review of Urban & Regional Development Studies*, Vol. 28 No. 1, pp. 2-15.
- Alam, M.M., Talib, B., Siwar, C. and Wahid, A.N.M. (2016), "Climate change and food security of the Malayan east coast poor: a path modeling approach", *Journal of Economic Studies*, Vol. 43 No. 3, pp. 458-474.
- Alam, M.M., Siwar, C., Molla, R.I., Talib, B. and Mohd Ekhwan, T. (2012), "Paddy farmers' adaptation practices to climatic Vulnerabilities in Malaysia", *Mitigation and Adaptation Strategies for Global Change*, Vol. 17 No. 4, pp. 415-423.
- Baer, R.D. and Madrigal, L. (1993), "Intra-household allocation of resources in larger and smaller Mexican households", *Social Science & Medicine*, Vol. 36, pp. 305-310.
- Bene, C., Headey, D., Haddad, L. and von Grebmer, K. (2016), "Is resilience a useful concept in the context of food security and nutrition programmes? Some conceptual and practical considerations", *Food Security*, Vol. 8 No. 1, pp. 123-138.
- Bene, C., Arthur, R., Norbury, H., Allison, E.H., Beveridge, M.C.M., Bush, S.R., Campling, L., Little, D.C., Leschen, W., Squires, D., Thilsted, S.H., Troell, M. and Williams, M. (2016), "Contribution of fisheries and aquaculture to food security and poverty reduction: assessing the current evidence", *World Development*, Vol. 79, pp. 177-196.
- BP (2018), "CO₂ emissions", available at: www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/co2-emissions.html (accessed May 25, 2018).
- Coates, J., Swindale, A. and Bilinsky, P. (2007), *Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide*, Food and Nutrition Technical Assistance Project, Academy for Educational Development, Washington, DC.
- Cristofar, S.P. and Basiotis, P.P. (1992), "Dietary intakes and selected characteristics of women ages 19-50 years and their children ages 1-5 years by reported perception of food sufficiency", *Journal of Nutrition Education*, Vol. 24 No. 2, pp. 53-58.
- Davies, S. (1996), *Adaptable Livelihoods: Coping With food insecurity in the Malian Sahel*, MacMillan Press, London.
- Devereux, S. (2001), "Livelihood insecurity and social protection: a re-emerging issue in rural development", *Development Policy Review*, Vol. 19 No. 4, pp. 507-519.
- Dore, A.R., Adair, L.S. and Popkin, B.M. (2003), "Low income Russian families adopt effective behavioral strategies to maintain dietary stability in times of economic crisis", *Journal of Nutrition*, Vol. 133 No. 11, pp. 3469-3475.

