A Framework for Understanding Agribusiness Stakeholders Decision-Making Dynamics in the Pesticide Industry of Pakistan

Muhammad Imran, Ayesha Nida, and Fred A. Yamoah

1 Introduction

The overall population of the world is estimated to rise to 9 billion by 2050 (Gerland et al., 2014). To oblige this expansion in world population, food production will essentially have to rise too. In any case, new cultivate-able land is restricted, so sustainable production and increasing productivity of existing cultivated land is a significant angle to address

M. Imran
School of Business Management, Kedah, Malaysia

A. Nida
Institute of Business Management and Administrative Sciences, The Islamic University of Bahawalpur, Bahawalpur, Pakistan

F. A. Yamoah (✉)
Department of Management, School of Business, Economics and Informatics, Birkbeck, University of London, London, UK
e-mail: f.yamoah@bbk.ac.uk

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global food security (Popp et al., 2013). Most agricultural products depend on the utilization of chemicals to keep up high crop yields. The utilization of these chemicals in current agrarian practices is seen as a fundamental part of the rise of the agricultural industry. Be that as it may, a large portion of the pesticides applied to cultivated lands may affect non-target organisms and taint soil and water resources (Damalas & Eleftherohorinos, 2011). Lately, there has been an expanding worry that pesticides comprise a risk to the general public through deposits in the food supply. There is a need to decide the degree of the genuine issue concerning the utilization of pesticides. Pesticides are chemical substances used to terminate animals, herbs, insects, and pests in agricultural, household, and industrial setting. The primary groups of ordinarily used pesticides comprise herbicides (used to terminate herbs/plants), insecticides (used to kill insects), fungicides (used to kill fungus), fumigants, and rodenticides (Xu et al., 2018). In particular, the use of protective measures for pesticides (PPBs), enforced by WPS—including long-sleeved shirts, long trousers closed footwear, tidy work clothing, and soap cleaning—could reduce exposure to agricultural pesticides and potentially minimize adverse health outcomes (Curwin et al., 2003; Ekqvist et al., 2019). Unsafe pesticide usage relates to increased hazards to human health, whereas pesticide safety and adequate hygiene procedures are desirable safety behaviors that can lower these risks (Hashemi et al., 2012; Fan et al., 2015). Several studies, however, have demonstrated that, despite clear awareness of the negative effects of pesticides (Abdollahzadeh et al., 2016), farmers fail to use precautionary measures to reduce the occurrence of poisoning (Hashemi et al., 2012). Organochlorine, organophosphate, and carbamate insecticides are of leading interest because of their toxicity and persistence in the ecosystem. Organochlorine insecticides are banned for agricultural and domestic use in most of the developed countries, but they are still used in some non-western developing countries. Most of the pesticides are broad-spectrum and kill both target and non-target objects (Ekqvist et al., 2019).

This research will answer the following questions:

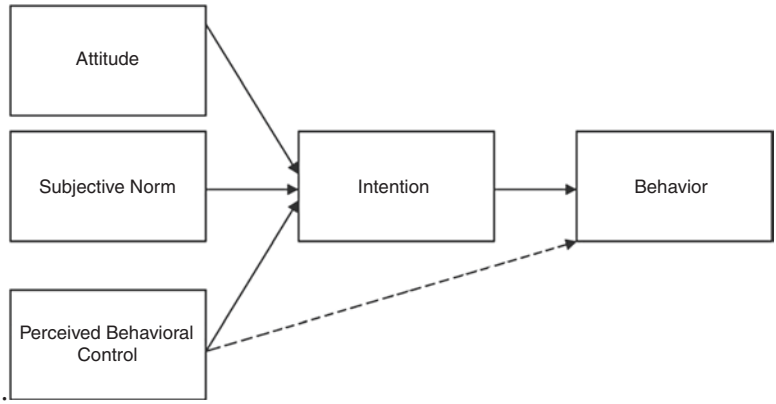
(i) Does the knowledge of pesticide use influence the protective behavior concerning pesticide use?
(ii) Does the intention to reduce pesticide use influence the protective behavior concerning pesticide use?
(iii) Does the past health experience with pesticide influence the protective behavior concerning pesticide use?
(iv) Does the attitude toward pesticides use mediates the relationship between knowledge of pesticide use and protective behavior concerning pesticide use?
(v) Does the attitude toward pesticides use mediates the relationship between intention to reduce pesticide use and protective behavior concerning pesticide use?
(vi) Does the attitude toward pesticides use mediates the relationship between past health experience with pesticide and protective behavior concerning pesticide use?

