

Determinants of Perceived Crop Yield and Pro-Environmental Social Norms: Role of Agricultural extension Services and New Ecological Paradigm

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The aim of the current research was to analyze the role of “Agricultural extension Services” (AES) and “New Ecological Paradigm” (NEP) in the enhancement of “Perceived Crop Yield” (PCY) and “Pro-Environmental Social Norms” (PESN). The current study analyzed the impact of AES on PCY and PESN along with the mediation of NEP in these relationships. To fulfil the research objectives of the current study, the deductive and quantitative methodological approach was adopted in which the data was collected from 350 farmers of Thailand. The current study was conducted in agricultural sector of Thailand from where the sample was selected through purposive sampling technique. The data collected through questionnaires from farmers was put into analysis through SPSS and AMOS in which the “structural equation modelling” was performed to test the hypotheses. Findings of the current study revealed that AES has a significant positive impact of PCY and PESN. Furthermore, it has been found that NEP plays a significant role of mediator between AES and PCY. The positive significant mediating role of NEP was also found between AES and PESN. The current study has significant implications in theory and practice because literature and practical knowledge in agriculture will be enhance through its findings.

Key words: *Perceived Crop Yield, Pro-Environmental Social Norms, Agricultural extension Services, New Ecological Paradigm.*

Introduction

The growing environmental concerns due to the growing environmental pollution are raising needs for attention of researchers so that the environmental issues can be addressed through proper research and solutions (Kasayanond, Umam, & Jermisittiparsert, 2019; Somjai & Jermisittiparsert, 2019). The industrial revolution and growing depletion of natural resources are two key reasons behind these environmental concerns because modern businesses and industries are expected to influence the natural environment around the world (Sae-Lim & Jermisittiparsert, 2019). To address these environmental concerns, firms need to adapt their behavior and strategies so that they can satisfy these concerns and achieve their business objectives (Prasad, Kumar, & Prasad, 2014; Singh, Pandey, & Singh, 2011). In this modern era with a lot of environmental concerns, the performance of firms is much reliant on the financial as well as environmental performance because the financial performance is not enough to satisfy these concerns (Jermisittiparsert, Siriattakul, & Wattanapongphasuk, 2019; Jermisittiparsert, Siriattakul, & Sangperm, 2019). Firms need to enhance their market and environmental performance through proper strategies and policies. These environmental concerns particularly become more important when they are discussed with respect to agricultural sector because several agricultural activities are linked with environmental pollution therefore, there is need to address these concerns by adopting proper ecological attitude, services, norms and behaviors (Seufert, Ramankutty, & Foley, 2012; Tuomisto, Hodge, Riordan, & Macdonald, 2012).

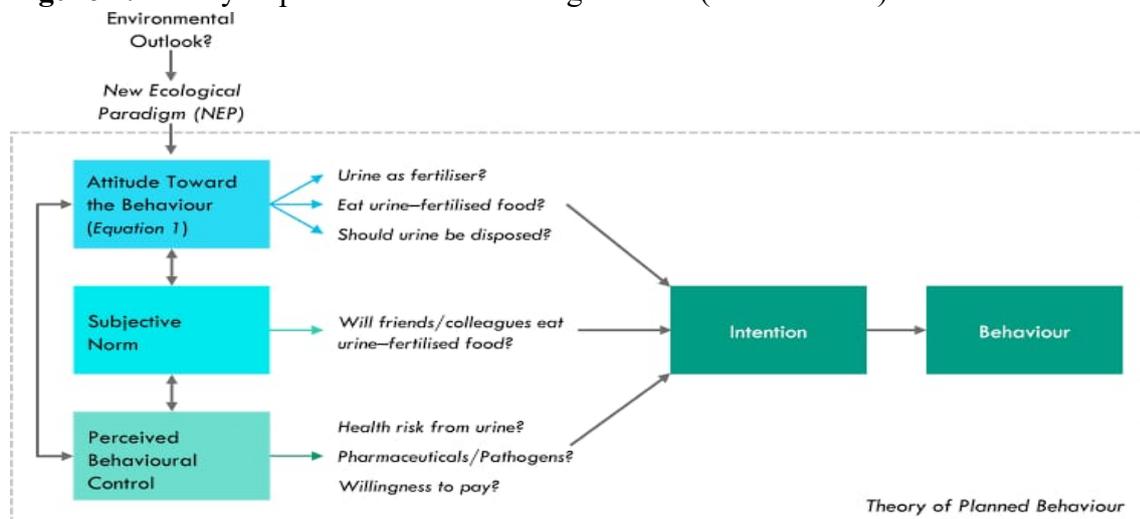
In this regard, the role of “*agricultural extension services*” (AES) is of great importance because AES represents a great application of scientific research and knowledge. AES provides farmers with information inputs required for effective decision-making regarding productivity. The advisory services provided by AES enables farmers to realize the importance of environmental concerns and to find ways to cope with those concerns. Furthermore, AES enhances the ability of firms or farmers to enhance their crop yield by adopting effective techniques and methods. The contribution of AES is not limited to the improved crop yield rather, the environmental performance can also be enhanced in results of the knowledge of AES. Since, the knowledge provided by AES assists farmers to augment their environmental performance as well as crop productivity therefore, AES is regarded as an important element of agriculture in modern era due to the growing environmental concerns (Benin et al., 2011; Dimelu & Anyaiwe, 2011). Given the role of AES in the enhancement of “perceived crop yield” (PCY), the first objective of the current study is to analyze the influence of AES on PCY in the agricultural sector of Thailand.

