WORKING PAPER 273/2024

Use of Information by Agricultural Households in India: Determinants and Preferences

Aritri Chakravarty

MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

December 2024

Use of Information by Agricultural Households in India: Determinants and Preferences

Aritri Chakravarty
Assistant Professor, Madras School of Economics,
Chennai, Tamil Nadu, India, 600025
aritri@mse.ac.in

MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

December 2024

WORKING PAPER 273/2024

December 2024

MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

Phone: 2230 0304/2230 0307/2235 2157
Fax: 2235 4847/2235 2155
Email : info@mse.ac.in
Website: www.mse.ac.in

Use of Information by Agricultural Households in India: Determinants and Preferences

Aritri Chakravarty

Abstract

The NSSO report (2015) shows that 41 percent of the rural households in India have accessed information and 34 percent households have used them. This paper explores the households' use of information and understand their preference of information sources and their determinants. Households with better socio-economic conditions access information and from multiple sources. Media has the highest access while public sources have the lowest. Most of the households accessing information use it but the source-wise adoption rates show that, the source with the highest access, media, has the lowest use. This study tries to identify potential factors that lead to a systematic difference in using patterns across households and also across sources. Almost 80 percent of the households accessing information have used it and those not using information have cited lack of credit as a big hurdle to adoption among other reasons. Source-wise disaggregation of use shows that media has the lowest use at around 60 percent, even though it is the highest accessed resource. For all other sources, the share hovers around 80 to 90 percent. The analysis uses a Heckman Selection model to identify the potential factors that drive information use and also the differences between users and non-users of information from media. Overall, use of information is driven more by education and availability of credit than by other factors directly. Caste doesn't appear to be a significant determinant of use directly, but obviously through the caste dynamics that shape different outcomes like education, access to information and access to credit. This analysis finds evidence to support the existing argument that development of human capital is crucial in processing information and using it for efficiency gains.

Keywords: *Agriculture, Information, Sample selection bias, human capital*
JEL Codes: *Q12, O13, D81*

Acknowledgement

I would like to thank my PhD Supervisors Prof. Manmohan Lal Agarwal and Dr. Srikanta Kundu for their guidance and support in doing this study. I also want to thank the CDS faculty members and friends for their comments and suggestions during the research period. My gratitude extends to the MSE faculty members and PhD students for their valuable comments when this work was presented at the Eleventh Faculty Seminar in April 2024. I have tried my best to incorporate all the suggestions. Any mistake is solely mine.

Aritri Chakravarty

INTRODUCTION

The NSSO report (2015) shows that 41 percent of the rural households in India have accessed information and 34 percent households have used them. Availability of information does not ensure its adoption. Persons differ greatly in perceptions of the value of information, in ability and willingness to use, in assessments of costs and in their ability to pay. The ability to decode the language (information) by receiver is very important in adoption (Arrow, 1969) and is ensured by the user's education and experience, among other factors (Wozniak, 1987; Nelson and Phelps, 1966 and Welch, 1970). Access to and availability of credit is also an important determinant of adoption.[1]

This paper explores the households' use of information after accessing it. [2] It further tries to understand their preference of information sources and their determinants. It is found that households with better socio-economic conditions access information and from multiple sources. Media has the highest access while public sources have the lowest. However, when it comes to using the information accessed, it is lowest for media at 68 percent while for other sources it varies between 83 to 91 percent. Overall, in the sample, 37 percent are users which accounts for 84 percent users among households accessing information. Therefore, most of the households accessing information use it but the source-wise adoption rates show that, the source with the highest access, media, has the lowest use. This paper mainly tries to explore this. The paper is organised as follows. After a brief introduction, section 2 discusses the existing studies on use of information and section 3 covers the data and method used here. Section 4 discusses the results and the chapter ends with the concluding remarks in section 5.

[1] Feder, 1980; Feder et al., 1985; Besley and Case, 1993; Sunding and Zilberman, 2001; Abdulai and Huffman, 2005

[2] In the NSSO questionnaire, Table 14, households are asked "Whether recommended advice adopted-Yes/No". Since, the questionnaire uses the term "adoption", we also use it here synonymously with "use" of information

LITERATURE

At the onset it should be made clear that adoption here is not akin to diffusion, which is a long-term phenomenon. Diffusion process at the aggregate level as defined by Mansfield (1968) is "the process of spread of a new technology within a region." Here adoption is typically restricted to the cross-sectional analysis of the relationship between the status of adoption (or use) and several farm and farmer characteristics as explained by Besley and Case (1993).

Use of information is mainly guided by two basic parameters apart from access to or availability of credit. One is attitude towards risk which is captured by farmers' socio-economic characteristics and unobservable factors like farmers' enthusiasm, mindset etc. The other is human capital. Several scholars like Woznaik (1987), Arrow (1969) and Just (2005) argue that human capital captured by education and experience is a principal catalyst in comprehending the available information. Moreover, the sources used are also dependent on their human-capital intensity. Thus, farmers with less education depend more on interpersonal contacts than media sources imparting general information. Another factor that influences use after suitable comprehension is the availability of credit. Some relevant theoretical and empirical studies is discussed below to understand use of information overall and across sources.

Attitude Towards Risk, Farm Size and Credit

The objective of this study is to understand the adoption of information at a given point of time by agricultural households. Therefore, studies that are static in nature concentrating mainly on farm-level adoption will be discussed here.[3] Hiebert (1974) uses a stochastic production function and assumes risk aversion and finds probability of adoption increases as the stock of information pertaining to modern production increases, like

[3] Hence, dynamic analysis on the adoption of information over time (or diffusion) would not be the main point of discussion in this section.

through extension efforts. His theoretical results regarding the effects of extension are consistent with arguments advanced by Nelson and Phelps (1966) and by Welch (1970). In addition, a more favourable physical environment, better soil and water availability also increases the probability of adoption. Producer's skills in deciphering and analysing information also influence adoption.

In another study, Feder (1980) found that if farmers are not credit constrained then the level of fertilizer use per acre for the new crop is independent of the degree of risk aversion, uncertainty and farm size. Then risk affects only the land-allocation decision (between the old and new crops) in a manner consistent with Hiebert's (1974) analysis. Feder (1980) also showed that land allocated to the modern crop depends on the relationship between relative risk aversion and income. Just and Zilberman (1983) later extended these considerations to all inputs using a simple production function and showed that the intensity of using modern inputs depends on whether they increase or decrease risk and on whether relative risk aversion is increasing or decreasing.

