Rephrase of research paper

**INFORMATION ASYMMETRY, INPUT MARKETS, ADOPTION OF INNOVATIONS AND AGRICULTURAL LAND USE IN KHYBER PAKHTUNKHWA, PAKISTAN**

**Abstract**
This paper presents empirical evidence on the results of knowledge asymmetry in input markets on the adoption of innovations and agricultural land use in rainfed districts of Khyber Pakhtunkhwa, Pakistan. Farmers’ input market integration may contribute to innovation and adoption among farmers, which can successively positively influence the sustainable use of agricultural land. to look at this hypothesis, we conducted a study of farmers and input providers to assess the potential constraints on quality inputs, prices, and extension information. We used a multistage sampling technique to gather data from 395 respondents. We then compared differences among adopters and non-adopters using the Mann-Whitney U test and Mood’s median test. Our results indicate that there's a big difference between the adopters and non-adopters when considering their perceptions of asymmetric market information. Non-adopters are suspicious of exaggerated prices, the non-availability of tariffs, adulteration of agricultural inputs, unbalanced input weight and also the supply of low-quality alternate commodities (e.g., fertilizers and pesticides) in situ of the recommended commodities within the markets. Our results involve the reformulation and implementation of appropriate policies to make sure transparent and equal information sharing among farmers engaged in input markets and for the availability of timely and quality inputs assured by regulatory checks and price checks. Free availability of knowledge on innovations and appropriate oversight over markets appear not only to motivate farmers to adopt agricultural technologies but also to influence more sustainable land use practices.

**1. Introduction**
Pakistan is that the sixth most populated country within the world. Agriculture is taken into account the mainstay of Pakistan’s economy, contributing 19.5 you must gross domestic product and interesting 42 you look after the workforce while also supplying raw materials to variety of value-added industries (GOP, 2016-17). Currently, agricultural growth in Pakistan is comparatively stagnant partially because of large gaps between actual and potential crop yields (Elahi et al., 2018). Estimates show that farmers in Pakistan obtain only half-hour of the potential crop yields (Prikhodko and Zrilyi, 2013). This condition contributes partly to 47 you look after Pakistan’s population experiencing food insecurity and malnutrition (Kirby et al., 2017). Changes in agricultural and ecological land use negatively affect agricultural productivity (Griewald, 2018; Wang et al., 2018). Innovations in agricultural productivity that close yield gaps while contributing to sustainable land use and agricultural and economic process are proposed to handle these problems (Tambo and Wünscher, 2018). Agricultural innovations increase productivity and contribute significantly to reducing household food insecurity (Tambo and Wünscher, 2018; Montalbano et al., 2018). However, insufficient and inadequate adoption of productivity enhancing innovations remains a challenge, particularly in Pakistan (Senyolo et al., 2018). the present literature suggests that insufficient adoption of improved technology considerably negatively affects land use and farming patterns (Roy et al., 2018; de Oliveira Cervone et al., 2017).
Farmers’ judicial decision to adopt innovations for sustainable land use depends on a much better market integration of farmers and also the providers of innovations and inputs (Alomia-Hinojosa et al., 2018; Zhang and Wu, 2018). a couple of studies report access to agricultural extension and marketing information because the main factors that significantly affect farmers' adoption decisions of innovations and hence sustainable land use (Arshad et al., 2016, 2017; Mehmood et al., 2017; Zulfiqar and Thapa, 2017). In agriculture, the role of data in enhancing agricultural development can not be overemphasized since information is crucial for increasing agricultural production and improving marketing and distribution strategies (Rehman et al., 2013). However, due to an information asymmetry within the input markets, farmers obtain inadequate information for higher cognitive process in farming operations (Raungpaka and Savetpanuvong, 2017). Farmers in Pakistan aren't receiving timely and proper new agricultural information (Mirani and Memon, 2011) due to information asymmetries (Ndofor et al., 2015). Pakistani farmers largely depend upon informal sources that include agriculture traders and input providers in agricultural advisory services and data thanks to their easy availability and processing (Elahi et al., 2018). In such conditions, asymmetries of data, i.e., the chance of masses hiding information or not keeping their promises and making adverse use of data is way greater and must be taken under consideration when designing sustainable agricultural land use policies (Ekeland, 2014). Therefore, the necessity for up to this point information delivery to all or any farmers on farming systems and marketing linkages is becomes increasingly important. Agriculture extension is that the means available to supply up to this point information to farmers because extension services aim to boost farmland use, rural livelihoods and well-being by enhancing information exchange and also the capacity for collective action.