The agricultural sector of Thailand is an essential contributor to the success and economic development of Thailand because the production of the agricultural sector makes a considerable portion of total Gross Domestic Product (GDP) of Thailand. It is estimated that 10 to 11 percent of total GDP of Thailand is from the agricultural production of the country.

Furthermore, this sector provides employment to a large portion of population therefore, the success or failure of this sector has great significance for the country (Kasem & Thapa, 2012; Riwthong, Schreinemachers, Grovermann, & Berger, 2015). However, the agricultural sector of Thailand has been largely ignored in literature of AES, PCY and “pro-environmental social norms” (PESN). The PESN refers to the standards of social behaviours regarding the environment that occur due to the social moral norms regarding such actions and concerns. However, these PESN are determined by different individual and social factors including belief-based factors. For instance, AES and its advisory services can significantly determine these norms (Chua, Quoquab, Mohammad, & Basiruddin, 2016; Tashakor, 2019). Given the great role of AES in determining the PESN, the second objective of the study is to assess the impact of AES on PESN of farmers of Thailand.

Another important factor playing a role in determining these norms and PCY is “new ecological paradigm” (NEP) which represents the overall belief of the individual about the environment. It is argued by past researchers that NEP can play an important role in enhancing the PESN and PCY because the belief-based factors of NEP can affect the norms and behaviors of farmers so that they direct their behaviors to enhance PCY and PESN (Horlings & Marsden, 2011; Perrea et al., 2014). Figure 1 provides the simplified representation of planned behavior theory.

Figure 1: Theory of planned behavior in Agriculture (Source: SLU)



It can be seen in figure 1, that attitudes, norms, intentions and behavior of individuals are significantly related with each other so it can be argued based on planned behavior theory that NEP and belief-based factors included in it can determine the behavior of farmers through which they can enhance their crop yield (Greaves, Zibarras, & Stride, 2013; Papagiannakis & Lioukas, 2012). Given the importance of NEP between the relationship of AES and PCY, the third objective of the current study is to analyze the mediating role of NEP in the association between AES and PCY of farmers of Thailand. Furthermore, NEP also enhances the PESN because beliefs of individuals always play significant role in disentwining their norms so, the

fourth objective of the current study is to examine the mediating role of NEP between AES and PESN of farmers of Thailand.

The remaining portion of this paper encompasses the review of literature about the current variables and their associations, the methodology adopted in the current study, analysis, discussion of findings and conclusion of this study.