Human Capital and Sources of Information

Producer's decision to gather information is more complicated when information is available in increasing degrees of reliability at increasing costs (Kihlstrom, 1976). The determinants of the adoption decision may differ with the channels of information dissemination (Wozniak, 1993 and Gervais et al., 2001). In addition, farmers are more likely to gather technical information from various sources (Genius et al., 2006). According to human capital theory, innovative ability is closely related to education level, experience and information accumulation; characteristics associated with the resource allocation skills of farm operators (Schultz, 1972; Huffman, 1977; Rahm and Huffman, 1984). Adoption behaviour under uncertainty depends on the endowment of human capital and the investment in adoption information. Woznaik (1987) analyses the role of education, experience, and information acquisition in the decision to be an early adopter. The results support the hypothesis that adoption

decision-making is a human capital-intensive activity. The econometric evidence suggests that education and information reduce adoption costs and uncertainty, and thereby raise the probability of early adoption. Adoption behaviour is also shown to vary significantly across farm size.

Like Arrow (1969) argues, media is easily accessible but interpersonal connections help in learning and hence leads to higher usage. This is also in line with the argument of Just et al. (2002) that generic information from media is difficult to use for less educated households while specific information from neighbours or personal contacts is easier to use.

Mittal and Meher (2016) using a multivariate probit model on 1,200 farmer households of five Indo-Gangetic states of India find that farmer's age, education level and farm size influence farmer's behaviour in selecting different sources of information. The results show that farmers use multiple information sources, that may be complementary or substitutes to each other which implies that any single source does not satisfy all information needs of the farmer. Ali (2012) analyses the influences of socio-demographic factors, business orientation of farmers, and farm characteristics on adoption of ICT-based information through primary data collected from 461 farmers in eight districts of Uttar Pradesh, India. Using Poisson Count Regression Model, the findings indicate that education, income, and social category of farmers are important socio-demographic factors affecting the adoption of ICT-based information systems. Similarly, farmers who consider farming as a business venture, practice a diversified cropping system and are more likely to use ICT-based information.

A majority of published literature that examines factors that influence farmers' use of information include personal characteristics such as age (Carter and Batte 1993), education (Schultz, 1972; Huffman, 1977; Rahm and Huffman, 1984 and Ali, 2012), and experience in farming (Schnitkey et al. 1992); business characteristics such as market

orientation of farming (Ngathou et al., 2006), farm size (Solano et al., 2003; Alvarez and Nuthall 2006; Llewellyn 2007), type of farm enterprise (Carter and Batte 1993), debt level (Tucker and Napier 2002), and ownership of farm (Ngathou et al., 2006); and geographical characteristics such as distance to market centres (Solano et al., 2003) and distance to nearest technological adopter (Llewellyn 2007).[4]

METHOD OF ANALYSIS

The objective of this paper is twofold. First is to find the factors that drive information use and the second is to find (if any) systematic difference between users and non-users of information from media. This is to understand the reasons for media having the lowest use in spite having the highest access. To analyse the issues at hand, two models are used. The first is discussed on section 3.1 regarding the determinants of use and section 3.2 discusses the method employed to compare the use of media with other sources.

Determinants of Use of Information

The empirical model used to find the factors that determine use of information by agricultural households in India is described here. Using a simple logit/probit model to determine the factors will lead to a sample selection bias because households not using information after accessing it and households not using because of not accessing will be treated as same. Again, dropping the households that have not accessed information (56 percent of sample households) will lead to loss of vital information. Both the above techniques would result in specification error emanating from the classic problem of sample selection bias (Heckman, 1976, 1979). Therefore, a Heckman selection model is used here with

[4] Tenurial arrangements play an important role in the adoption decision (see for example Bhaduri (1973), Scandizzo (1979), (Srinivasan, 1972), Newbery (1975) Ghose and Saith (1976), (Bell, 1972) and Bardhan (1979). However, most of the households in the sample own land and tenants occupy a negligible fraction,thus tenurial structure is not included in this analysis.

the determinants of use in the outcome equation and access in the selection equation.

The Model

$Use_i = f(X_i'\beta) + u_i$ (1)

Where, use = 1 if household has used information
= 0 otherwise

X is the matrix of explanatory variables (displayed below in Table 1) similar to that of the previous chapter and hence, not discussed here separately. β is the corresponding vector of parameters including the constant. u is the random error term following a normal distribution with 0 mean and variance, 1. The selection equation is given as

$Access_i = f(Z_i'\gamma) + \varepsilon_i$ (2)

where access = 1 if household has accessed information
= 0 otherwise

Z is again the matrix of explanatory variables and γ is the corresponding the vector of parameters including the constant. The error terms in both equations 1 and 2 have a standard normal distribution as in probit models are expressed below.

$u_i \sim N(0, 1)$
$\varepsilon_i \sim N(0, 1)$
$Corr(u_i, \varepsilon_i) = \rho$

If the correlation coefficient of the error terms, ρ, is zero it means that the log likelihood for the probit model with sample selection is equal to the sum of the probit model for the outcome and the selection model. This means that the selection equation and the outcome equation are independent and hence, can be run separately. However, in this model, the Wald test of independent equations show that the value ρ is

significantly different from 0 as shown at the end of Table 4. This justifies the use of probit model with sample selection.