2 Literature Review and Hypotheses Development

Theory of Planned Behavior

To better understand why people do what they do, it has always been a matter of importance to identify the variables that influence behavior. Theory of reasoned action (TRA) attempts to understand and explain how various influences, such as motivation, work together to bring about a particular action behavior. Theory of reasoned action (TRA) was first proposed by Jacob and Fishbein in 1975 and lately upgraded by Jacob in 1985 to the theory of planned behavior (TPB). The theory of planned behavior (TPB), as depicted in Fig. 1, is an augmentation of the TRA model that includes a new construct called "perceived behavioural control," which measures how much an individual believes their behavior is

within their volitional control (Ajzen, 1991). Due to the inclusion of perceived behavior control (PBC), TPB is regarded one of the most predictive models of consumer behavior (Maichum et al., 2016)



According to the TBP model, an individual's behavior is governed by his or her intention to engage in that behavior, and three key conceptually independent factors, attitudes, subjective norms, and perceived behavioral control (PBC), can predict a person's behavioral intention (BI) (Ajzen, 2006a). Behavioral belief influences attitude toward behavior, whereas normative beliefs impact perceived subjective standards, according to the idea. The PBC is influenced by control beliefs (Ajzen, 2006b; Davis et al., 2002).

Pesticides

Pesticides are the things that have been categorized for their tremendous assistance in pest management. They are useful tools for agricultural creation, so they have been incorporated into the growing process to prevent infestations create crop issues, as well as shield crops from losses, both in terms of food and decreased yield (Damalas, 2009). They play a critical role in the demand for food caused by vector-borne diseases, alongside assorted other options (Cooper & Dobson, 2007).

Farmers Attitude Toward Pesticide Use

Research has shown that agricultural farmers in developing nations often fail to meet best practices when it comes to handling pesticides (Ntow et al., 2006; Wumbei et al., 2019). Acute as well as chronic health effects can be caused by pesticide exposure.

One of the various factors which contribute to enormous growth in agricultural production is the use of pesticides. Pesticides are important inputs of modern agricultural production and because they are highly capable of protecting crops from pesticides and guarantee high crop yields (Ahmed et al., 2011; Cooper & Dobson, 2007). About 25 million farmers and farm workers suffer from poisoning, and three million farmers and farm workers suffer from severe pesticide poisoning every year, resulting in approximately 180,000 deaths among rural workers in developing countries every year (Hashemi et al., 2014).

Protective Behavior Concerning Pesticide Use

Human behavior reflects either the action or reaction of an individual to external or internal sources of stimulation. Behavior can be traced to innate characteristics and imposed influences and learned patterns. Survival behavior is inborn and reflected in the nervous systems. By the way, this kind of behavior is linked to various species. Contrarily, learned behavior is molded by the exposure to and practice and alterations in the individual (Zinn & Skorupa, 2015).

Knowledge of Pesticide Use

Knowledge can influence performance, but it is not the only variable. The reason for this is that people differ in their levels of knowledge. It is determined by their understanding. To be able to adopt new technology, system behavior, or practices, consumers must have a working knowledge of the current market.

Attitude Toward Pesticide Use

There are various attitudes placed on different aspects of the concept of importance. According to Eagly and Chaiken (1993), attitudes are expressions of the psychological tendency to evaluate something either positively or negatively. Consider this description: "This example emphasizes all three aspects of attitudes being the same, as a tendency, is about an entity, and can also be described as how an attitude is focused" (Eagly & Chaiken, 2007). Attitudinal objects can be objects, moods, people, or feelings. Attitudes are not to be considered feelings, as well (Albarracin & Shavitt, 2018). Personal protective equipment reduces exposure to dermally, by wearing gloves, long sleeves, and eye wear by using goggles. That makes it less likely you can inhale or swallow pesticide residues, which can cause serious poisoning. (Dobbs & Pretty, 2004).

Past Health Experience with Pesticides

One learns more from his own experience than from getting all the correct answers, the way different types of information about the same piece of information can impart (Nisbett & Ross, 1980). Even if the factual content is constant, people's experiences may alter new facts, systems, procedures, or practices. Psychological research suggests that individuals act by how they experienced their emotional discomfort (Gilbert et al., 1998). Each individual's behavior about something is affected by reference to their past personal experience.

Intention on Pesticide Use

Researchers have indicated that behavioral intentions are the immediate determinant of behavior, and many have used intentions as a proxy for actual behaviors (Ajzen, 1985). Erickson and Johansson (1985) stated that behavioral intention refers to the motivational components that determine a specific behavior. The stronger the intention to adopt the behavior, the more likely the behavior would be adopted.

Knowledge of Pesticides Use Toward Protective Behavior Concerning Pesticides Use

Knowledge has in particular concentrated on pro-environmental and health behavior concepts and environment-mindedness (Arcury, 1990). Studies on the effect of information on health behavior (Jensen, 2002) and its connection to health have instead looked at the influence of health knowledge on students' food and nutrition beliefs (Bettinghaus, 1986). Behavioral intentionality, as a result of these attitudes, influences (Ajzen & Fishbein, 1975). Knowledge of pesticide use significantly influences the farmer's protective behavior (Akter et al., 2018). Motivating from it, the scholar proposed the following hypothesis:

H1: There is a significant impact of knowledge about pesticides on farmers' protective behavior concerning pesticides use.