Literature Review

Agriculture Extension Services and Perceived Crop Yield

As per studies by Baloch & Thapa (2018), this study explains the effect of agriculture extension services (AES) on the perceived crop yield (PCY) while data analysis of this study depends on the data collection from the farmers who work for the better growth of the crops and who somehow have more knowledge about agriculture, farming, fertile lands, crops cultivations and crops production. Due to their experience and know-how they are largely being considered as the experts of farming and agriculture. Much research in this field is conducted by those researchers who can easily get acquainted with farmers, stakeholders, cultivators as well as producers. However, as a result, there can be many loopholes found through the collection of data that focuses on the knowledge and experience of farmers' only. However, according to other studies (Baloch & Thapa, 2018) agriculture extension services are provided by the government to the land owners to promote agricultural production by disseminating proper knowledge and latest technologies to the farmers.

The agricultural extension (AE) department deals with the efficiency and effectiveness of farmers in this field while, they also deal with increasing perceived crop yield by providing different extension services to the agriculture management team. AE department also focuses on the agricultural policies and reforms which provide better extension services along with facilities to promote the growth and production rate of the crops at the same time. The knowledge, technology and information provided by extension officials or the department are quite informative and helps in increasing crop yield, but the gap that has to be filled, is that many farmers are illiterate and they are majorly unaware of these techniques and methods, because of which crop yield faces a downfall in growth and production or both. Nevertheless, in recent literature studies (Feliciano, Nayak, Vetter, & Hillier, 2017), value-belief-norm theory specifies different approaches and strategies regarding agricultural production and yield growth which may help in future studies, so that researchers can extract empirical evidence and theoretical based analysis from it. Value or ecological orientation helps in the formation of ecological economies which further portrays the concept of green supply chain, green consumer behavior, and green agrochemical function. These green supply chains produce a positive impact of AES on PCY for better yearly growth. Agriculture extension is a huge field of education that invites people like agriculture marketing-based managers, employees, agriculture researchers, health care and business studies management team from different

disciplines moreover from rural and urban areas in order to promote agriculture extension services along with ecological economies AES and PCY. However, many researchers (Nijbroek & Andelman, 2016) believe that farmers in this area of study have very poor access to extension services due to a collective effect of several generating factors. Thus, the following hypothesis is proposed that:

H1: AES has a significant impact on PCY.

Agriculture Extension Services and Pro-Environmental Social Norm

Dawson et al. (2017) explains the farmers' pro-environmental behavior towards crop cultivation and agriculture production. This study suggests that AES has a belief that agricultural sustainable practices can only be applied on the ecological environment with the help of pro-environmental social norms which can further be promoted through theoretical application of VBN theory, which has the potential to promote food security, increase yearly crop yield and furthermore address environmental as well as cultivation issues. Theory (Garbaccio, Chagas, & de Paula Dias, 2017) also develops a concept of generating socio-psychological behavior of farmers with respect to sustainable practices. Another theory by Ladeira Garbaccio, Chagas, & de Paula Dias (2017) may be used by researchers to analyze the intentions and motivation of farmers through decomposed theory of planned behavior. Intentions and social norms of farmers and other people who are working in this field can only be carried further if there are various opportunities available that will perhaps positively affect the normative issues of environment at social and practical level. Studies (Ladeira Garbaccio et al., 2017) propose a design that AES positively influence pro-environmental socio norms under the circumstances of perceived social capital, and perceived ease of operation that has a significant effect on training, social capital, intention, motivation and perceived resources. However, there are various factors that drive pro-environmental socio norms along with values and beliefs to play a mediating role between the relationships of social capital norms, personal efficacy, training and perceived usefulness which will directly lead to the improvement in farm productivity, crop yield and social behavior of farmers. Environmental and social behavior also leads the consumer attention towards the ethical behavior in relation with AES promotion. Though, as a matter of fact, it is the function of AES (Man, 2017) to promote environment significant behavior with the help of PESN which acts as a turning point in the improvement of measures related to environment and social norms. Thus, the following hypothesis is proposed that:

H2: AES has a significant impact on pro-environmental socio norms

Role of New Ecological Paradigm between Agriculture Extension Services and Perceived Crop Yield