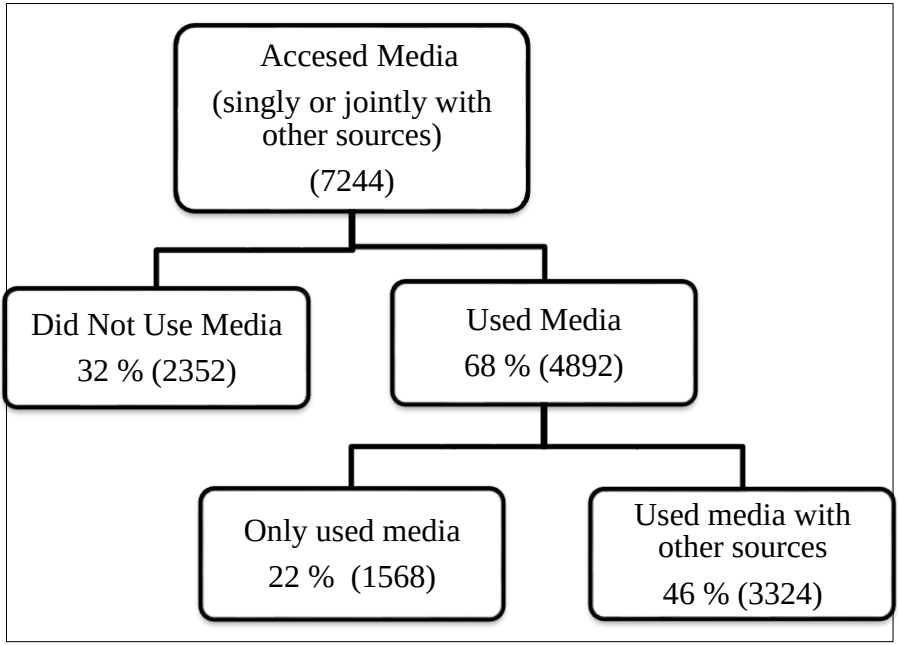
Several explanatory variables which are either continuous or categorical are used for this estimation as given in Table 1. The proportion of households accessing information per village is used as the exclusion restriction. It is expected that the probability of access would be higher in villages where more people access information and it has no direct bearing on use of information also.

Determinants of Information Use from Media

In this sample, 84 percent of the households accessing information have used it. However, adoption rate of information across the sources show that media has the lowest rate of adoption (68 percent) while other sources have a rate varying between 85 and 91 percent. Thus, the highest accessed source has the lowest adoption and here, the reasons for the same are explored. To do so, use of media is compared with use of other sources when households have accessed media either singly or jointly with other sources. The diagram below (Figure 1) will explain the path of this analysis clearly.7244 households have accessed media either singly or jointly with other source(s). Of them, 2352 (32 percent) did not use the information accessed from media. 4892 (68 percent) households used media and among them,1568 have used only media and 3324 have used media jointly with some other source(s). Therefore, 22 percent of the households accessing media have used only media while 46 percent have used media in combination with other source(s) and 32 percent have not used it. Thus, I want to explore the systematic difference (if any) between the characteristics of households (i) using and not using media and (ii) using only media and using media jointly with other sources.[5]

[5] This can be further disaggregated into households accessing only media and households accessing media jointly with other sources and then calculating the number of households using and not using media in each category. However, only 1 percent of households accessing media jointly, use media and hence carrying regression with such a small percentage might not give correct estimates.

Figure 1: Decision to Use information from Media Sources by Households



Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Note: Numbers in parentheses are household frequencies

Thus, there are two regression models. The first where the dependent variable is binary taking values 0 if households have not used media and 1 if households have used media. Since households not using media can also include households not accessing media, therefore there can be a sample selection bias if only the households accessing media are used in the regression. Thus, a Heckman selection model is used that distinguishes the households accessing and not accessing media. The selection equation is also a probit model with binary dependent variable taking value 1 if household accessed media and 0 otherwise.

Use Vs Non-Use of Media

THE MODEL

The outcome equation is written as

Using Media= $f(X'\beta) + u_i$ (3)

where use of media = 1 if household has used information from media

= 0 otherwise

X is the matrix of explanatory variables (discussed below) and β is the corresponding vector of parameters including the constant. u is the random error term following a normal distribution with 0 mean and variance, 1.

Access to media = $f(Z'\gamma) + \varepsilon_i$ (4)

where access = 1 if household has accessed information from media

= 0 otherwise

Z is again the matrix of explanatory variables and γ is the corresponding vector of parameters including the constant. The error terms in both equations 3 and 4 are assumed to follow a standard normal distribution as in a probit model and the expression is same as above in the previous model. The Wald test of independent equations show that the value of ρ is significantly different from 0 as shown at the end of Table14. Hence, the use of probit model with sample selection.

The exclusion restriction, like in the previous chapter is the proportion of households reporting access to media in a village. This is expected to be positively related to the probability of accessing from media channels in a village.

Table 1: Explanatory Variables

Characteristics	**Sample Mean/ Share**
Land Owned: hectares	1.5*
Cultivation as primary source of income: percent	65
Male headed households: percent	92
Age of farmers in a household: years	50.6*
Square of age of farmers in a household: years^2	2751*
Farmers in a household: persons	2*
Education Level Attained by Head of Household	
Illiterate: percent (Base)	34
Primary and Below: percent	26.5
Middle: percent	16
Secondary: percent	11.5
Above secondary: percent	11
Social Category	
Scheduled caste: percent	19
Scheduled tribes: percent (Base)	13
Other backward classes: percent	40
Others: percent	28
Food Crop: percent (Base)	50
Non-Food Crop or Mixed: percent	50
Households involved in MGNREGA: percent	45
Proportion of households with access to information per village	0.4
Bank Density (number of households with bank account/sq. km.)	57
Agroclimatic Zone Dummies	15^
State Dummies	36^
No. of observations	30,338

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Note: *denotes sample mean, ^denotes total number of agroclimatic zones and states in India

Use of Media Singly Vs. Jointly With Other Sources

The second model is a simple logit regression for households that have used media singly or jointly. The dependent variable is binary with *using only media* categorised as 1 and *using media jointly* is categorised as 0 (base category). The model is written as

$$\ln(Y_i) = \beta_0 + \beta' X + u_i \quad (5)$$

where,

Y_i = odds of using media for the i^{th} household = $\frac{Probability\ of\ using\ only\ media}{Probability\ of\ using\ media\ jointly}$

β_0 is the constant and β is the vector of coefficients corresponding to the explanatory variables, X. u_i is the residual for the i^{th} household.

Bank density: This is defined as the total number of banks (co-operative and commercial) and agricultural credit societies in the rural area of a district. It is constructed from district-wise rural data from Census (2011). Bank density is the ratio of total formal financial institutions (commercial, co-operative and agricultural credit societies) to rural geographical area of the district.[6]

Simple descriptive analysis shows that households with larger proportion of formal loans have larger probability of accessing and using information and from multiple sources. However, there can be reverse causality and hence a problem of endogeneity if proportion of formal loans is used as an explanatory variable. Hence, to avoid that, this variable is used to capture the role of access to credit in using information. It is expected that households belonging to districts with higher bank density will have a higher probability of using information.

[6] I have also used the ratio of total formal financial institutions to rural population as another proxy for bank density but the results remain qualitatively unchanged and hence are not reported here.