Khyber Pakhtunkhwa (KP) is one among the four provinces of Pakistan. additionally to the unavailability of irrigation facilities, agricultural productivity within the province is low mainly thanks to the dearth of access to and adoption of improved technology and also the channels required for the suitable introduction of innovations (Ali et al., 2015). The adoption of innovations can improve land use sustainability (Rantala et al., 2018). The introduction of recent technology requires the input market integration of the farming community (Louw et al., 2017; Tang et al., 2015). Farmers’ perceptions of knowledge on innovations are decisive for the adoption of farming inputs (Cui et al., 2017; Kante et al., 2017).
This paper critically examines important indicators associated with the standard and costs of extension recommended inputs, with the aim of determining whether the outsmarting of farmers by traders in imperfect input markets affects the adoption of innovations suggested by various provincial and federal extension agencies for sustainable agricultural land use. Information asymmetry may play a very important role in adopting agricultural innovations. Therefore, we investigated farmers’ adoption status, that is, whether or not they have adopted any of the suggested innovations by the general public extension department during the survey year. Farmers who have a minimum of adopted one item among the suggested innovations are considered adopters, and people who haven't yet adopted one innovation are considered non-adopters. Finally, we made a comparison of variables (related to quality and prices) to see whether information asymmetry affects the adoption of agricultural innovations within the study area.
**2. Theoretical framework**
In agriculture, innovation can generally be divided into technological and non-technological innovations. Technological innovation means a replacement product applied in production (e.g., seeds, breeds and fertilizer). Nevertheless, innovation may also be non-technological, for instance, changes in attitude and behavior, e.g., the inclusion of animal welfare or environmental issues (Läpple et al., 2016 and Schut et al., 2016). Rogers (2003) and (2010) defines an innovation as an inspiration, a practice or an object that's perceived as new by a personal or a bunch of individuals. He further says that “the perceived newness of the concept, practice or object for the individual defines his or her reaction to that and if a plan, practice or object seems new the individual, it's an innovation”. The rapid adoption of innovations incorporates a positive impact on growth in agricultural productivity, sustainable use of agricultural land and guaranteed food security (Bruegel, 2011). during this study, by innovation, we mean any new idea, practice or object that the farmers perceived as new. However, we only work with the adoption of object innovations like seeds, breeds and fertilizers.
Rogers and Shoemaker (1971) define adoption as “making full use of an innovation because the best course of action available”. How and why individuals adopt innovations has inspired an excellent deal of research, and a number of other researchers across different disciplines have established technology adoption models and theories. In 1995, Rogers developed the idea of ‘diffusion of innovation’ because the basis for guiding research on innovation acceptance and adoption. Rogers synthesized research from over 508 diffusion studies and came out with the ‘diffusion of innovation’ theory for the adoption of innovations among individuals and organizations (Rogers, 1995, p. 5). Moreover, Rogers (1962) says that adoption may be a process, and he defines the adoption process as “the cognitive process a personal passes from first hearing about an innovation to final adoption”.