Recent studies (Klain, Olmsted, Chan, & Satterfield, 2017) propose the relationship between AES and PCY, whereas, new ecological paradigm acts as a source of a mediator between these two variables. The paradigm shows a positive relationship between AES and PCY due to continuous value orientation and NEP and PPN interaction. As mentioned in different studies (Choi, Jang, & Kandampully, 2015) VBN theory focuses on the relation between NEP and PPN which measures the level of relationship between human and environment. New ecological paradigm NEP is considered as equally prominent, and is referred to as characterizations of beliefs that are often used to help explain further pro-environmental behavior. NEP has a significant impact on AES and PCY through relational value which helps in developing the link between values of people and ecosystem via tangible and intangible relationship with nature. NEP associates itself with the principles, virtues, and notions of a good life related to pro-environmental factors. Empirical evidences of various studies (Rubin, White, Lee, & Basile, 2016) depict that people hold both instrumental and intrinsic values within the burgeoning field of ecosystem services including extension services which are long associated with a purely instrumental perspective. AES is globally recognized with the Millennium Ecosystem Assessment (MEA) that defines the concepts of sustainability of environment and ecological cultural values. There is an increasing influence on agrochemical values which cause environmental and health risks to the society. Three values orientations (Calic & Mosakowski, 2016) are biosphere, altruistic and egoistic values and these focus on the approaches related to social orientation which predicts the ability of value orientation. Furthermore, NEP has a positive impact on ASE and PCY ability, orientation and concerning values. Thus, the following hypothesis is proposed that:

H3: NEP has a significant mediating role between AES and PCY

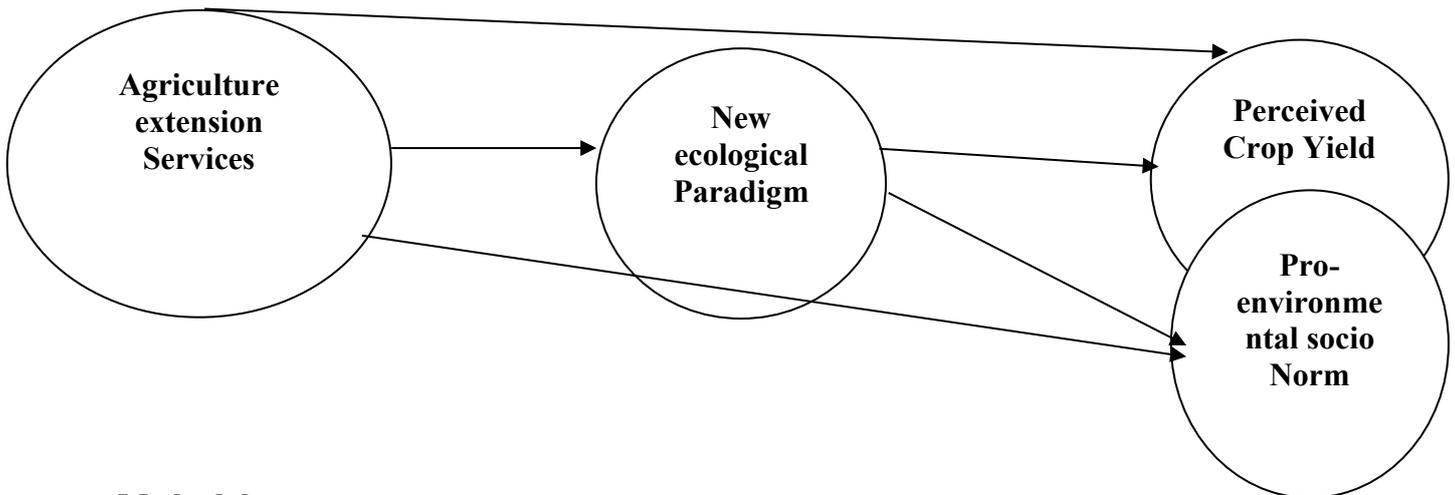
Role of New Ecological paradigm between Agriculture Extension Services and Pro-Environmental Social Norm