RESULTS

Use of Information

A total of 13,344 households accessed information and 11,261 of them adopted/used that information. This accounts for 84 percent of the households accessing information. Thus, only 16 percent (2083 households) did not use the information after accessing it. The households that did not use information were asked to cite one of the following five reasons – *lack of financial resources*, *non-availability of input and physical resources*, *lack of technical advice for follow up*, *difficulty in storage, processing and marketing of products* and *others*. Among the first four reasons, lack of financial resources is cited as the most common impediment followed by *lack of technical advice for follow up* (see Table 2 below).

Although the reason category involving *others* has the highest frequency, we cannot probe into it further because the NSSO questionnaire (or instruction files) do not explain them. Also, a small percentage of households (3 percent) cite more than one reason for not using information. Thus, among the rest four reasons, lack of financial resources and follow up advice are the dominant reasons for inability to use information.

Table 2: **Reasons for not Adopting Information**

Reason	Percentage
Financial Resources	24
Input and Physical Resources	15
Technical Advice for follow up	19
Logistics	4
Other Reasons	35
Combination of Above	3
Total	100 (2083 households)

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Profile of Households

A simple profiling of the households with respect to their socio-economic characteristics using the mean difference test shows that users of information have larger land ownership, higher percentage of male heads, a greater number of farmers and a higher percentage with cultivation as the primary source of income (see Table 3). However, age of head of the household and number of female farmers in a household do not show any significant difference in their means between users and non-users.

There is no significant difference between users and non-users across social groups once it is conditioned on access, except for *scheduled castes* where it shows a significantly higher proportion of users. There is no particular explanation for this in the literature except one can argue that caste effects are stronger at the initial level of access and thereafter acts through other factors but does not have a direct effect on use. As one moves up the social ladder, the number of users becomes more than the number of non-users for each group, except for general category where users are 32 percent, 1 percent less than the non-users. As education level increases, the distribution between users and non-users weighs in favour of users. That is, for lower education levels like illiterate and below primary, the percentage of users is less than non-users while for education levels middle and higher, the share of users is more than non-users. However, the difference is not significant for illiterate and middle educational level. Unlike caste, education as argued in the literature, still has a strong potential in influencing use of information.

Comparison of a few key farm characteristics show that users of information have larger gross cropped area, more area under irrigation, higher net returns from farming and grow a higher percentage of non-food crops. In terms of market awareness, users of information have a higher percentage of households which are aware of minimum support prices and have crop insurance.

Table 3: Comparison of Some Salient Features Between Users and Non-Users

Characteristics	(1) Users	(2) Non-Users	Difference in Means/ Proportions (1-2)
Socio-economic characteristics			
Land Owned: hectares	1.9	1.7	0.2***
Cultivation as primary source of income: percent	74	70	4***
Male headed households: percent	94	92	2**
Age of farmers in a household: years	51.9	51.7	0.2
Farmers in a household: percent	2.5	2.4	0.1***
Female farmers in a household: percent	32	33	1
Educational attainment of the head of household: percent			
Illiterate	28	28.5	-0.5
Primary and Below	26	28.5	-2.5***
Middle	17.5	17	-0.5
Secondary	14	13	1*
Above secondary	14.5	13	1.5**
Social Group: percent			
Scheduled caste	10	11	-1
Scheduled tribes	15.5	14	1.5**
Other backward classes	42.5	42	0.5
General	32	33	-1
Farm Characteristics			
Gross cropped area: hectares	1.6	1.3	0.3*
Area irrigated: percent	54	48	6***
Net return from farming (Rs.)	56075	40857	15218***
Food Crop: percent	43	45	-2**
Market and policy awareness			
Minimum support price: percent	32	29	3**
Insurance: percent	8	4	4***
Total loan (Rs.)	165933	135739	30194***
Formal Credit: percent	63	60	4**
No. of observations	11,261	2083	

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)
Note: *,**,*** represents significance at 10, 5 and 1 percent respectively

The users all have larger amounts of loan as well as a higher proportion of formal loans. In the previous chapter it was found that these characteristics differ significantly between households accessing and not accessing information. Overall, the pattern holds true here also, except for social group at large.

Regression Results

The results shown in the descriptive analysis is further subject to regression techniques for robustness as shown in Table 4 and corroborates the descriptive statistics. Social group, which is a significant characteristic determining access to information, is not a significant determinant of use of information.

Table 4: Regression results of Probit Model with Selection

	Outcome Equation	**Selection Equation**
Dependent Variable	**(1) Used Base=Did not Use**	**(2) Accessed Base=Did not Access**
Socio-economic Characteristics		
Total Household Land	0.01* (0.010)	0.01* (0.007)
Gender of head of household (Base=Male)	0.08 (0.061)	0.12*** (0.034)
Age of head of household	0.01* (0.007)	0.01*** (0.004)
Square of age of head of household	-0.0001*** (0.00004)	-0.0001*** (0.00004)
Number of farmers per household	0.03*** (0.013)	0.03*** (0.009)
Main source of income (Base=Not Cultivation)	0.02 (0.046)	0.06*** (0.026)
MGNREGA Job Card (Base=Yes)	0.01 (0.045)	0.02 (0.027)
Social Group (Base=ST)		
SC	0.07 (0.097)	0.10* (0.056)
OBC	0.01 (0.107)	0.19*** (0.049)
General	0.06 (0.111)	0.17*** (0.052)
Educational Attainment of Head of Household (Base=Illiterate)		
Primary and below	-0.003 (0.056)	0.11*** (0.025)

Middle	0.10 (0.068)	0.19*** (0.031)
Secondary	0.15** (0.081)	0.28*** (0.034)
Higher Secondary and above	0.19** (0.091)	0.33*** (0.036)
Farm Characteristics		
Gross Cropped Area	0.06** (0.024)	0.07*** (0.012)
Proportion of land under irrigation	0.15** (0.061)	0.13*** (0.036)
Crop Insurance (Base=No)	0.38*** (0.074)	0.21*** (0.053)
Type of crops grown (Base=Non-food crop)		
Food crop (or both)	-0.10* (0.062)	-0.13*** (0.029)
Bank Density	1.72** (0.527)	1.02** (0.448)
Proportion of households accessing information in a village (Exclusion Restriction)		0.33*** (0.117)
Constant	-0.17*** (0.640)	-0.56*** (0.20)
Agricultural zones Fixed Effects	Yes	Yes
State Fixed Effects	No	Yes
State x Agricultural Zone	No	Yes
Total Observations		25,388
Rho	-0.47* (0.209)	
Total Observations	25388	
Selected = 12,996; Non-selected = 12,392		
Wald chi2(33) = 114.56, Prob > chi2 = 0.00, Log pseudolikelihood = -21457.82		

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Note: *** p<0.01, ** p<0.05, * p<0.1. Village wise clustered standard errors in parentheses (adjusted for 4,364 clusters in village)

Households with larger land holdings and with a greater number of farmers have a higher probability of using information. The same is true for households with more gross cropped area and higher proportion of land under irrigation. The probability of using information also increases for older head of households and decreases after the age of 50 years (inflection point). Probability of use is significantly higher for secondary and above secondary educated heads of households as compared to illiterate heads.