Intention to Reduce Pesticides Use Toward Protective Behavior Concerning Pesticides Use

Designed according to the TPB (Ajzen, 1985), intention is the major influencing factor in physical activity and behavior. It is believed that attitude, an objective norm, and PBC affect physical activity by influencing intentions. Perceived behavioral control is a significant factor in an increase or decrease in behavior. Knowledge about an object or a fact that either came from past personal perception or experience or the experience from anyone else can be a contributor to an intention toward behavior (Ajzen, 1991). Motivating from this, the following hypotheses is developed.

H2: There is a significant impact of intention to reduce pesticide use on farmers' protective behavior concerning pesticides use.

Past Health Experience with Pesticides Toward Protective Behavior Concerning Pesticides Use

People value their personal experiences greatly. An increasing body of evidence suggests that an individual's own experience is essential, but facts often get lost in the process of finding out more (Fox & Hadar, 2006; Newell & Rakow, 2007). Studies (Skogan, 1987; Small & Simonsohn, 2008) have found that the personal experience includes affective information as well as information about how one was accosted, but not whether it was accurate or not. Experience with pesticides regarding their health influences them to adopt protective behavior (Akter et al., 2018). Based on these arguments, the following hypothesis is developed.

H3: There is a significant impact of past health experience with pesticides on farmers' protective behavior concerning pesticides use.

Mediating Effect of Attitude Toward Pesticides Use on the Relationship Between Knowledge of Pesticides and Farmers' Protective Behavior Concerning Pesticides Use

Attitudes can be categorized as effects, thoughts, and actions. Cognitive, affective, and behavioral views of attitudes as being causal (Haddock & Zanna, 1993), for example, perceived messages or advertisements can lead to behavioral changes (i.e., values, beliefs, perceptions, emotions, actions, opinions, characteristics, abilities, interests, purposes, etc.) and that they ascribe to that entity or trait have been revealed in many analyses, it has nonetheless received many accolades. These three concepts are inseparable (Eagly & Chaiken, 1993). Attitudes do not always need to be formed or expressed through cognitive, affective, and behavior processes. Attitudes focus on how a consumer feels about the products, rather than

on how they think or know. According to Akter et al. (2018), attitude toward pesticide use has a significant and positive impact on farmers' protective behavior to use pesticides. Based on prior literature, the researcher proposed the following hypothesis.

H4: Attitude toward pesticide use significantly mediates the relationship between knowledge of pesticides and farmers' protective behavior concerning pesticides use.

Mediating Effect Attitude Toward Pesticides Use on the Relationship between Intention to Reduce Pesticides Use and Farmers' Protective Behavior Concerning Pesticides Use

The TPB is a famous news behavioral model that attempts to explain variation in regardless had some success (Ajzen, 1991; Rosenfeld et al., 2006). According to TPB, an individual's attitude toward a specific object determines their behavior, so the intention is seen as the outcome of the attitude that is the most distal predictor of behavior (Arvola et al., 2008). TPB has been used in the sense of pro-environmental practices widely and effectively (Yazdanpanah & Forouzani, 2015; Yazdanpanah et al., 2014). So, there can be an argument that the theory supports the linkage of attitude toward pesticides to use pesticides.

H5: Attitude toward pesticides significantly mediates the relationship between intention to reduce pesticide use and farmers' behavior protective behavior concerning pesticides use.

Mediating Role of the Attitude Toward Pesticides on the Relationship Between Past Health Experience with Pesticide and Farmers' Protective Behavior Concerning Pesticide Use

The theory of reasoned action (TRA) was extended to create TPB (Jafarabadi et al., 2017). TRA is a social psychological model that argues that an individual's actual conduct in performing a specific action is directly influenced by his or her behavioral purpose, which is in turn influenced by experience, subjective norms, and attitude toward the behavior (Ajzen & Fishbein, 1975). Experience with a series of practices may affect potential actions with those procedures. The theory of reasoned action (TRA) was extended to create TPB (Jafarabadi et al., 2017). Experience with a series of practices may affect potential actions with those procedures.

H6: Attitude toward pesticide use significantly mediates the relationship between personal experience with pesticide and farmers' protective behavior concerning pesticides use.

Research Framework

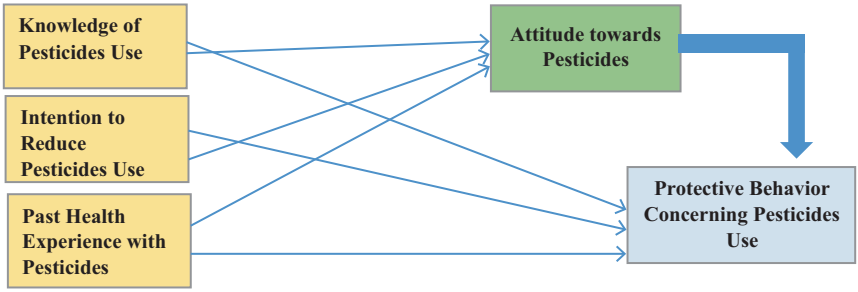


Fig. 1 Research model of knowledge of pesticides use, intention to reduce pesticides use, past health experience with pesticides and protective behavior concerning pesticides use with a mediating role of the top attitude toward pesticides use