Recent studies by Franco (2018) analyzed a model of environment significant behavior that are mainly divided into pro-social and rational streams. The study by Bolderdijk, Lehman, & Geller (2018) portrayed the evaluation of influence on NEP that acts as a mediator between AES and PESN. NEP depends on the tangible and intangible elements that realize the actual value of sociological and psychological factors on human behavior that derive human from a better environment. VBN theory is considered as reforms of the moral behavior and obligation to protect the environment in the light of NEP that acts as a predictor as the function of NEP correspond with the function of PPN in the ecological environment. There were past studies (Blok, Wesselink, Studynka, & Kemp, 2015) that were only conducted to figure out the effect

of ascription of responsibility on pro-environmental personal and social norms, during which underpinning of theoretical based analyses consisted of AES and NEP rationales along with its significant theories based modules. NEP is distinguished into descriptive norms and subjective norms to play a significant role of a mediator between AES and PESN to display humanity's relationship with the environment and worldwide view in which general belief of individuals are adopted to gain better future objectives as well as goals. According to literature of the study (Pothisou, Hanna, & Chalvatzis, 2016), NEP has always played a positive role in developing a relationship between environment, human behavior, ecological paradigm, and also considers the state of balance between humans and the environment. However, NEP is presented as an extended scale of new environmental paradigm due to which objectives of NEP along with AES and PCY has to be revised and crossed check because of the change in environment, human behavior and human exemptionalism. Thus, the following hypothesis is proposed that:

H4: NEP has a significant mediating role/impact between AES and PESN.

Model:



Methodology

Population and Sampling

This study discusses the importance of role of agriculture extension services and new ecological paradigm in determining perceived crop yield and pro-environmental social norms. New ecological paradigm is necessary to develop the environmental social values in farmers so that they contribute toward environment friendly production and solve all the environment matters effectively. In this study, farmers of Thailand have been selected in order to study how environment education helps the farmers to enhance crop yields and develop environment social values which ultimately yield profit. As far as sampling is concerned, the researcher selected farmers as respondent because farming training can lead to desired outcomes and for this purpose the researcher used purposive sampling technique. Selecting the accurate sample

size is the main issue. As the researcher used SEM analysis approach, the sample size should be large as elaborated by Hazen et al. (2015). Sample size has been raised on the bases of idea presented by Klein (2015) which states that formula number of items*10 provides actual sample size. So, in this study sample size was 350 respondents among whom the questionnaire was distributed, out of which 330 responses were collected and after deletion of invalid responses, 320 responses were considered valid.

Data Collection and Procedure

For collecting primary data from respondent, data collection method used was questionnaire. This method has been considered best suitable because numeric data can easily be statistically analyzed. In this study, a structured questionnaire has been used which composed of closed ended questions which farmers could easily be respond. The procedure used by the researcher to administer the questionnaire was self-administered method due to the low literacy of farmers. This method allowed farmers queries to be solved. Online questionnaire method was not used as farmers did not have the facility of online service.

Validity, Reliability and Common Bias

In the present study, the researcher has assessed the validity and reliability through AMOS and SPSS respectively. Reliability has been examined by the criteria which elaborate that Cronbach's α larger than 0.7 (Chin,1998). Different criteria have been examined for assessing the convergent and discriminant validity. For convergent validity, three criteria have been examined (1) items loading larger than 0.70 and statistical significance (2) composite construct validity larger than 0.80 and (3) average variance extracted larger than 0.50. On the other hand, discriminant validity between constructs has been examined by using the criteria which elaborate that square root of AVE must larger than all other constructs.

Common bias method has been examined when respondents used same method to measure exploratory and dependable variables, which has been prescribed by common rater (Donaldson & Grant-Vallone, 2002; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) for the variables of this study. The set of variables used in this study are agriculture extension services, new ecological paradigm, environmental social norms and crop yield. Harman's single factor test has been used in order to ensure inexistence of risk of common bias. This test has been examined in order to check whether all constructs were accounted for by a single factor. Outcome reports all constructs were accounted for by different factor. 97% of variance accounted for by factor solution and 12% of variance accounted for by single factor.

Measures of Variables

A self-administrated questionnaire scale for the measurement of constructs was used in the study. The following study adopts the measurement of every variable from reliable and published resources. The scale of agricultural extension service was adopted from different studies (Aker, 2011; Benjamin, 2014), and it has 10 items in this study. The scale of the new ecological paradigm was adopted from the study of Chua et al. (2016) and it has 14 items. Furthermore, the scale for pro-environmental social norm was also adopted from this study and it contains 7 items. The scale of perceived crop yield was adopted from the study of Okada, Styles, & Grismer (2008) and it has 4 items.