- Douxchamps, S., Van Wijk, M.T., Silvestri, S., Moussa, A.S., Quiros, C., Ndour, N.Y.B., Buah, S., Some, L., Herrero, M., Kristjanson, P., Ouedraogo, M., Thornton, P.K., Van Asten, P., Zougmore, R. and Rufino, M.C. (2016), "Linking agricultural adaptation strategies, food security and vulnerability: evidence from West Africa", *Regional Environmental Change*, Vol. 16 No. 5, pp. 1305-1317.
- Easterling, W.E., Aggarwal, P.K., Batima, P., Brander, K.M., Erda, L., Howden, S.M., Kirilenko, A., Morton, J., Soussana, J.-K., Schmidhuber, J. and Tubiello, F.N. (2007), "Food, fibre and forest products", in Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J. and Hanson, C.E. (Eds), *Climate Change 2007: Impacts, Adaptation and Vulnerability – Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, pp. 273-314.
- ECA (2004), *Land Tenure Systems and Their Impacts on Food Security and Sustainable Development in Africa*, United Nations Economic Commission for Africa, Addis Ababa.
- ECER Master Plan (2007), "Economic drives of the region-agriculture", East Coast Economic Region Development Council, Kuala Lumpur.
- ECER Master Plan (2008), "Key targets, east coast economic region (ECER) master plan, east coast economic region development council", available at: www.ecerdc.com.my/en/master-plan/success-factors/ (accessed July 18, 2016).
- Ellis, F. (1998), "Survey article: household strategies and rural livelihood diversification", *Journal of Development Studies*, Vol. 35 No. 1, pp. 1-38.
- EPU (2017), "Sustainable development goals, voluntary national review", Economic Planning Unit, Prime Minister's Department, Putrajaya.
- Fabinyi, M., Dressler, W.H. and Pido, M.D. (2017), "Fish, trade and food security: moving beyond 'availability' discourse in marine conservation", *Human Ecology*, Vol. 45 No. 2, pp. 177-188.
- FAO (1997), *Implications of Economic Policy for Food Security: A Training Manual* (Training Materials for Agricultural Planning 40), Food and Agriculture Organization of the United Nations, Rome.
- FAO (2003), *Trade Reforms and Food Security: Conceptualizing the Linkages*, Food and Agriculture Organization of the United Nations, Rome.
- FAO (2005), *The State of Food Insecurity in the World*, Food and Agriculture Organization of the United Nations, Rome.
- FAO (2006), *Food Security, Policy Brief*, Food and Agriculture Organization of the United Nations, Rome.
- FAO (2008), *Climate Change and Food Security: A Framework Document*, *FAO Inter-Departmental Working group on Climate Change*, Food and Agriculture Organization of the United Nations, Rome.
- FAO (2009), *Profile for Climate Change*, Food and Agriculture Organization of the United Nation, Rome.
- FAO (2016), *Climate Change and Food Security: Risks and Responses*, Food and Agriculture Organization of the United Nation, Rome.
- FAO (2017), *The State of Food Security and Nutrition in the World*, Food and Agriculture Organization of the United Nation, Rome.
- Fartahun, M., Berhane, Y., Wall, S., Byass, P. and Hogberg, U. (2007), "Women's involvement in household decision making and strengthening social capital are crucial factors for child survival in Ethiopia", *Acta Paediatrica*, Vol. 96 No. 4, pp. 582-589.
- Farzana, F.D., Rahman, A.S., Sultana, S., Raihan, M.J., Haque, M.A., Waid, J.L., Choudhury, N. and Ahmed, T. (2017), "Coping strategies related to food insecurity at the household level in Bangladesh", *PLoS ONE*. Vol. 12 No. 4, p. e0171411.
- Field, A. (2000), *Discovering Statistics using SPSS for Windows*, Sage Publications, London.
- Frankenberger, T. (1992), "Indicators and data collection methods for assessing household food security", in Simon, M. and Frankeberger, T.R. (Eds), *Household Food Security: Concepts, Indicators, and Measurements: A technical Review*, IFAD and UNICEF, Rome and New York, NY, pp. 74-134.