3 Research Methodology

A research methodology is a systematic process that is adopted to find the answer to specific research questions which are developed to conduct research. According to Collis and Hussey (2009), there are different stages in research methodology that are employed to analyze the viability of the research problem in a specific study. In some cases, there are various ways to answer the specific question or achieve the specific research objectives. The present study looks into the impact of knowledge of pesticide use, attitude toward pesticides, and personal experience with pesticide on the protective behavior of farmers through the mediating effect of intention to use pesticides. The researcher makes deliberate choices in research methodology, to differentiate the study from similar researches that are conducted on relevant topics. The present chapter aims to attain the research objective by using the different scientific methods and approaches that are deliberately chosen for this study. Moreover, a brief explanation is given in this chapter. The current research is grounded in the theory of planned behavior, responses are based on the farmers' perception and are likely to be collected and measured objectively rather than subjectively.

To collect the data on all the identified variables, the researcher designed a structured questionnaire which comprises three different sections. The first section of the questionnaire is dedicated to inquiring about the personal information (demographics) of the respondents (e.g., gender, age, cultivation type, experience, etc.). The second section is dedicated to measuring all the independent variables (e.g., knowledge of pesticide use, attitude toward pesticides, and personal experience with pesticide) and mediating variable (intention to use pesticides). The third section of the questionnaire inquiries about the protective behavior of the farmers concerning pesticide use. The present research uses the snowball sampling technique to collect the data from respondents. Snowball sampling is a type of non-probability sampling in which data is collected on a referral basis. The target population of the study is fruit and vegetable farmers in South Punjab, Pakistan. According to Saunders et al. (2007), data collected through the quantitative survey is easy to handle, compare, and analyze. The structured adapted questionnaire helps the researchers to record the right and valuable responses of employees, closer to the context of the research topic. The deductive

approach and quantitative measures for data are helpful for data handling, analyzing, and concluding. This study research uses the quantitative approach as the responses are collected through the structured close-ended questionnaire (i.e., 5-point Likert scale ranging from "strongly disagree" to "strongly agree").

4 Data Analysis

The main objective of the present research study is to understand and empirically examine the impact of knowledge of pesticide use, attitude toward pesticides, and past health experience with pesticides on protective behavior concerning pesticides use among the vegetables and fruit farmers of South Punjab, Pakistan. Data was collected and analyzed with a statistical package of social sciences (SPSS 20.0) to calculate Cronbach alpha. It can provide information about the model and the relative contribution of each of the independent variables that make up the model. KMO and Bartlett's test, correlations (bivariate correlation measures the association between two continuous variables without establishing directional causality), regression analysis (it describes the relationship between one or more predictor variable and response variable), and describe statistic (it describes a set of data with a measure of central tendency and measure of dispersion).

Reliability Analysis

Reliability of the construct of all the variables is ensured by the Cronbach's alpha test. In the present study, internal reliability is assessed by Cronbach's alpha. Composite Cronbach's alpha of the construct knowledge of pesticide use is 0.803, attitude toward pesticides is 0.623, past health experience is 0.662, intention to use pesticides is 0.792, and for protective behavior concerning pesticides, it is 0.681. Cronbach's alpha value for all the constructs is better than the recommended value of 0.50 by Mohajan (2017). Thus, the values of Cronbach's alpha test indicate that all the items of this construct are reliable, and further tests can be run with confidence. Table 1 shows this:

Table 1 Reliability of measurement scales

Variable	No. of items	Cronbach's alpha
Knowledge of pesticide use	10	0.803
Attitude toward pesticides	5	0.623
Past health experience	4	0.662
Intention to use pesticides	4	0.792
Protective behavior concerning pesticides	3	0.681

Table 2 KMO and Bartlett's test

Kaiser–Meyer–Olkin measure of sampling adequacy		0.727
Bartlett's test of sphericity	Approx. Chi-square	4.882E3
	Df	406
	Sig.	0.000

Kaiser–Meyer–Olkin (KMO) and Bartlett's Test

Kaiser–Meyer–Olkin test or KMO test ensures the adequacy of the research sample. The value of KMO test should be 0.5 or above in a valid sample. Bartlett's test shows the strength of association between the variables, and it also shows satisfaction with the results. Mohajan (2017) suggested that the value of the KMO test should be above 0.5. The data collected in this study shows the KMO value of 0.727, which is good enough for an adequate and spherical sample (Table 2).

Response Rate

The researcher floated the 400 questionnaires to the vegetable and fruit farmers of South Punjab, Pakistan, using snowball sampling (a type of non-probability sampling). Out of 400 questionnaires, 385 were collected back in the full form of responses. Thus, the response rate was 96% (Table 3).