3. Materials and methods
3.1. Universe of the study
The primary data for this study were collected from the rainfed districts of KP. This province is found within the northwestern region of the country and is bounded by Afghanistan to the west and north, and therefore the economy of KP is essentially supported farming (Fahad et al., 2018). In terms of agricultural land use and productivity, it's the smallest amount developed province within the country (Khan and Shah, 2012). an outsized portion of the cultivable land in KP is rainfed (only 1.15 million ha of the entire cultivable land of 5.73 million ha is irrigated), showing that a major proportion of the population is liable to weather-induced risks. Not having a secure source of water, farming in rainfed areas within the province often leads to low productivity (Asian Development Bank, 2016). Two districts, i.e., Karak and Lakki Marwat, were purposively selected for conducting this study because these are the most rainfed areas of Khyber Pakhtunkhwa (Ullah and Khan, 2019). District Lakki Marwat covers a part of 3164 km² with a cultivated area of roughly 116,900 ha and geographically lies between 32° 61 N and 70° 91 E at an altitude of 200–1000 m above water level. the typical yearly temperature is 24.21 °C, and therefore the district receives approximately 326 mm of precipitation annually. The driest month is November, with 3 mm of rainfall. Most of the rain falls in August, with a mean of 74 mm (Ullah et al., 2014). Similarly, District Karak covers the realm from 32° 47 to 33° 28 North and from 70° 30 to 71° 30 East (Roohi et al., 2014). In topography, this district is sub-mountainous, rainfed and located within the arid zone of the province. District Karak is principally an occasional rainfall area that receives but 500 mm of annual rainfall. This low level of rain falls within the southwestern a part of the district that has only sandy soils, where within the month of June and July the temperature reaches 42−45 °C (Khattak et al., 2011).
3.2. Selection of sample
We first identified variety of important factors that are associated with an information asymmetry and also the outsmarting of farmers by traders. This was done through a pilot study conducted within the study area by randomly selecting 20 respondents. employing a multistage sampling technique, we then collected information from 395 respondents from the study area for the ultimate data analyses. within the first stage, among all 25 districts, two districts, i.e., Lakki Marwat and Karak, were purposively selected because these are the first rainfed areas of KP. within the 2nd stage, 1 tehsil was randomly selected from each district. within the 3rd stage, 2 Union Councils (UCs) were randomly selected from each tehsil, making the general number of UCs 4. within the 4th stage, 2 villages from each UC were selected, making the full number of villages 8. within the fifth stage, for the choice of sample respondents, a listing of farmers from all selected villages was prepared with the support of the local agricultural extension department, revenue department and population welfare department. From this list, the overall sample size of the respondents for the study was specified using Yamane’s formula (Yamane, 1967).
The formula is given as(3.1)n = N/ (1+Ne2)where
n is that the total sample size of the study, N is that the total number of farming households, and e is that the precision set at 95 the arrogance level, i.e., e = 0.05.
Based on Eq. (3.1), data were collected by randomly selecting a complete of 395 farmers employing a comprehensive interview schedule (Zulfiqar and Thapa, 2018) (Table 1).
Table 1. Distribution of Selected Sampling Units.
S.No. District Tehsil Union Council Village Farming Population Sampled

After preparing the interview schedule and before conducting the particular survey, to test the validity and reliability, the interview schedule was tested within the study area through a pilot study. supported this testing, the desired changes were made to the interview schedule. Then, the jury method (Kerlinger, 1973) was again employed by subjecting the whole instrument to the scrutiny of relevant experts. Each of the judges (experts) was requested to independently give his/her own expert opinion on the relevance and adequacy of the things, vis-a-vis the objectives of the study. Additionally, before computing the scales, items were subjected to a reliability analysis with Cronbach’s alpha statistics. The Cronbach’s alpha value was 0.88, showing a high reliability.