- Hammond, S.T., Brown, J.H., Burger, J.R., Flanagan, T.P., Fristoe, T.S., Mercado-Silva, N., Nekola, J.C. and Okie, J.G. (2015), "Food Spoilage, storage, and transport: implications for a sustainable future", *BioScience*, Vol. 65 No. 8, pp. 758-768.
- Hindin, M.J. (2006), "Women's input in household decision and their nutritional status in three resource-constrained settings", *Public Health Nutrition*, Vol. 9 No. 4, pp. 485-493.
- IEA (2013), "CO₂ emissions from fuel combustion highlights", International Energy Agency, Paris.
- IFAD (2011), "Rural poverty report 2011. New realities, new challenges: new opportunities for tomorrow's generation", International Fund for Agricultural Development, Rome.
- Intergovernmental Panel on Climate Change (IPCC) (2007), "Climate change 2007: the physical science basis", Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.
- Intergovernmental Panel on Climate Change (IPCC) (2012), *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, A Special Report of Working Groups I and II of the Cambridge University Press, Cambridge University Press, Cambridge and New York, NY.
- Iram, U. and Butt, M.S. (2004), "Determinants of household food security: an empirical analysis for Pakistan", *International Journal of Social Economics*, Vol. 31 No. 8, pp. 735-766.
- Lino, M. (1996), "Income and spending of poor households with children", *Family Economics and Nutrition Review*, Vol. 9 No. 1, pp. 2-13.
- Lovendal, C.R. and Knowles, M. (2006), "Tomorrow's hunger: a framework for analysing vulnerability to food security", Research Paper Nos 2006/119, UNU-WIDER, Helsinki.
- Makinen, M., Waters, H., Rauch, M., Almagambetova, N., Bitran, R., Gilson, L., McIntyre, D., Pannarunothai, S., Prieto, A.L., Ubilla, G. and Ram, S. (2000), "Inequalities in healthcare use and expenditures: empirical data from eight developing countries and countries in transition", *Bulletin of the World Health Organization*, Vol. 78 No. 1, pp. 55-65.
- Marchand, P., Carr, J.A., Dell'Angelo, J., Fader, M., Gephart, J.A., Kumm, M., Magliocca, N.R., Porkka, M., Puma, M.J., Ratajczak, Z. and Rulli, M.C. (2016), "Reserves and trade jointly determine exposure to food supply shocks", *Environmental Research Letters*, Vol. 11 No. 9, p. 095009.
- Maxwell, D., Ahiadeke, C., Levin, C., Armar-Klemesu, M., Zakariah, A. and Lamptey, G.M. (1999), "Alternative food security indicators – revisiting the frequency and severity of coping strategies", *Food Policy*, Vol. 24 No. 4, pp. 411-429.
- Myntti, C. (1993), "Social determinants of child health in Yemen", *Social Science & Medicine*, Vol. 37 No. 2, pp. 233-240.
- Negatu, W. (2006), "Determinants of small farm household food security: evidence from South Wollo, Ethiopia", *Ethiopian Journal of Development Research*, Vol. 28 No. 1, pp. 1-29.
- Nyariki, D.M. and Wiggins, S. (1997), "Household food insecurity in Sub-Saharan Africa: lesson from Kenya", *British food journal*, Vol. 99 No. 7, pp. 249-262.
- Olson, C.M., Rauschenbach, B.S., Frongillo, E.A. and Kendall, A. (1997), "Factors contributing to household food insecurity in rural upstate New York", *Family Economics and Nutrition Review*, Vol. 10 No. 2, pp. 2-17.
- Paul, B. (2013), "Food security in Malaysia challenges and opportunities for Malaysia of present and in 2050 for maintaining foods security", University of Alberta, Edmonton, doi: 10.13140/2.1.2707.7923.
- Pfeiffer, J., Gloyd, S. and Ramirez, L.L. (2001), "Intra-household resource allocation and child growth in Mozambique: an ethnographic case-control study", *Social Science & Medicine*, Vol. 53 No. 1, pp. 83-97.
- Piaseu, N. (2006), "Factors affecting food insecurity among urban poor in Thailand", *South African Journal of Clinical Nutrition*, Vol. 18 No. 2, pp. 156-160.