Table 3 Response rate

Questionnaire delivered	Questionnaire received	Questionnaire received in complete form	Response rate
400	388	385	96%

Table 4 Crop type

Valid	Frequency	Percentage	Valid percentage	Cumulative percentage
Vegetables	234	60.8	60.8	60.8
Fruits	151	39.2	39.2	100.0
Total	385	100.0	100.0	

Respondent Demographics

Crop Type

The total sample size of the study is 385 and there are no missing values in the collected data. So, all 385 samples are considered in the study. Table 4 shows the crop type where the farmers are working. The table shows that the majority of respondents are vegetable farmers, and their total number in the sample is 234 that is 60.8% of the total sample. Rest of the 151 respondents are fruits farmers, which is 39.2% of the total sample size. This indicates that vegetable farming is more common in South Punjab, Pakistan (Fig. 2).

Experience of Respondents

The table below indicates the experience demographics of the respondents. Of the total sample size, 144 respondents have farming experience of between 1 and 5 years, which is 37.4% of the total sample. Of the total respondents, 162 (which are 42.1%) have experience of between 6 and 10 years. Total 59 respondents are in the experience bracket of 11 to 15 years, which is 15.3%. Only 15 respondents are in the experience bracket of 16 to 20 years which is 3.9%. Only 5 employees have experience of over 25 years which is 1.3% of the total respondents (Table 5 and Fig. 3).

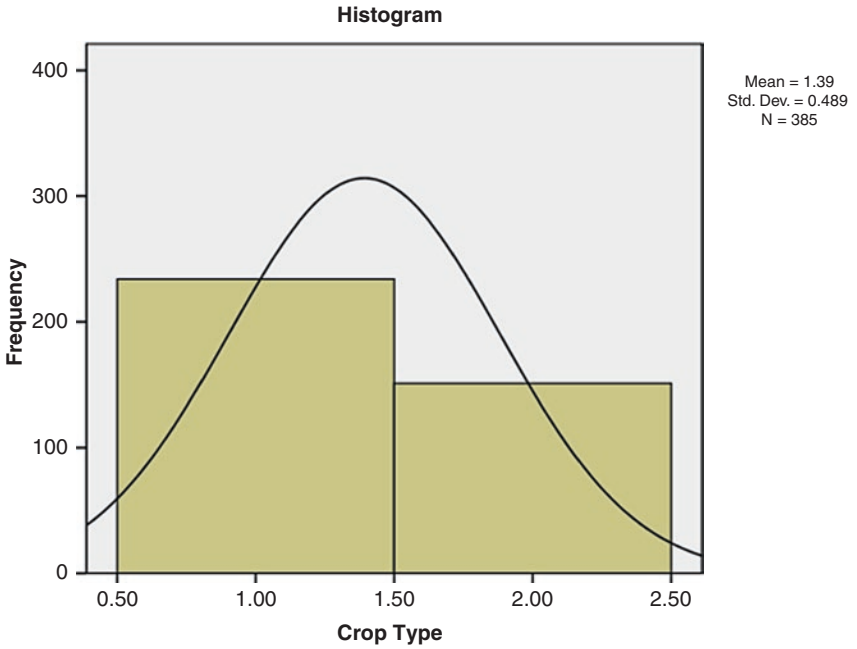


Fig. 2 Crop type

Table 5 Experience

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1 to 5 years	144	37.4	37.4	37.4
	6 to 10 years	162	42.1	42.1	79.5
	11 to 15 years	59	15.3	15.3	94.8
	16 to 20 years	15	3.9	3.9	98.7
	Above 25 years	5	1.3	1.3	100.0
	Total	385	100.0	100.0	
	1 to 5 years	144	37.4	37.4	