3.4. Statistical analysis of knowledge
The collected data were analyzed using the Statistical Package for scientific discipline (SPSS) version 22 software. Data were tested for normality of distribution by the Kolmogorov-Smirnov test (de Assunção et al., 2018). the info were presented as frequencies, percentages, medians, modes and interquartiles because they weren't normally distributed (Kemigisha et al., 2018). Because the ranked rating system was used and therefore the gathered data were ordinal, a nonparametric statistical test called the Mann-Whitney analysis was distributed (Wahbi-Izzettin et al., 2018; Kemigisha et al., 2018; Schrader, 2015; Mayilla et al., 2017). to check if there have been statistically significant differences between the two groups, Mood's median test for non-normally distributed outcome variables was used (McGraw-Tatum et al., 2017; Chuc et al., 2018). Questions regarding attribute importance were supported a 5-point Likert scale (Likert, 1932). Likert scales measure the extent to which respondents agree or trouble a given statement, typically starting from 1 (not at all) to five (to a really great extent) (Kokthi et al., 2015). within the present study, the dimensions measures the extent to which the participant values the attribute as not important or as vital. Differences in scoring tendencies are measured between adopters and non-adopters within the study area using the Mann–Whitney U test.
3.5. Explanation of variables
In this study, we compared the differences between the 2 groups. adopters and non-adopters of agricultural innovations. By adopting innovations, we mean the total use of improved agricultural technology that has seeds, fertilizer, etc., in fields suggested by pedagogy providers. The adoption of innovations is crucial for improving crop performance (Joshi et al., 2017) and, hence, the sustainable use of farm land. The adoption of innovations was defined as a binary variable with the worth of “1” for adopters: a farmer who has adopted a minimum of one improved technology, either as recommended by extension workers or with some modification, was defined as adopter. a worth “0” was given to “non-adopters” who didn't use any improved technology and who are assumed to be influenced by asymmetric information.
The differences between the 2 groups were compared on the idea of variables that included exaggerated prices, non-availability of tariffs, adulteration, unbalanced weight of commodities, supply of a low-quality alternate commodity in situ of the particular commodity suggested by the instruction providers, circulation of expired materials like medicine, and counterfeit materials (such as drugs and pesticides, etc.) within the market. These indicators of market asymmetry were identified because the most vital variables because the results of the pilot study. it had been assumed that the farmers who don't adopt innovation may face a better level of knowledge asymmetry than those that adopt. as an example, if a farmer has no information and he/she becomes suspicious of knowledge provided by traders as exaggerated, he/she will tend to not adopt the recommended technology/ies, and he/she might not be an adopter. All the variables generated through the pilot study were measured on a Likert scale within the data collection and analysis. The results of the pilot study and also the description of the attributes and scale are presented in Table 2.
Table 2. Results of the pilot study, description of attributes and scale.
Factors for knowing farmers’ perceptions Attributes included within the analyses Scale 1-5 suggests farmers’ perception of every attribute’s existence within the market and its effect on purchasing farming inputs, as suggested by various extension sources, like fertilizers, insecticides, pesticides, medicine, wheat varieties etc. Description
Prices Exaggerated prices (information deficiency) 1 = Not in the slightest degree, 2= Little extent, 3= Moderate extent, 4= Great extent, 5= Very great extent Farmers’ perception of exaggerated prices of inputs within the market and its effect on their decision to get the improved technology, as suggested by various extension organizations within the market…if so, what's the level?
Prices Non-availability of a list (information deficiency) 1 = Not in the least, 2= Little extent, 3= Moderate Extent, 4= Great extent, 5= Very great extent Farmers’ perception of the non-availability of tariffs within the markets; if so, then does it affect their decision to get materials, as suggested by the varied extension organizations within the market…if so, what's the level?
Quality Adulteration (information deficiency) 1 = Not in any respect, 2= Little extent, 3= Moderate Extent, 4= Great extent, 5= Very great extent Do farmers think the adulteration of materials may be a common thing within the market and does this affect their decision to get improved materials, as suggested by the assorted extension organizations within the market…if so, what's the level?
Quality Unbalanced weight (information deficiency) 1 = Not in the slightest degree, 2= Little extent, 3= Moderate extent, 4= Great extent, 5= Very great extent Farmers’ suspicion of the unbalanced weight of materials within the local markets may affect their decision to get such materials.