Hypothesis Testing

Hypothesis testing has been examined statistically with structure equation modelling which runs on AMOS. Path analysis has been conducted under SEM analysis approach in order to test the hypotheses such as crop yield, environmental social norms, new ecological paradigm and agriculture extension services. Path analysis has been done in two steps, first step was to examine the standardized path in structure model and second step was to examine the significance of influenced path. This has been done to find out whether the structure model is acceptable or not acceptable.

Empirical Results

The researcher applied the frequency distribution test in order to check the respondents' profile. The finding shows that 171 males and 150 females participated in this study. Most respondents have graduation degree: 101 respondents have a Masters' degree; 48 respondents have a graduation degree; and 29 respondents have another degree. The respondents who participated in this study are mostly young and their age lies between 30 to 40 years whereas 101 respondents have age ranging from 21 to 30 years and only 15 respondents have age more than 40 years.

Reliability test

To check the reliability of the data, the Cronbach Alpha test was applied in order to investigate the factor loading of each construct. Following table presents the outcome of Cronbach Alpha test.

Table 1: Reliability Test

Variable	No of items	Cronbach Alpha
PES	7	0.913
NEP	14	0.921
PEY	4	0.932
AES	10	0.942

In the above-mentioned table, the Cronbach Alpha value for agricultural Extension Service is .942, for PES, NEP, and PEY is .921, .932, and .943 respectively. Hence, the value of each variable is greater than .70.

Convergent and Discriminant Validity

Validity master sheet was used to confirm the convergent and discriminant validity of the research model variables. Discriminant validity provides the discrimination between variables while convergent validity was measured with the help of composite reliability and average variance extracted. Following are the results of both validities.

Table 2: Convergent and Discriminant Validity

	CR	AVE	MSV	PES	NEP	PEY	AES
PES	0.916	0.854	0.189	0.924			
NEP	0.901	0.886	0.243	0.404	0.941		
PEY	0.935	0.907	0.243	0.361	0.493	0.953	
AES	0.940	0.912	0.233	0.435	0.359	0.483	0.955

In table 2, results of convergent and discriminant validity show that the overall model is a good fit because the composite reliability of each variable is more than 70% and average variance extracted is more than 50% whereas discriminant validity shows that loading of each variable discriminates from others. Every variable has maximum loading for itself as compared to others, so these validities prove the authenticity of collected data.

Confirmatory Factor Analysis

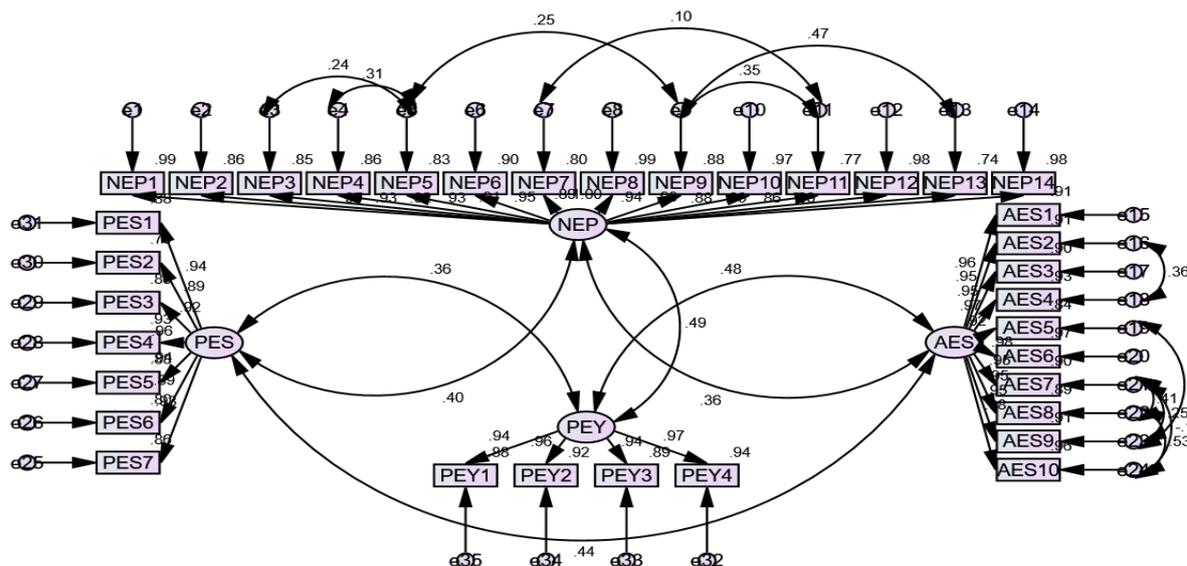
Confirmatory factor analysis is a test which is used to confirm the fitness of hypothetical model before structural equation modelling. Different measures are used to confirm the fitness of the model. The following table presents each indicator and its observed value for the current study.