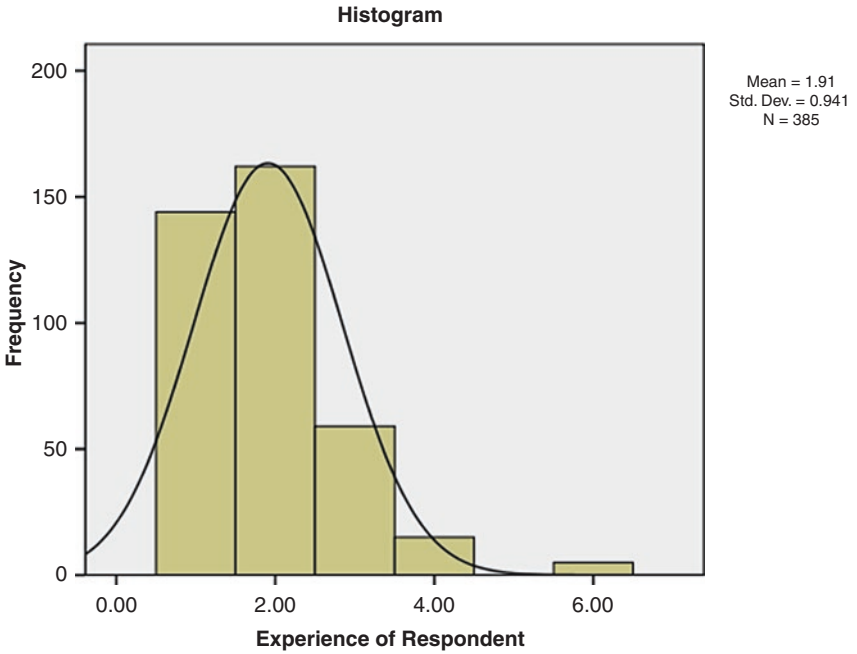


Fig. 3 Experience

Table 6 Age of respondents

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	20 to 25 years	24	6.2	6.2	6.2
	26 to 30 years	78	20.3	20.3	26.5
	31 to 35 years	192	49.9	49.9	76.4
	36 to 40 years	61	15.8	15.8	92.2
	41 to 45 years	12	3.1	3.1	95.3
	Above 45	18	4.7	4.7	100.0
	Total	385	100.0	100.0	

Age of the Respondent

Table 6 represents the age of the respondent. According to the table, 24 of the total respondents are in the age bracket of 20 to 25 years, which is 6.2%, 78 (20.3%) are in the age bracket of 26 to 30 years, 192 (49.9%)

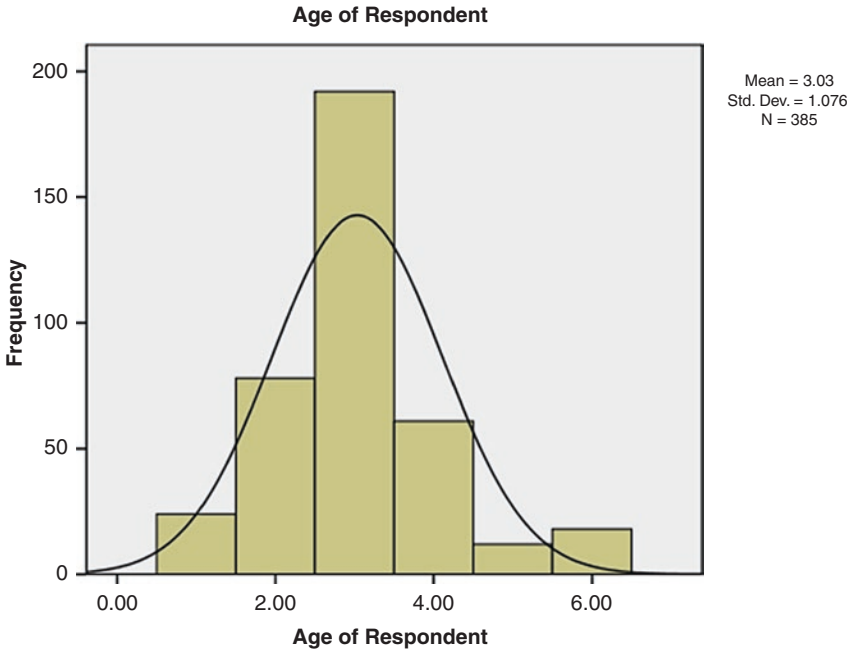


Fig. 4 Age of respondents

are in the age bracket of 31 to 35 years, 61 (15.8%) are in the age bracket of 36 to 40 years, 12 (3.1%) are in the age bracket of 41 to 45 years, and 18 (3.9%) are above 45 years of age (Fig. 4).

Qualification of Respondents

Table 7 indicates the educational demographics of the respondents. The education level of 16 farmers (4.2% of the total respondents) is up to the primary level. The education level of 159 farmers (41.3% of the total respondents) is middle. 163 (42.3%) of total respondents are Matric qualified. 41 farmers have an education level of intermediate and remaining 6 farmers have the bachelor's degree or above that are 10.6% and 1.6% of the total respondents, respectively (Fig. 5).

Table 7 Qualification of the respondents

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Upto primary	16	4.2	4.2	4.2
	Middle	159	41.3	41.3	45.5
	Matric	163	42.3	42.3	87.8
	Intermediate	41	10.6	10.6	98.4
	Bachelor and above	6	1.6	1.6	100.0
	Total	385	100.0	100.0	