- Pielke, R., Prins, G., Rayner, S. and Sarewitz, D. (2007), "Lifting the taboo on adaptation", *Nature*, Vol. 445 No. 7128, pp. 597-598.
- Qureshi, M.E., Dixon, J. and Wood, M. (2015), "Public policies for improving food and nutrition security at different scales", *Food Security*, Vol. 7 No. 2, pp. 393-403.
- Rezai, G., Shamsudin, M.N. and Mohamme, Z. (2016), "Urban agriculture: a way forward to food and nutrition security in Malaysia", *Procedia – Social and Behavioral Sciences*, Vol. 216, pp. 39-45.
- Rose, D. (1999), "Economic determinants and dietary consequences of food insecurity in the United States", *Journal of Nutrition*, Vol. 129 No. 2, pp. 517-520.
- Rose, D., Basiotis, P.P. and Klein, B.W. (1995), "Improving federal efforts to assess hunger and food insecurity", *Food Review*, Vol. 18 No. 1, pp. 18-23.
- Seekell, D., Carr, J., Dell'Angelo, J., D'Odorico, P., Fader, M., Gephart, J., Kumm, M., Magliocca, N., Porkka, M., Puma, M. and Ratajczak, Z. (2017), "Resilience in the global food system", *Environmental Research Letters*, Vol. 12 No. 2, p. 025010.
- Selamat, R., Ahmad, H., Lin, C.Z., Zainuddin, A.A., Shariff, Z.M. and Bakar, W.A.A. (2015), "Household food insecurity in Malaysia: findings from Malaysian Adults Nutrition Survey", *Medical Journal of Malaysia*, Vol. 70 No. S1, p. 11.
- Shariff, Z.M. and Khor, G.L. (2008), "Household food insecurity and coping strategies in a poor rural community in Malaysia", *Nutrition Research and Practice*, Vol. 2 No. 1, pp. 26-34.
- Siwar, C., Alam, M.M., Murad, M.W. and Al-Amin, A.Q. (2009), "A review of the linkages between climate change, agricultural sustainability and poverty in Malaysia", *International Review of Business Research Papers*, Vol. 5 No. 6, pp. 309-321.
- Smit, B. and Skinner, M.W. (2002), "Adaptation options in agriculture to climate change: a typology", *Mitigation and Adaptation Strategies for Global Change*, Vol. 7 No. 1, pp. 85-114.
- Smith, L.C. and Frankenberger, T.R. (2018), "Does resilience capacity reduce the negative impact of shocks on household food security? Evidence from the 2014 floods in northern Bangladesh", *World Development*, Vol. 102 No. C, pp. 358-376.
- Smith, P.J. (1998), "Food security and political stability in the Asia-pacific region", Conference Report, Asia-Pacific Center for Security Studies, Honolulu, September 11.
- Stern, N. (2007), *The Economics of Climate Change: The Stern Review*, Cambridge University Press, Cambridge.
- Studdert, L.J., Frongillo, E.A. and Valois, P. (2001), "Household food insecurity was prevalent in Java during Indonesia's economic crisis", *Journal of Nutrition*, Vol. 131 No. 10, pp. 2685-2691.
- Thi, N.G.D., Kumar, G. and Lin, C.Y. (2015), "An overview of food waste management in developing countries: current status and future perspective", *Journal of Environmental Management*, Vol. 157, pp. 220-229.
- UN (2015), "The millennium development goals report 2015", United Nations, New York, NY, available at: [www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20\(July%201\).pdf](http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf) (accessed May 25, 2018).
- UPM (2017), "Sekuriti Makanan di Malaysia", Fakulti Pertanian, Universiti Putra Malaysia, Serdang, available at: www.agri.upm.edu.my/article/food_security_in_malaysia-30913 (accessed May 25, 2018).
- Vaghefi, N., Shamsudin, M.N., Radam, A. and Rahim, K.A. (2016), "Impact of climate change on food security in Malaysia: economic and policy adjustments for rice industry", *Journal of Integrative Environmental Sciences*, Vol. 13 No. 1, pp. 19-35.
- Webb, P., Braun, J.V. and Yohannes, Y. (1992), "Famine in Ethiopia – policy implication of the coping failure at national and household levels", Research Report No. 92, International Food Policy Research Institute, Washington, DC.
- World Bank (2012), "Global monitoring report 2012: food prices, nutrition, and the millennium development goals", World Bank, Washington, DC, available at: <https://openknowledge.worldbank.org/handle/10986/6017>

- Yamane, T. (1967), *Statistics: An Introductory Analysis*, 2nd ed., Harper and Row, New York, NY.
- Yohe, G.W., Lasco, R.D., Ahmad, Q.K., Arnell, N.W., Cohen, S.J., Hope, C., Janetos, A.C. and Perez, R.T. (2007), "Perspectives on climate change and sustainability", in Parry, M.L., Canziani, F., Palutikof, J.P., van der Linden, P.J. and Hanson, C.E. (Eds), *Climate Change 2007: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, pp. 811-841.
- Zalilah, M.S. (1998), "Growth status determinants of school age children from primarily low-income households in the urban area of Kuala Lumpur, Malaysia: a focus on intra-household factors", PhD dissertation, Michigan State University, East Lansing, MI.
- Zalilah, M.S. and Ang, M. (2001), "Assessment of food insecurity among low income households in Kuala Lumpur using the Radimer/cornell food insecurity instrument – a validation study", *Malaysian Journal of Nutrition*, Vol. 7 Nos 1-2, pp. 15-32.