Table 3: CFA

Indicators	Threshold range	Observed value
CMIN/DF	>3	2.891
GFI	<0.80	.800
IFI	<0.80	.932
CFI	<.080	.932
RMSEA	>.08	.080

All the indicators of model fitness are showing that all observed values are within the acceptable range limit. For example, the value of CMIN/DF is 2.891, which is less than 3. The value of GFI is 0.80 is greater than 0.932. Similarly, the value of CFI and IFI is greater than 0.932 and the last but not the least indicator which is RMSEA has value less than .08. Hence, these indicators prove that model is a good fit. The following figure is the Screenshot of CFA.

Figure 2. CFA



Structural Equation Modelling

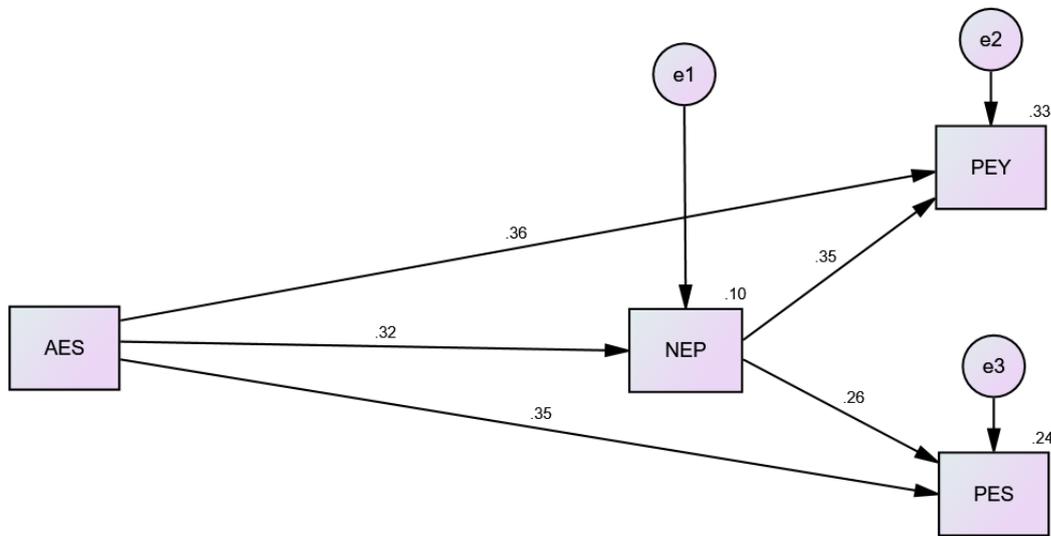
Structural equation modelling is a multivariate regression analysis which is used mostly in primary data to confirm the hypotheses of the study at the same time. SEM provides the facility of direct regression test and indirect regression test in a single structural model. The following table shows the results of structural equation modelling.