Households growing only food crops or both food and non-food crops as compared to non-food crops (base) have a lower probability of using information. Also, households with crop insurance have a higher probability of use. Availability of credit captured by bank density has a

positive influence on use of information. The results support the arguments in the literature on the positive influence of education and availability of credit on use of information.

Use of Information From Media

Descriptive Statistics

There is not much variation in the rate of using information across various sources except for media (see Table 5). Media, has the highest access but lowest share of users at 67.5 percent while for the rest of the sources it ranges from 83 percent to as high as 91 percent.

Table 5: Access and Use of Information from various Sources

Information Sources	Accessed	Used (%)
Extension Agent	2412 (10.5)	85.5
Krishi Vigyan Kendra	1311 (6)	83
Agricultural University/College	564 (2)	84
Veterinary Department	3224 (14)	91
Private Commercial Agents	1867 (8)	84
Progressive Farmers	5963 (26)	91
Radio/TV/Newspaper/Internet	7244 (32)	67.5
NGO	355 (1.5)	77
Total	13344 (100)	84 [11261]

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)
Note: () denotes percentage and [] denotes frequency

It is found that *lack of technical advice for follow up* is the greatest impediment to using information from media (see Table 6). An equal percentage of households report *Other reasons* for not using media, but we do not have any data/information to probe further into it. Barring *Other reasons,* which is the most cited reason for not using both media as well any other source, lack of financial resources is the most cited reason followed by lack of technical advice for non-users of information; a pattern that is just opposite for households not using media.

Table 6: **Reasons for not Adopting Information from Media**

Reason	Media (%)	Other Sources (%)
Financial Resources	21	27
Input and Physical Resources	16	16
Technical Advice for follow up	30	19
Logistics	3	4
Other Reasons	30	34
Total	100 (2352 households)	100 (1879 households)

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Use of Media Across Social Group

Unlike the relationship between social group and use of information, the relationship between social group and use of media is not independent of each other as shown by the chi square value in Table 7. Only 12 percent of STs access information from media and of them 70 percent use it after that. Access and use of media are lowest for SCs. For OBCs and General households, their share in access and use are both high.

Table 7: Use of Media across Social Category

Social Category	Users of media (row %)	Total Access by Households
Scheduled Tribes (ST)	70	880 (12)
Scheduled Caste (SC)	63	616 (8.5)
Other Backward Classes (OBC)	66	3099 (43)
General	69	4281 (32)
Total Households	68 [4892]	7244 (100)
Pearson chi2(3)	16.7***	

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)
Note: *** denotes significance at 1 percent, ( ) denotes column percentage and [] denotes frequency

It is however, worth mentioning that the proportion of SC and ST households accessing media is much smaller (around 20 percent) than the OBC and General households. Therefore, only 12 percent of ST

households accessed media and 70 percent of them used it while 43 percent and 37 percent of OBC and General households accessed media respectively and 66 and 69 percent used it respectively.

Use of Media Across Education Level

Table 8 shows the relative frequency distribution of users across education levels for households reporting use of media. It is observed that the percentage of households using information from media increases with increase in education level Also, it was found that the number of households decreases as one moves from illiterate to higher education levels which as shown in the last column of Table 8.

Table 8: Use of Media across Educational Level

Education Level	Users of media (row %)	Total Access by Households
Illiterate	63	1585 (22)
Primary and Below	65	1872 (26)
Middle	68	1330 (18)
Secondary	71	1182 (16)
Above Secondary	72	1275 (18)
Total Households	67.5 [4892]	7244 (100)
Pearson chi2(4)	41.4***	

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Note: *** denotes significance at 1 percent, ( ) denotes column percentage and [] denotes frequency

Use of Media Across Land Size Holding

Table 9 shows that percentage of users of media does not vary much across land size classes except for large holdings. Large landed households form only 1 percent of the households and they have the largest share of users of media at 84 percent; others have between 60 and 70 percent. Users of information from media show a gradual increase in their share from marginal to medium but a substantial leap from medium to large.

Table 9: Use of Media across Land Size Holdings

Land Size Class	Users of media (row %)	Total Access by Households
Marginal (less than 1 ha)	68	2272 (31)
Small (1 – 2 ha)	67	2316 (32)
Semi-medium (2 – 4 ha)	68	1948 (27)
Medium (4 – 10 ha)	66	622 (8.5)
Large (more than 10 ha)	84	86 (1)
Total Households	67.5 [4892]	7244 (100)
Pearson chi2(4)	11.6**	

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Note: ** denotes significance at 5 percent, ( ) denotes column percentage and [] denotes frequency

Regression Results

Media has the lowest number of users while it is the highest accessed source of information. This study has tried to identify its reasons by using some descriptive statistics and then for robust results used regression analysis. The regression estimates of the factors influencing use of media is given in the Table 10 below and they corroborate the findings in the descriptive section. Households with cultivation as the primary source of income, belonging to OBC and *general* social groups and having a greater number of farmers have a higher probability of using media. Households with more land and having larger area under irrigation also have a relatively higher probability of using information from media. Users of media also grow relatively more non-food crops and have crop insurance.