Appendix 1. List of variables

- Y1: Household food availability in the last one month, where available enough of the kinds of food you want to eat = 5, enough but not always the kinds of food you want = 4, sometimes not enough to eat = 3, often not enough to eat = 2, frequently stay hungry = 1.
- Y2: Household status of food accessibility, where food secure access = 4, mildly food insecure access = 3, moderately food insecure access = 2, severely food insecure access = 1.
- X1: Education level, where illiterate = 1, primary = 2, secondary = 3, higher = 4.
- X2: Number of school going children.
- X3: Household poverty/economic status, where marginally non-poor = 4, recent marginally non-poor = 3, poor = 2, hard core poor = 1.
- X4: Spouse doing job, where yes = 1, no = 0.
- X5: Head of household having supplementary job, where yes = 1, no = 0.
- X6: Earning ratio (earning family member/total family member) is coded in 1-5 scale based on equal value for every 20 percent ratio value, where 0-20 percent, 21-40 percent, 41-60 percent, 6-80 percent, and 81-100 percent are coded as 1, 2, 3, 4, 5, respectively.
- X7: Household having any savings, where yes = 1, no = 0.
- X8: Locality, where urban = 1, rural = 0.
- X9: Ownership of house, where yes = 1, no = 0.
- X10: Type of home, where wood made = 1, mixed = 2, brick = 3.
- X11: Household having any transport for buying food, where yes = 1, no = 0.
- X12: Household buying bulk amount of food, where yes = 1, no = 0.
- X13: Household having neat and clean kitchen and dining place, where yes = 1, no = 0.
- X14: Household having a hygienic sanitation facility, where strongly disagree = 1, disagree = 2, not sure = 3, agree = 4, strongly agree = 5.
- X15: Household managing waste properly, where strongly disagree = 1, disagree = 2, not sure = 3, agree = 4, strongly agree = 5.
- X16: Household having knowledge about maintaining nutrition level and having good sense of hygiene, where strongly disagree = 1, disagree = 2, not sure = 3, agree = 4, strongly agree = 5.
- X17: Household having knowledge about taking precaution against dengue, malaria, etc., where strongly disagree = 1, disagree = 2, not sure = 3, agree = 4, strongly agree = 5.

- X18: Dependency on common resources for cattle or livestock feeding, where very low = 1, low = 2, normal = 3, high = 4, very high = 5.
- X19: Having the ability to adopt to non-climatic/general food insecurity (not caused by climatic issues), where strongly disagree = 1, disagree = 2, not sure = 3, agree = 4, strongly agree = 5.
- X20: Changing food processing system for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X21: Changing food storing system for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X22: Borrow money or foods for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X23: Reduce the number of meal for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X24: Cook whatever food available for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X25: Reduce intake of food taken outside of home for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X26: Reduce food variation for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X27: Reduce fruits and vegetables consumption for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X28: Reduce spending on children education for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X29: Take cheap medical treatment for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X30: Take medical treatment only when situation get worse for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X31: Engage in a second job for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X32: Migrate other places for adaptation to non-climatic/general food insecurity, where yes = 1, no = 0.
- X33: Having the ability to adapt to food insecurity causes by climatic issues, where strongly disagree = 1, disagree = 2, not sure = 3, agree = 4, strongly agree = 5.
- X34: Changing food processing system for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X35: Changing food storing system for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X36: Borrow money or foods for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X37: Reduce the number of meal for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X38: Cook whatever food available for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X39: Reduce intake of food taken outside of home for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X40: Reduce food variation for adaptation to climatic food insecurity, where yes = 1, no = 0.

- X41: Reduce fruits and vegetables consumption for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X42: Reduce spending on children education for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X43: Take cheap treatment for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X44: Take medical treatment only when situation get worse for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X45: Engage in a second job for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X46: Migrate other places for adaptation to climatic food insecurity, where yes = 1, no = 0.
- X47: Overall external supports are needed to ensure food security, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X48: Supports are needed for income increasing program or incentive, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X49: Supports are needed for road and transport infrastructure improvement to ensure food distributions, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X50: Supports are needed for improving drinking water services, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X51: Supports are needed for improving health and medical services, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X52: Supports are needed for updating food distribution channel, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X53: Supports are needed for monitoring and adjustment in price at local market, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X54: Supports are needed for improving agriculture and other agency services, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X55: Supports are needed for climatic related subsidies or rationing for food, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X56: Supports are needed for food aids for emergency time, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X57: Supports are needed for providing emergency services for disaster time, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.
- X58: Supports are needed for special food distribution arrangements in emergency time, where strongly not needed = 1, not needed = 2, not sure = 3, needed = 4, strongly needed = 5.