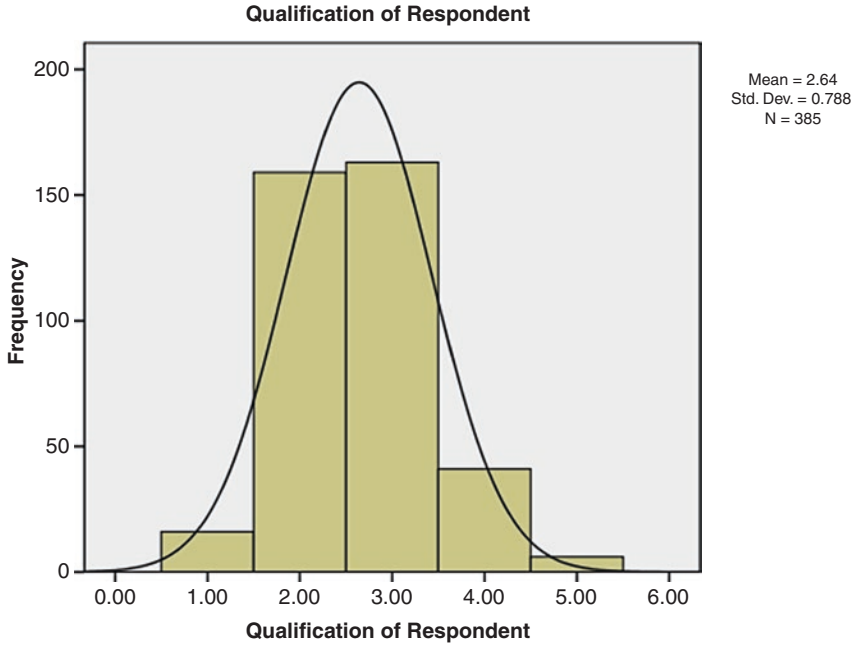


Fig. 5 Qualification of the respondents

Discriminant Validity

Fornell and Larcker criterion and HTMT are applied to measure the discriminant validity of the collected data. According to Fornell and Larcker, if the average variance explained (showed in diagonal matrix) surpasses the squared correlation of latent variables, then the assumption

Table 8 HTMT

	ATT	INT	KNO	PHE	PB
ATT					
INT	0.061				
KNO	0.382	0.058			
PHE	0.259	0.051	0.434		
PB	0.433	0.093	0.389	0.508	

of discriminant validity is supported. In the table of Fornell and Larcker criterion, all the diagonal values (square roots of AVEs) are greater than the other values in the same row/column (correlation). Therefore, the assumption of discriminant validity is supported by Fornell and Larcker criterion. To achieve discriminant validity, the HTMT values must be less than 0.90. This demonstrates the construct's discriminant nature. All correlation coefficients were less than 0.90 in the HTMT study (Gold et al., 2001). The discriminant validity of the concept was determined using the heterotrait–monotrait (HTMT) ratio (Table 8).

Correlation

According to Fielding & Schreier (2001), correlation is a statistical tool, which represents the nature and strength of the relationship between two or more quantitative variables. Bivariate correlation is used in the present section to evaluate the relationship of protective behavior concerning pesticide use with knowledge of pesticide use, attitude toward pesticides, past health experience with pesticides, and intention to use pesticides. According to Collis and Hussey (2013), bivariate correlation measures the association between two continuous variables without establishing directional causality. While, as per the analysis, knowledge of pesticide use and attitude toward pesticides are positively correlated with protective behavior concerning pesticides, and correlation is significant at the *P*-value below 0.05 level. On the other hand, past health experience and intention to use pesticides are not significantly correlated with protective behavior concerning pesticides (Table 9).

Table 9 Correlation

	Knowledge of pesticide use	Attitude toward pesticide use	Past health experience with pesticides	Intention to use pesticides	Protective behavior concerning pesticide use
Knowledge of pesticide use	1	0.300[a]	-0.175[a]	-0.007	0.379[a]
		0.000	0.001	0.894	0.000
	385	385	385	385	385
Attitude toward pesticide use	0.300[a]	1	-0.015	0.008	0.336[a]
	0.000		0.767	0.874	0.000
	385	385	385	385	385
Past health experience with pesticides	-0.175[a]	-0.015	1	-0.018	0.017
	0.001	0.767		0.720	0.745
	385	385	385	385	385
Intention to use pesticides	-0.007	0.008	-0.018	1	-0.004
	0.894	0.874	0.720		0.940
	385	385	385	385	385
Protective behavior concerning pesticide use	0.379[a]	0.336[a]	0.017	-0.004	1
	0.000	0.000	0.745	0.940	
	385	385	385	385	385

[a]Correlation is significant at the 0.01 level (two-tailed)

Structural Equation Modeling

Structural equation modeling (SEM) is implied to test the hypotheses. SEM is based on regression tools. According to Fielding (2018), regression analysis is a statistical valuation to analyze or estimate the relationship between independent and dependent variable(s). An analysis is as under (Fig. 6):

Table 10 shows the direct effects of knowledge of pesticides use, intention to reduce pesticides use and past health experience on attitude toward pesticides use and farmers' protective behavior concerning pesticides. It also states the direct effect of attitude toward pesticides use on farmers' protective behavior concerning pesticides use.