Table 10: Regression Coefficients of Heckman Selection Model with Use of Media as the Outcome

	Outcome Equation	Selection Equation
Dependent Variable	**Used Media Base=Did not use Media**	**Accessed Media Base=Did not Access Media**
Socio-economic Characteristics		
Total Household Land	0.02**(0.010)	0.03***(0.006)
Gender of head of household (Base=Male)	0.12** (0.051)	0.10**(0.039)
Age of head of household	0.017**(0.006)	0.02**(0.005)
Square of age of head of household	-0.0001*(0.00001)	-0.0001*(0.00001)
Number of farmers per household	0.02 (0.012)	0.11 (0.009)
Main source of income (Base=Cultivation)	0.08***(0.039)	0.09***(0.028)
MGNREGA Job Card (Base=Yes)	0.07 (0.050)	0.17*** (0.028)
Social Group (Base=ST)		
SC	0.03 (0.089)	0.14**(0.058)
OBC	0.19**(0.080)	0.28***(0.050)
General	0.17**(0.087)	0.29***(0.053)
Educational Attainment of Head of Household (Base=Illiterate)		
Primary and below	0.15***(0.050)	0.21***(0.028)
Middle	0.27***(0.053)	0.31***(0.033)
Secondary	0.42***(0.059)	0.45***(0.036)
Higher Secondary and above	0.52***(0.056)	0.52***(0.037)
Farm Characteristics		
Gross Cropped Area	0.02 (0.010)	0.001 (0.01)
Proportion of land under irrigation	0.13*** (0.049)	0.11*** (0.037)
Crop Insurance (Base=No)	0.23*** (0.065)	0.16*** (0.052)
Type of crops grown (Base=Non-food crop)		
Food crop (or both)	-0.16*** (0.051)	-0.23*** (0.031)
Bank Density	1.14** (0.490)	0.60 (0.434)

	Outcome Equation	Selection Equation
Dependent Variable	**Used Media Base=Did not use Media**	**Accessed Media Base=Did not Access Media**
Proportion of households accessing information from media in a village (Exclusion Restriction)		0.39*** (0.126)
Constant	-1.61*** (0.302)	-1.23*** (0.213)
Exclusion Restriction		0.633***(0.0603)
Agricultural zones Fixed Effects	Yes	Yes
State Fixed Effects	No	Yes
Rho	-0.84** (0.161)	
Total Observations	25,378	
Selected = 7,087; Non-selected = 18,291 Wald chi2(33) = 102.71, Prob > chi2 = 0.00, Log pseudolikelihood = -17513.41		

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Note: *** p<0.01, ** p<0.05, * p<0.1, Village wise clustered standard errors in parentheses (adjusted for 4,363 clusters in village)

The households with male heads have a higher probability of use of media. Older heads have a relatively higher probability of use and it slightly decreases with increase in age as shown by the very small coefficient of *square of age of head of household*; but the inflection point is high at 85 years. Households with educated heads have a relatively higher probability of using media as compared to their illiterate counterparts. Again, bank density comes out to be a positive and significant determinant of using media.

The next table (Table 11) tries to identify the systematic difference in characteristics between users using media either singly or jointly. In comparison to households using information from media and other sources jointly, a very strong systematic difference is not observed

in households using information from media only, except for few characteristics. Total land holding of a household has a negative relation with use of media only, implying that as land holding increases the probability of using only media relative to using media jointly decreases. This is further supported by the findings in Appendix (Table A1) which shows that the probability to use multiple sources increases with increase in land size holdings. This also suggests that economically stronger households prefer to use information from multiple sources[7]. The probability of using media jointly also increases with increase in area under irrigation. Households growing both food and non-food crops have a relatively lower probability of using only media as compared to households growing only non-food crop. Also, younger farmers have a higher probability of using only media as compared to using media jointly and this slightly reduces with age as given by the very low coefficient of *square of age of head of household.* In the previous model it was found that older farmers preferred media (Table 10) where media referred to both single and joint use. A deeper analysis in this model shows that older farmers prefer media along with other sources instead of using it alone.

Caste and education do not come out very strongly here and hence to tease out their effects, the regression is run with (Model 1 in Table 11) and without their interaction (Model 2 in Table 11). In the non-interactive model, SC is positive and significant at 5 percent, indicating that probability of using only media with respect to using media jointly is higher for SCs as compared to STs. This is also true for OBCs but the statistical significance is low at 10 percent. In terms of education, only middle level is significant at 10 percent and its negative sign indicates these households have a lower probability of using only media vis-à-vis using media jointly as compared to illiterates. Although other educational levels are statistically non-significant, this result supports the hypotheses

[7] I have also tried to find if household characteristics influence the intensity of use of information. The results are shown in Appendix A1. Overall, land owned, area under irrigation and age come out as positive predictors.

that less educated farmers (middle level educated farmers here) use less of human-capital intensive sources like media and complement them with other sources for better comprehension.

However, in the interaction expansion, this relation is only shown by households in the primary education level at the main level and at the interaction level only SC households with primary education yield a positive and statistically significant coefficient at 10 percent level of significance. This implies that compared to illiterate ST households, primary educated SC households have a higher probability of using only media than using media jointly. Therefore, in all household's land ownership, area under irrigation, type of crops grown and head's age come out to be significant determinants in choosing between using media singly or jointly.

Table 11: Regression Coefficients of Logit Model Estimating Use of Media Singly vs. Jointly

Dependent Variable (Base=Used Media Jointly)	**Model 1 Used Only Media**	**Model 2 Used Only Media**
Explanatory Variables		
Socio-economic Characteristics		
Total Household Land	-0.12** (0.056)	-0.12**(0.056)
Gender of head of household (Base=Male)	-0.14 (0.138)	-0.130(0.139)
Age of head of household	-0.04***(0.015)	-0.04**(0.016)
Square of age of head of household	0.0004***(0.0001)	0.0004***(0.0001)
Number of farmers per household	-0.011 (0.032)	-0.011 (0.032)
Main source of income (Base=Cultivation)	-0.13 (0.096)	-0.13 (0.097)
Gross Cropped Area	0.049(0.065)	0.05 (0.065)
Proportion of Area under Irrigation	-0.343*** (0.123)	-0.341***(0.123)
Social Group (Base=ST)		
SC	0.493**(0.215)	0.263 (0.340)
OBC	0.340* (0.182)	0.272 (0.291)
General	0.236 (0.189)	0.189 (0.314)