	X1	X2	X3	X4	X5	X6	X7	X8	X9
X2	0.263**								
X3	-0.056	-0.136**							
X4	0.004	0.146**	0.037						
X5	0.071	0.074	-0.091	-0.032					
X6	-0.206**	-0.390**	0.124**	-0.047	-0.091				
X7	0.082	-0.137**	0.144**	0.021	0.021	0.122**			
X8	0.015	0.03	0.048	0.018	-0.067	0.009	0.095*		
X9	-0.057	-0.071	0.023	-0.095*	-0.01	0.039	0.025	-0.01	
X10	-0.013	0.013	0.105*	0.075	-0.023	0.016	0.067	0.045	-0.031
X11	0.106*	0.157**	-0.02	0.071	0.008	-0.155**	-0.009	-0.067	0.008
X12	0.082	0.150**	0.091	0.046	-0.084	-0.109*	0.016	0.083	-0.023
X13	0.004	0.001	-0.003	-0.011	-0.014	-0.085	0.01	0.252**	0.007
X14	0.067	0.005	0.03	-0.084	0.083	0.016	0.142**	0.041	0.019
X15	0.034	-0.001	0.022	-0.041	0.03	0.018	0.083	0.053	0.041
X16	0.03	-0.023	-0.054	0.005	0.082	-0.052	0.055	-0.143**	-0.012
X17	0.024	-0.044	0.008	-0.091	0.029	0.018	0.072	0.01	0.057
X18	0.017	-0.032	-0.095*	-0.068	-0.051	-0.049	0.005	-0.049	-0.017
Y1	-0.052	-0.350**	0.292**	0.005	-0.081	0.247**	0.316**	0.021	0.047
Y2	-0.081	-0.351**	0.224**	0.024	-0.078	0.243**	0.296**	0.045	0.079
	X10	X11	X12	X13	X14	X15	X16	X17	
X2									
X3									
X4									
X5									
X6									
X7									
X8									
X9									
X10									
X11	0.100*								
X12	0.130**	0.276**							
X13	0.103*	0.018	0.183**						
X14	0.033	0.059	0.139**	0.058					
X15	-0.005	0.179**	0.088	-0.027	0.569**				
X16	-0.041	0.088	0.044	-0.021	0.313**	0.417**			
X17	-0.072	0.132**	0.131**	-0.011	0.519**	0.629**	0.320**		
X18	0.083	0.033	-0.035	-0.039	0.014	-0.033	0.171**	-0.051	
Y1	0.056	0.092*	0.065	0.03	0.150**	0.216**	0.135**	0.128**	
Y2	0.052	0.098*	0.029	0.041	0.132**	0.219**	0.144**	0.108*	

Table A1.
Correlation among the variables of household resilience factors

Notes: *,** Indicate correlations are significant at the 0.05 and 0.01 level (two-tailed)