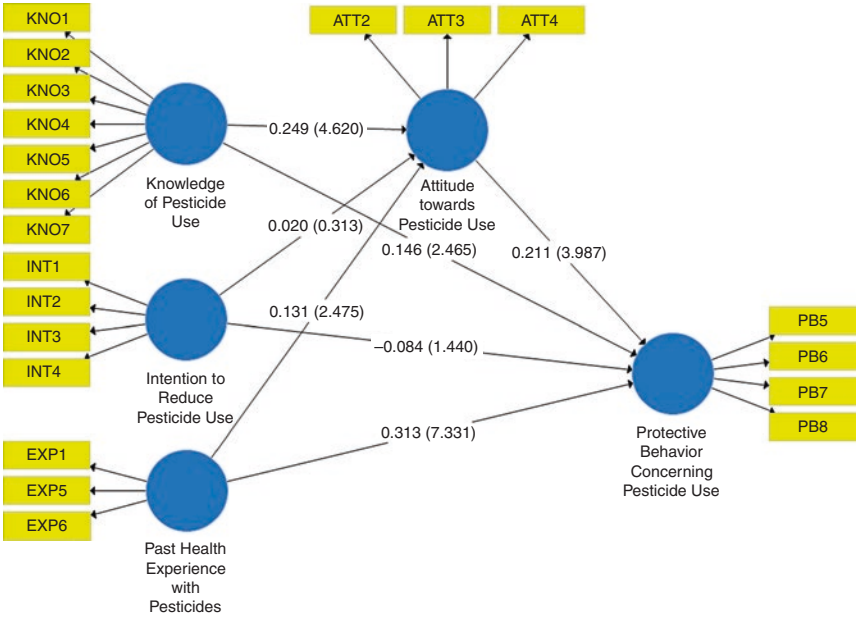


Fig. 6 Structural equation modeling

Table10 Direct effects

	Beta	M	S.D	*T*	*P* values
Attitude toward pesticide use → Protective behavior concerning pesticide use	0.211	0.215	0.053	3.987	0
Intention to reduce pesticide use → Attitude toward pesticide use	0.02	0.025	0.065	0.313	0.754
Intention to reduce pesticide use → Protective behavior concerning pesticide use	-0.08	-0.078	0.061	1.299	0.195
Knowledge of pesticide use → Attitude toward pesticide use	0.249	0.26	0.054	4.62	0
Knowledge of pesticide use → Protective behavior concerning pesticide use	0.199	0.209	0.056	3.578	0
Past health experience with pesticides → Attitude toward pesticide use	0.131	0.13	0.053	2.475	0.014
Past health experience with pesticides → Protective behavior concerning pesticide use	0.341	0.338	0.044	7.826	0

Summary of the Findings (Table 11)

Table 11 Summary of Findings

#	Statements	Method	Result
H1	There is a significant impact of knowledge about pesticides on farmers' protective behavior concerning pesticide use.	Regression	Accepted
H2	There is a significant impact of intention to reduce pesticide use on farmers' protective behavior concerning pesticide use.	Regression	Rejected
H3	There is a significant impact of past health experience with pesticides on farmers' protective behavior concerning pesticide use.	Regression	Accepted
H4	Attitude toward pesticide use significantly mediates the relationship between knowledge of pesticides and farmers' protective behavior concerning pesticide use.	Regression	Accepted
H5	Attitude toward pesticides significantly mediates the relationship between intention to reduce pesticide use and farmers' behavior protective behavior concerning pesticide use.	Regression	Rejected
H6	Attitude toward pesticide use significantly mediates the relationship between experience with pesticide and farmers' protective behavior concerning pesticide use.	Regression	Accepted

5 Conclusion

The main objective of the present study is to define the use and importance of pesticides in Pakistan and explain the determinants of farmers' protective behavior concerning pesticide use. The first research question of this study is: does the knowledge of pesticide use affect the protective behavior concerning pesticides use? Findings from the analysis indicate a significant positive effect of knowledge of pesticides use has a significant and positive effect on the farmers' protective behavior concerning pesticide use. The result from this analysis agrees with the findings from the past studies (Bagheri et al., 2019; Nasab et al., 2009) that pointed out that level of knowledge among farmers to use pesticides develops the

protective behavior among them regarding the application of the pesticide. According to the statistical analysis generated in this study, attitude toward pesticides use does not mediate the relationship between intention to reduce pesticides use and protective behavior concerning pesticides use. Sixth and final question of the present study is about the mediating effect of attitude toward pesticides use on the relationship between past health experience with pesticides and protective behavior concerning pesticides use.

6 Suggestions

The present study suggests developing a pool of knowledge among farmers and other farmworkers about the pesticides use and their potential benefits and drawbacks to develop protective behavior in their farm practices and pesticide application. The present study also implies raising awareness about the use of protective equipment and introduces the law and regulations about peptide application to promote safe pesticide use and reduce exposure risks.

7 Limitation and Recommendation

Like all the other investigations, present study also addresses some limitations. Firstly, the present study is based on the data collected from the vegetable and fruit farmers of South Punjab, Pakistan. Therefore, the results may not apply to any other geographical location or other farmers growing different crop types. So, a future study may come up with different respondents to make more generalizable results. Secondly, the present study collects quantitative data, which may give a general focus. Therefore, a future study may come up with qualitative data for more in-depth insights into farmer's perceptions. A future study may come with a more mediating or moderating variable for a more comprehensive framework to add to the literature of the theory of planned behavior (TPB).

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