Dependent Variable (Base=Used Media Jointly)	Model 1 Used Only Media	Model 2 Used Only Media
Explanatory Variables		
Educational Attainment of Head of Household (Base=Illiterate)		
Primary and below	-0.0945(0.109)	-0.549*(0.329)
Middle	-0.223*(0.121)	-0.0395(0.351)
Secondary	-0.174(0.127)	-0.0404(0.395)
Higher Secondary and above	-0.0831(0.127)	0.0145 (0.389)
Type of crops grown (Base=Non-food crop)		
Food crop	-0.120(0.143)	-0.128(0.143)
Both food and non-food crop	-0.312**(0.136)	-0.312**(0.135)
Bank Density	5.7e-06***(2.1e-06)	5.7e-06***(2.1e-06)
Interaction Expansion (caste X education) [Base ST and Illiterate]		
SC x Primary and below	-	0.754*(0.457)
SC x Middle	-	-0.064 (0.472)
SC x Secondary	-	-0.088 (0.537)
SC x Higher Secondary and above	-	0.265 (0.519)
OBC x Primary and below	-	0.549 (0.364)
OBC x Middle	-	-0.248 (0.382)
OBC x Secondary	-	-0.255 (0.429)
OBC x Higher Secondary and above	-	-0.096 (0.418)
General x Primary and below	-	0.442 (0.378)
General x Middle	-	-0.233 (0.400)
General x Secondary	-	-0.110 (0.437)
General x Higher Secondary and above	-	-0.179 (0.427)
Constant	0.726 (0.518)	0.743 (0.560)
Agricultural zones Fixed Effects	Yes	Yes
Total Observations	4,829	

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Note: Village wise clustered standard errors in parentheses (adjusted for 1,670 clusters in village), *** p<0.01, ** p<0.05, * p<0.1

CONCLUSION

This chapter studies the behaviour of agricultural households in using information after accessing it. It tries to identify potential factors that lead to a systematic difference in using patterns across households and also across sources. Almost 80 percent of the households accessing information have used it and those not using information have cited *lack of credit* as a big hurdle to adoption among other reasons. Source-wise disaggregation of use shows that media has the lowest use at around 60 percent, even though it is the highest accessed resource. For all other sources, the share hovers around 80 to 90 percent.

Information acquired from media requires proper comprehension which is conditioned mainly by education. Since, it is a human-capital intensive source and majority of the households are represented by illiterate or less educated heads, it explains to a great extent the reason for lower adoption of media. This is also supported by the fact that most of these households cite *lack of technical follow up* as the biggest problem of using information from media. A deeper analysis of users of media shows a lack of a strong systematic difference in household characteristics between using media singly and using media jointly. Land holding of the household surfaces as an important factor indicating that as land holding increases, the probability of using only media decreases in favour of using media jointly. In other words, increase in land holding, an indicator of economic status of a household, leads to an increase in using information from multiple sources represented by using of media jointly rather than from a single source represented by using media only. Although older farmers have a higher probability of using media, they prefer to use it jointly with other sources and not singly.

Overall, use of information is driven more by education and availability of credit than by other factors directly. Caste doesn't appear to be a significant determinant of use directly, but obviously through the caste dynamics that shape different outcomes like education, access to

information and access to credit. This analysis finds evidence to support the existing argument that development of human capital is crucial in processing information and using it for efficiency gains. Proper utilisation requires availability of funds at the farmer's disposal. These are complementary in reaping the benefits of extension and ultimately higher farm returns. Therefore, means to address these weaknesses are important for farmers to successfully use the available stock of information in achieving higher agricultural productivity and profitability. The existing evidence suggests that policies towards information dissemination should be complemented by tools that lead to better infrastructure mainly in education and timely loans to use the information beneficially.

REFERENCES

Ali, J. (2012). Factors affecting the adoption of information and communication technologies (ICTs) for farming decisions. *Journal of agricultural & food information*, *13*(1), 78-96.

Alvarez, J., & Nuthall, P. (2006). Adoption of computer based information systems: The case of dairy farmers in Canterbury, NZ, and Florida, Uruguay. *Computers and Electronics in Agriculture*, *50*(1), 48-60.

Arrow, K. J. (1969). Classificatory notes on the production and transmission of technological knowledge. *The American Economic Review*, 29-35.

Carter, B. R., & Batte, M. T. (1993). Identifying needs and audiences in farm management outreach education. *Review of Agricultural Economics*, *15*(3), 403-415.

Feder, G. (1980). Farm size, risk aversion and the adoption of new technology under uncertainty. *Oxford Economic Papers*, *32*(2), 263-283.

Genius, M., Pantzios, C. J., & Tzouvelekas, V. (2006). Information acquisition and adoption of organic farming practices. *Journal of Agricultural and Resource economics*, 93-113.

Gervais, J. P., & Lambert, R. F. Boutin-Dufrense (2001). On the Demand for Information Services: An Application to Lowbush Blueberry Producers in Eastern Canada. *Canadian Journal of Agricultural Economics*, *49*, 217-232.

GoI (Government of India). 2005a. Situation assessment survey of farmers, 59thRound. National Sample Survey Organization, Ministry of Statistics and Programme Implementation, Government of India, New Delhi.

GoI (Government of India). 2015a. Situation assessment survey of farmers, 70thRound. National Sample Survey Organization, Ministry of Statistics and Programme Implementation, Government of India, New Delhi.

GOI, NSSO (2013), 70th Round, Situation Assessment Survey of Farmers: Some aspects of farming.

Heckman, J. J. (1976). The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models. In *Annals of economic and social measurement, volume 5, number 4* (pp. 475-492). NBER.

Heckman, J. J. (1979). Sample selection as a specification error. *Econometrica*, *47*, 153-161.

Hiebert, L. D. (1974). Risk, learning, and the adoption of fertilizer responsive seed varieties. *American Journal of Agricultural Economics*, *56*(4), 764-768.

Huffman, W. E. (1977). Allocative efficiency: The role of human capital. *The Quarterly Journal of Economics*, 59-79.

Just, D. R., Wolf, S. A., Wu, S., & Zilberman, D. (2005). Consumption of economic information in agriculture. *American Journal of Agricultural Economics*, *84*(1), 39-52.

Just, R. E., & Zilberman, D. (1983). Stochastic structure, farm size and technology adoption in developing agriculture. *Oxford Economic Papers*,*35*(2), 307-328.

Kihlstrom, R. E. (1976). Firm demand for information about price and technology. *Journal of Political Economy*, *84*(6), 1335-1341.

Llewellyn, R. S. (2007). Information quality and effectiveness for more rapid adoption decisions by farmers. *Field Crops Research*, *104*(1-3), 148-156.

Mittal, S., & Mehar, M. (2016). Socio-economic Factors Affecting Adoption of Modern Information and Communication Technology by Farmers in India: Analysis Using Multivariate Probit Model. *The Journal of Agricultural Education and Extension*, *22*(2), 199-212.