	X19	X20	X21	X22	X23	X24	X25	X26	X27	X28	X29	X30	X31	X32
X20	-0.079													
X21	0.344**	0.449**												
X22	-0.124**	0.316**	0.103*											
X23	-0.238**	0.371**	0.265**	0.316**										
X24	-0.011	0.366**	0.105*	0.227**	0.265**									
X25	0.298**	0.311**	0.477**	0.150**	0.355**	0.355**								
X26	0.088	0.222**	0.427**	0.197**	0.360**	0.073	0.339**							
X27	-0.002	0.164**	0.427**	0.436**	0.360**	0.388**	0.081	0.600**	0.148**					
X28	0.075	0.428**	-0.007	0.427**	0.220**	0.292**	0.040	0.040	0.128**	0.356**				
X29	0.054	0.321**	0.062	0.427**	0.292**	0.277**	0.355**	0.297**	0.128**	0.279**	0.547**			
X30	0.149**	0.312**	0.316**	0.293**	0.134**	0.526**	0.525**	0.154**	0.090	0.436**	0.532**	0.575**		
X31	0.058	0.424**	0.256**	0.381**	0.200**	0.385**	0.367**	0.240**	0.239**	0.203**	0.249**	0.487**	0.415**	
X32	0.056	0.136**	0.203**	0.154**	-0.038	0.346**	0.304**	0.102*	0.048	0.098*	0.127**	0.183**	0.064	0.132**
X33	0.571**	-0.007	0.150**	0.004	-0.037	0.031	0.220**	0.133**	0.103*	0.024	-0.279**	-0.094*	-0.176**	0.143**
X34	-0.115*	-0.354**	0.221**	-0.143**	-0.059	-0.160**	-0.033	0.013	0.024	-0.279**	0.108*	-0.077	-0.018	-0.052
X35	-0.173**	0.068	-0.450**	0.190**	-0.080	0.055	-0.239**	-0.256**	-0.297**	0.099**	0.137**	0.162**	0.020	0.147**
X36	-0.087	-0.196**	0.329**	-0.339**	0.027	-0.054	-0.037	0.066	0.175**	-0.125**	-0.177**	0.035	-0.063	0.147**
X37	0.273**	-0.058	0.162**	-0.013	-0.279**	-0.008	0.347**	0.083	0.026	-0.123**	0.137**	0.162**	0.020	0.211**
X38	-0.179**	-0.166**	0.317**	-0.046	0.115*	-0.364**	-0.143**	0.225**	0.335**	-0.166**	-0.066	-0.102*	0.002	-0.031
X39	-0.224**	-0.006	-0.023	0.117*	0.291**	-0.089	-0.390**	0.000	0.009	0.079	-0.048	-0.151**	-0.059	-0.162**
X40	-0.016	0.017	-0.053	0.101*	0.008	0.141**	0.054	-0.329**	-0.232**	0.038	0.072	0.141**	-0.041	-0.023
X41	0.038	-0.027	-0.141**	0.113*	-0.056	0.242**	-0.029	-0.309**	-0.446**	0.206**	0.071	0.191**	0.099*	0.223**
X42	-0.138**	-0.295**	0.331**	-0.116*	0.012	-0.103*	0.036	0.095*	0.179**	-0.418**	-0.210**	-0.006	-0.094*	0.115*
X43	-0.055	-0.078	0.341**	-0.131**	0.146**	-0.046	0.034	0.052	0.114*	-0.239**	-0.427**	-0.142**	-0.245**	-0.033
X44	-0.050	-0.102*	0.049	-0.048	0.058	-0.201**	-0.262**	0.077	0.161**	0.035	-0.295**	-0.378**	-0.258**	-0.299**
X45	-0.168**	-0.179**	0.158**	-0.166**	-0.002	-0.062	-0.169**	-0.015	0.112*	-0.205**	-0.393**	-0.236**	-0.402**	-0.066
X46	-0.322**	0.015	0.099*	0.016	0.222**	-0.075	-0.279**	0.036	0.273**	-0.034	-0.209**	-0.197**	-0.107*	-0.327**
Y1	-0.041	-0.007	-0.012	-0.077	-0.070	-0.001	-0.124**	-0.010	-0.085	-0.056	-0.164**	-0.027	-0.104*	0.048
Y2	-0.021	-0.022	-0.007	-0.095*	-0.068	0.039	-0.117*	-0.001	-0.084	-0.037	-0.164**	-0.003	-0.096*	0.101*

(continued)

Table AII. Correlation among the variables of household adaptation approaches

Table AII.

	X20	X21	X22	X23	X24	X25	X26	X27	X28	X29	X30	X31	X32	X33	X34	X35	X36	X37	X38	X39	X40	X41	X42	X43	X44	X45	X46
X20																											
X21																											
X22																											
X23																											
X24																											
X25																											
X26																											
X27																											
X28																											
X29																											
X30																											
X31																											
X32																											
X33																											
X34	-0.093*																										
X35	-0.191**	0.186**																									
X36	-0.036	0.454**	-0.095*																								
X37	0.188**	0.218**	0.051	0.238**																							
X38	0.002	0.383**	-0.099*	0.442**	0.108*																						
X39	-0.049	0.193**	0.294**	0.180**	-0.161**	0.301**																					
X40	-0.054	0.197**	0.307**	0.087	0.294**	-0.090	0.142**																				
X41	0.094*	0.081	0.179**	0.006	0.125**	-0.116*	0.178**	0.425**																			
X42	0.026	0.534**	-0.189**	0.565**	0.203**	0.535**	0.178**	0.049	0.090																		
X43	-0.069	0.420**	-0.082	0.453**	0.126**	0.279**	0.319**	0.247**	0.024	0.526**																	
X44	-0.073	0.272**	0.056	0.246**	-0.017	0.276**	0.375**	0.033	0.021	0.185**	0.515**																
X45	-0.079	0.392**	-0.033	0.368**	-0.014	0.275**	0.214**	0.092*	-0.031	0.422**	0.622**	0.457**															
X46	-0.238**	0.260**	0.023	0.264**	-0.192**	0.319**	0.395**	0.143**	-0.044	0.276**	0.478**	0.505**	0.488**														
Y1	-0.077	0.099*	0.057	-0.008	-0.157**	-0.009	0.019	-0.142**	-0.060	-0.041	0.047	0.009	0.119*	0.068													
Y2	-0.022	0.054	-0.028	-0.003	-0.167**	0.001	0.004	-0.178**	-0.031	-0.020	0.042	.002	0.112*	0.038													