Quality Supply of another similar-looking commodity in situ of the particular suggested commodity (information deficiency) 1 = Not in the slightest degree, 2= Little extent, 3= Moderate extent, 4= Great extent, 5= Very great extent The farmers’ low or nonexistent understanding of the precise suggested innovation may end in the availability of other similar-looking low-quality inputs and this might affect the farmers’ decision to buy the materials, as suggested by the assorted extension organizations within the market.
Quality Circulation of expired materials like medicine, etc. (information deficiency) 1 = Not in the least, 2= Little extent, 3= Moderate extent, 4= Great extent, 5= Very great extent Circulation of expired materials in local markets may affect the farmers’ decision to get the suggested innovations and their adoption.
Quality Counterfeit materials (like drugs, pesticides, etc.) within the market (information deficiency) 1 = Not in the slightest degree, 2= Little extent, 3= Moderate extent, 4= Great extent, 5= Very great extent The non-adopters may perceive a better level of circulation of counterfeit materials within the markets, which can have a control on their decision to buy and adopt the suggested drugs.
Source: Authors’ explanation, 2018.
4. Results and discussion
Problems in agricultural land use are increasingly called complex, uncertain, and as operating at multiple levels (field to global value chains) and involving economic, institutional, and technological change. Stakeholders must organize capabilities and resources across multiple levels in agricultural innovation systems from the individual to the network to mobilize and build systemic innovation capacity (Turner et al., 2017). Without proper regulation and monitoring of the agricultural economy and markets, the farmers might not acquire sufficient and proper knowledge about an innovation. The input providers may provide them with asymmetric information, which can cause non-adoption. Therefore, for effective land use and to reinforce productivity levels, farmers have to be given time- and region-specific innovations, and that they must remember of the standard and cost-effectiveness of innovations.
4.1. Farmers’ perception of price issues in local markets
The results of the pilot study specified that information asymmetry has created issues associated with the costs of farming inputs in local markets. They identified two major issues concerning prices, namely, the exaggerated prices of inputs and therefore the non-availability of tariffs. the value of innovation could be a important economic factor, and also the variables related to innovation have significant effects on farmers’ decisions to adopt innovation in agriculture (Pannell et al., 2014; Senyolo et al., 2018). Fig. 2, Fig. 3 show the results for both variables.

Fig. 2 shows the results of farmers’ perceptions of exaggerated prices within the markets. quite half the respondents were suspicious of the exaggerated prices of the innovations suggested by the extension within the markets, which discouraged them from adopting such innovations and, as a result, they use the old technology. Out of a complete of 170 (43.03 %) respondents who weren't suspicious of exaggerated prices within the market, the bulk, i.e., 93 (23.54 %) respondents were adopters, whereas only 77 (19.49 %) respondents were non-adopters of improved technology. The latter might not have adopted the technology for other reasons. In contrast, 225 (56.96 %) respondents who were suspicious of exaggerated prices in domestic markets were non-adopters of the innovation, whereas only 94 (23.8 %) were adopters. It appears that farmers’ suspicion of exaggerated prices in markets is because there are not any proper checks and balances by concerned departments/organizations.
Fig. 3 shows the results of the farmers’ perceptions about the non-availability of tariffs within the markets. It shows that farmers complain that sellers don't keep price lists; thus, farmers don't know the precise prices of commodities, which hinders their willingness to adopt extension-suggested innovations. Fig. 3 shows the bulk|that almost all} respondents weren't suspicious of the non-availability of the worth lists of suggested innovations in local markets; however, there was an oversized number of farmers who were suspicious. The results indicate that out of a complete of 221 (55.95 %) respondents who weren't suspicious of availability of tariffs in domestic markets, the bulk, that is, 119 (30.13 %) were adopters, whereas 102 (25.82 %) were non-adopters. On the opposite hand, of the 174 (44.05 %) respondents who were suspicious of traders not keeping tariffs within the markets, the bulk, that is, 106 (26.84 %) were non-adopters, whereas only 68 (17.21 %) were adopters.