Table 4: SEM

Total Effect	AES	NEP
NEP	.323***	.000
PEY	.469***	.353**
PES	.429***	.258**
Direct Effect	AES	NEP
NEP	.323***	.000
PEY	.355***	.353***
PES	.345***	.258**
Indirect Effect	AES	NEP
NEP	.000	.000
PEY	.114*	.000
PES	.083*	.000

Above mentioned table presents the results of structural equation modelling for the current study. The results indicated that Agricultural Extension Service has a positive and significant impact on perceived crop yield because this effect is 36% which means that an increment of one unit in Agricultural Extension Service will lead to 36% positive change in perceived crop yield. The results also indicated that the direct effect of Agriculture Extension Service on pro-environmental social norms is 35%. New ecological paradigms were regarded as a mediator in the current study and the results showed that they significantly mediated the relationship. It has a direct impact on perceived crop yield of 35% and a direct impact of 26% on pro-environmental social norms. Furthermore, findings are also showing that the indirect effect of perceived Agricultural Extension Service on perceived crop yield is 11% and on pro-environmental social norms is 8%. So, overall results indicated that all the hypotheses of this study are accepted. Following picture presents the SEM.

Figure 3. SEM



Discussion and conclusion

Discussion

The aim of this research was to explore the impact of agricultural extension services on perceived crop yield and pro-environmental social norm, this study also aimed to know the mediating role of new ecological paradigm between agricultural extension services and perceived crop yield and between agricultural extension services and pro-environmental social norm (Pornpratansombat, Bauer, & Boland, 2011). The first hypothesis proposed in the study was that “agricultural extension services (AES) have a significant impact on perceived crop yield (PCY)”, this hypothesis is true, and it is accepted that AES impacts PCY positively. Carlos L. Ballare in a research article proved that AES improves agricultural efficiency, that is why the PCY increase by applying the techniques learned from AES (Amburgey & Thoman, 2012). The second hypothesis proposed was that “agricultural extension services have a significant impact on pro-environmental social norm” this hypothesis is accepted. Jorge J. Casal in a study concluded that AES has a positive impact on the pro-environmental social norm and it increases with an increase in AES, this is proved by the current study as well (Nguyen, Nguyen, Lippe, & Grote, 2017). The third hypothesis proposed was that, “New ecological paradigm (NEP) has a significant mediating role between agricultural extension services and perceived crop yield”, this hypothesis is accepted with the logic from the study of JG Kelly that ecological paradigm is a scale for ecological and environmental concerns and

according to it, PCY increases with the increase in AES activities so it positively mediated between AES and PCY (Amburgey & Thoman, 2012). When AES will cast an impact on NEP then NEP will cast an impact on PCY that will increase the perceived crop yield. The fourth proposed hypothesis in the study was that “New ecological paradigm has a significant mediating role between Agricultural extension services and pro-environmental social norm (PSM)”, this hypothesis is accepted, and it is concluded from the study of S. Nanos that NEP mediates positively between AES and PCY as normally it is expected to keep a balance between costs and benefits, likewise, it is important to keep a balance between the efforts that the farming sector puts in and the yield that comes out (Hanboonsong, Jamjanya, & Durst, 2013).

Conclusion

This study was conducted in order to know about the relationship between AES and PCY. This study took NEP as a mediator between AES and PCY and between AES and PSM. This study was conducted in Thailand. Three hundred farmers from the agricultural sector of Thailand were taken as a sample and that sample was asked questions and questionnaires were filled. This data was then subjected to various testing techniques and measures and with the help of those techniques, the concluded results were that AES impacts PCY and PSM positively. NEP positively mediates between AES and PCY and between AES and PSM.

Implications of the study

This study has increased the data about the impact of AES on PCY and PSM in the literature. This study has also taken a very naive mediator “NEP” between AES and PCY and between AES and PSM and this way a good contribution in literature is made as almost no one took it as a mediator before. This study can be implemented in the policymaking process to gain maximum yield by spending the lowest on agriculture by using efficiency techniques. The agricultural sector can practically implement AES with the farmers and their farming by keeping the norms into account and by keeping the new ecological paradigm scale on the table to equally contribute to the environment and agricultural sector.

Limitations and future research indications

This study was conducted in Thailand only, and because this problem of the agricultural sector is global, this study should be conducted outside of Thailand as well to look at the same variables in a different setup. This study targeted PSM and PCY only whereas, the hurdles to high yield can also be considered to know about the constraints in the agricultural sector and to make policies for the ease of farmers by knowing their viewpoint and by predetermining the plans and quantity of resources that are ideal for an ideal yield. Future researchers are

encouraged to conduct surveys on larger samples and then conclude results on similar variables.

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