Notes: ** Indicate correlations are significant at the 0.05 and 0.01 level (two-tailed)

	X47	X48	X49	X50	X51	X52	X53	X54	X55	X56	X57	X58	Y1
X48	0.554**												
X49	0.366**	0.635**											
X50	0.372**	0.578**	0.628**										
X51	0.434**	0.605**	0.634**	0.748**									
X52	0.296**	0.569**	0.647**	0.564**	0.613**								
X53	0.333**	0.526**	0.586**	0.496**	0.526**	0.794**							
X54	0.366**	0.482**	0.541**	0.545**	0.391**	0.559**	0.578**						
X55	0.624**	0.415**	0.302**	0.345**	0.270**	0.224**	0.268**	0.384**					
X56	0.447**	0.623**	0.560**	0.494**	0.680**	0.426**	0.401**	0.206**	0.388**				
X57	0.275**	0.476**	0.499**	0.505**	0.642**	0.670**	0.691**	0.360**	0.171**	0.569**			
X58	0.330**	0.580**	0.627**	0.573**	0.582**	0.755**	0.760**	0.589**	0.324**	0.506**	0.780**		
Y1	0.112*	0.011	-0.07	-0.05	-0.09	-0.106*	-0.112*	-0.04	0.095*	-0.01	-0.089	-0.125**	
Y2	0.089	-0.01	-0.06	-0.06	-0.100*	-0.110*	-0.124**	-0.03	0.066	-0.02	-0.094*	-0.133**	0.942**

Notes: **, * Indicate correlations are significant at the 0.05 and 0.01 level (two-tailed)

Table AIII. Correlation among the variables of expected supports

About the authors

Md. Mahmudul Alam is Senior Lecturer of Finance at Universiti Utara Malaysia (UUM). He is also affiliated with Accounting Research Institutes (ARI) at the University Technology MARA (UiTM) in Malaysia and International Islamic University Chittagong (IIUC) in Bangladesh as a Research Associate. He obtained the PhD and Master's Degrees in Environment and Development (Fin. and Econ.) from National University of Malaysia (UKM) and Bachelor (Hons) Degree in Business Administration (Fin. and Econ.) from North South University (NSU) in Bangladesh. He has a good number of publications including 100+ articles in refereed journals and five books/ monographs. He has presented articles in 60+ international conferences. He is recognized as one of the "Top Bangladesh Development Researchers of the Millennium" by BDRC. His research areas include sustainable development, ecological economics, Islamic economics, governance, finance and investment, etc. Md. Mahmudul Alam is the corresponding author and can be contacted at: rony000@gmail.com

Abu N.M. Wahid is Professor of Economics at Tennessee State University and the Managing Editor of *the Journal of Developing Areas*. Up until now, he has produced six books as an author, editor, and co-editor and has made about 60 publications in the form of refereed journal articles and book chapters. Professor Wahid received many research grants including the Fulbright Research Fellowship in 1997. He received the faculty excellence awards for research at Tennessee State University and Eastern Illinois University. Professor Wahid has visited academic institutions in about 20 different countries to give public lectures and seminar presentations. Since 2008, he delivered four keynote addresses in international conferences held in Malaysia, the Philippines, and Taiwan. He read and reviewed 20 PhD dissertations as external examiner for various reputed universities around the world.

Chamhuri Siwar is Emeritus Professor and Principal Research Fellow at the Institute for Environment and Development (LESTARI), National University of Malaysia (UKM). He has been working UKM as a lecturer, the Head of department, and Research Fellow for more than 40 years. He graduated from UKM, Leeds and Iowa State University in the areas of Applied Economics, Agriculture and Resource Economics. He has successfully supervised 40 PhD and 20 Master's students. He has been external examiners of numerous graduate students in Malaysia and abroad. He has wide publications in reputed international and national journals. His area of specialization includes agricultural and resource economics, rural economics, environmental economics, poverty and income distribution, sustainable economics, socioeconomics impact, and sustainable livelihood studies.

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgroupublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com