Nelson, R. R., & Phelps, E. S. (1966). Investment in humans, technological diffusion, and economic growth. *The American economic review*, *56*(1/2), 69-75.

Ngathou, I. N., Bukenya, J. O., & Chembezi, D. M. (2006). Managing agricultural risk: examining information sources preferred by limited resource farmers. *Journal of extension*, *44*(6), 1-13.

Rahm, M. R., & Huffman, W. E. (1984). The adoption of reduced tillage: the role of human

Schnitkey, G., Batte, M., Jones, E., & Botomogno, J. (1992). Information preferences of Ohio commercial farmers: implications for extension. *American Journal of Agricultural Economics*, *74*(2), 486-496.

Schultz, T. W. (1972). Human capital: Policy issues and research opportunities. In *Economic Research: Retrospect and Prospect, Volume 6, Human Resources* (pp. 1-84). NBER.

Solano, C., León, H., Pérez, E., & Herrero, M. (2003). The role of personal information sources on the decision-making process of Costa Rican dairy farmers. *Agricultural systems*, *76*(1), 3-18.

Tucker, M., & Napier, T. L. (2002). Preferred sources and channels of soil and water conservation information among farmers in three Midwestern US watersheds. *Agriculture, ecosystems & environment*, *92*(2-3), 297-313.

Welch, F. (1970). Education in production. *Journal of political economy*,*78*(1), 35-59.

Wozniak, G. D. (1987). Human capital, information, and the early adoption of new technology. *Journal of Human Resources*, 101-112.

APPENDIX

Table A.1: Coefficients of Poisson Count Regression Estimating Number of Sources Used

Variables	Poisson
Total household land	0.01*** (0.003)
Gross Cropped Area	0.002 (0.0002)
Sex (Base=Female)	-0.0001 (0.022)
Age	0.01*** (0.003)
Square of Age	-0.0001*** (0.00003)
Farmers per households	0.001 (0.005)
Main Source Income (Base= Not Cultivation)	0.04** (0.017)
Social Category (Base=ST)	
SC	-0.03 (0.030)
OBC	0.02 (0.026)
Others	0.05* (0.028)
Education (Base=Illiterate)	
Primary	0.05*** (0.016)
Middle	0.06*** (0.018)
Secondary	0.11*** (0.020)
Above Secondary	0.13*** (0.021)
Crop Insurance (Base=No)	0.09*** (0.028)
MGNREGA (Base= Yes)	-0.01 (0.015)
Bank Density	-0.25 (0.167)
Proportion of Area under irrigation	0.09*** (0.019)
Type of Crops Grown (Base=Non-food crop)	
Food crop	-0.04* (0.024)
Both food and non-food	0.04* (0.021)
Constant	0.20** (0.088)
Agroclimatic Zones FE	Yes
Observations	10,970
Log Pseudolikelihood	-15069.18
Wald chi2(34)	538.26

Source: Computed from NSSO 70th Round, Situation Assessment Survey of Farmers (2012-13)

Note: Village wise clustered standard errors in parentheses (adjusted for 2,799 clusters in village), *** p<0.01, ** p<0.05, * p<0.1

MSE Monographs

* Monograph 34/2015
Farm Production Diversity, Household Dietary Diversity and Women's BMI: A Study of Rural Indian Farm Households
Brinda Viswanathan

* Monograph 35/2016
Valuation of Coastal and Marine Ecosystem Services in India: Macro Assessment
K. S. Kavi Kumar, Lavanya Ravikanth Anneboina, Ramachandra Bhatta, P. Naren, Megha Nath, Abhijit Sharan, Pranab Mukhopadhyay, Santadas Ghosh, Vanessa da Costa and Sulochana Pednekar

* Monograph 36/2017
Underlying Drivers of India's Potential Growth
C.Rangarajan and D.K. Srivastava

* Monograph 37/2018
India: The Need for Good Macro Policies *(4th Dr. Raja J. Chelliah Memorial Lecture)*
Ashok K. Lahiri

* Monograph 38/2018
Finances of Tamil Nadu Government
K R Shanmugam

* Monograph 39/2018
Growth Dynamics of Tamil Nadu Economy
K R Shanmugam

* Monograph 40/2018
Goods and Services Tax: Revenue Implications and RNR for Tamil Nadu
D.K. Srivastava, K.R. Shanmugam

* Monograph 41/2018
Medium Term Macro Econometric Model of the Indian Economy
D.K. Srivastava, K.R. Shanmugam

* Monograph 42/2018
A Macro-Econometric Model of the Indian Economy Based on Quarterly Data
D.K. Srivastava

* Monograph 43/2019
The Evolving GST
Indira Rajaraman

MSE Working Papers
Recent Issues

* Working Paper 264/2024
  Elementary Education Outcome Efficiency of Indian States: A Ray Frontier Approach
  Jyotsna Rosario & K.R Shanmugam
* Working Paper 265/2024
  Are the Responses of Oil Products Prices Asymmetrical to Global Crude Oil Price Shocks? Evidence from India
  Abdhut Deheri & Stefy Carmel
* Working Paper 266/2024
  Drivers and Barriers to the Adoption of Renewable Energy: Investigating with the Ecological Lens
  Salva K K & Zareena Begum Irfan
* Working Paper 267/2024
  A Multi-Criteria Decision-Making Model to Determine the Share of Variable Renewable Energy Sources
  Salva K K & Zareena Begum Irfan
* Working Paper 268/2024
  Determinants of Renewable Energy in Asia: Socio-Economic and Environmental Perspective
  Salva K K & Zareena Begum Irfan
* Working Paper 269/2024
  Adaptive Analysis of 3E Factors (Economy, Energy, and Environment) for Renewable Energy Generation in the South and South-East Asian Region Salva K K & Zareena Begum Irfan
* Working Paper 270/2024
  Detecting and Forecasting Financial Bubbles in The Indian Stock Market Using Machine Learning Models
  Mahalakshmi Manian and Parthajit Kayal
* Working Paper 271/2024
  Is Health Insurance Actuarially Fair? Quantifying Discrepancies in the Indian Health Insurance Sector
  Nikhil Rathee and Rupel Nargunam
* Working Paper 272/2024
  Trade Effects of Eurasian Economic Union and Global Production Sharing: A Gravity Analysis
  Sanjeev Vasudevan and Suresh Babu Manalaya

---

* Working papers are downloadable from MSE website http://www.mse.ac.in