From these results, it may be noted that in imperfect markets, those farmers who get suspicious of exaggerated prices of farming inputs mostly don't adopt innovations. The results also indicate that the problem of non-availability of tariffs isn't as important because the issue of exaggerated prices; however, an outsized number of the farmers facing this issue are non-adopters.
4.2. Supply of inferiority inputs
Farmers specified the existence of issues associated with the availability of false information on the standard of agricultural inputs within the domestic markets. thanks to information deficiency, the farmers faced problems with identifying the standard of inputs. They identified five major problems, namely, adulteration, unbalanced weight, supply of low-quality but similar-looking inputs rather than the particular suggested quality, and therefore the supply of expired materials like medicine and counterfeit materials (such as fertilizers, pesticides, etc.) to the farmers within the rural markets. Fig. 4, Fig. 5, Fig. 6, Fig. 7, Fig. 8 show the results of the farmers’ perceptions of those variables.

Fig. 8. Farmers’ perception regarding the circulation of counterfeit drugs within the market and its effect on farmers’ adoption of innovations and sustainable land use.
Fig. 4 shows that over 1/2 the respondents were suspicious of the adulteration of the suggested inputs, which discouraged them from purchasing such inputs, and as a result, they adhered to the old technology. The results indicate that out of 186 (47.09 %) farmers who stated that input providers don't cash in of data on the standard of inputs which they are doing not face any problems with adulteration in domestic markets, the bulk, that is, 104 (26.33 %) were adopters, whereas only 82 (20.76 %) were non-adopters. In contrast, of the 209 (52.9 %) farmers who reported that they're usually not kept informed of the standard which they face problems with adulteration in domestic markets, the bulk of those farmers, that is, 126 (31.89 %) were non-adopters, whereas only 83 (21.01 %) were adopters. This again shows that farmers are suspicious of the existence of large-scale adulteration of farming inputs within the local markets, which affects their adoption level and hence farmland use. This also shows the importance of knowledge and provision of quality new inputs. Keeping farmers responsive to the standard of inputs and providing quality inputs may increase adoption and hence sustain farmland use. just like the importance of knowledge on the standard of farming inputs and of undertaking measures to stop the adulteration of farming inputs, the results also specified the importance of knowledge on the load of farming inputs: farmers also complained that traders always pack 45 kg of fertilizer bags, which lowers their willingness to get. Fig. 5 shows the results of farmers’ perceptions about the unbalanced weight of commodities within the markets and shows that over 1/2 the respondents complained about the unbalanced weight of the suggested innovations within the markets, which affected their decision to get innovations and as a result they adhered to standard farming, again highlighting the importance of data. The results indicate that out of 171 (43.29 %) farmers who stated no issues regarding the unbalanced weight of commodities in domestic markets, the bulk, that is, 104 (26.33 %) were adopters, whereas 67 (16.96 %) were non-adopters. On the opposite hand, of the 224 (56.71 %) farmers who stated problems with unbalanced weight of commodities in domestic markets, the bulk, that is, 141 (35.7 %) were non-adopters, whereas only 83 (21.01 %) were adopters. supported these findings, it's important for the local regulatory authorities to confirm the precise weight of every commodity within the domestic markets to boost the adoption level.
Fig. 6 shows the results of farmers’ perceptions about supply of low-quality but similar-looking alternate inputs rather than the particular extension-suggested quality inputs within the markets. this is often also a really important and regularly occurring problem within the domestic markets. The leads to Fig. 6 show that quite half the respondents complained that they are doing not usually have information on the standard of inputs. additionally, traders supply alternate and similar-looking commodities in situ of the particular suggested commodities, which makes the farmers doubt their decision to buy innovations and mostly leads to non-adoption. Out of the entire 186 (47.09 %) farmers who stated no problems with supply of other similar-looking commodities in situ of the particular suggested commodities in domestic markets, the bulk, that is, 101 (25.57 %) were adopters, whereas 85 (21.52 %) were non-adopters. On the opposite hand, of the 209 (52.92 %) farmers who stated problems with unbalanced weight of commodities in domestic markets, the bulk, that is, 123 (31.15 %) were non-adopters, whereas only 86 (21.77 %) were adopters.
The other problem identified by the farmers was the circulations of expired materials like pesticide and insecticide sprays, etc., within the markets. The results indicate that this problem is a smaller amount important, but most farmers face this problem, and that they think that the circulation of expired materials affects their level of adoption. The results are shown in Fig. 7, which shows that although most of the farmers didn't report the circulation of expired materials within the markets, there was an outsized number of farmers who did. Out of the entire 238 (60.25 %) farmers who didn't report the availability of expired materials within the markets, 118 (29.87 %) were non-adopters, whereas 120 (30.38 %) were adopters. On the opposite hand, of the 157 (39.75 %) farmers who did report the circulation of expired materials within the markets, the bulk, that is, 88 (22.28 %) were non-adopters, whereas only 69 (17.47 %) were adopters. These results indicate that the circulation of expired materials may be lower but that it still exists which a policy regulation is required to manage this.
Last, farmers reported the sale of counterfeit materials (such as drugs and pesticides, etc.) within the markets. The results are given in Fig. 8. It shows that although most of the respondents didn't report the supply of counterfeit materials within the markets, there was an oversized number of farmers who did. The results indicate that out of 206 (52.15 %) farmers who failed to report the circulation of counterfeit materials within the markets, the bulk, that is, 105 (26.58 %) were adopters, whereas 101 (25.57 %) were non-adopters. On the opposite hand, of the 189 (47.84 %) farmers who did report the presence of counterfeit materials within the markets, the majority, that is, 107 (27.08 %) were non-adopters, whereas only 82 (20.76 %) were adopters. These results indicate that the circulation of counterfeit materials and also the circulation of expired materials like medicine, etc., on the domestic markets aren't as extreme as adulteration, unbalanced weight and also the supply of alternate and similar-looking commodities by traders in situ of the particular suggested commodities within the study area. These results also indicate that farmers must be kept informed of the standard of every input within the domestic markets to extend adoption levels, because any doubts within the farmers’ minds regarding the standard of farming input will affect their decision on the adoption or non-adoption of innovations.
Likert responses were presented into bar charts and therefore the central tendency was summarized by the median and therefore the mode, whereas the dispersion was summarized by the interquartiles. Table 3 shows the central tendency and dispersion of every variable.
Table 3. Central tendency and dispersion of farmers’ perception of the assorted issues that they face in domestic markets.
market
Source: Authors’ estimation supported field survey data (2017).
Measures of central tendencies were conducted to summarize the information for the variables, whereas measures of dispersion were computed to know the variability of the scores for every variable. The measure of central tendencies shows the typical respondents’ likeliest response, whereas the interquartile range shows whether the responses are clustered together or scattered across the range of possible responses. The experimental results indicate that the median recorded for exaggerated prices is 3, which comes within the group of moderate extent; therefore, the median for this group (value of the center case for this group) is moderate. this means that the common respondents’ likeliest response regarding exaggerated prices is moderate. The median is that the value that's within the middle of the distribution. this means that a minimum of half (50 %) of the cases had that value or the next value, while a minimum of half (50 %) of the cases had that value or a lower value for this group. The median for adulteration, unbalanced weight and also the supply of alternate similar-looking commodities in situ of the particular suggested commodities is recorded as 2 for every variable, which comes within the group of little extent; therefore, the median for this group is no extent. Similarly, the median for the non-availability of tariffs, the circulation of expired materials like pesticides and medicine, etc., and counterfeit materials (such as drugs, pesticides, etc.) within the market is recorded 1, which indicates that the median for these groups is “not at all”. within the table above, it's clear that the variable exaggerated prices “is the foremost important variable” since it's the best median, indicating that nearly 1/2 the respondents have faced that problem from moderate to great and really great extent. The separate medians for both groups, i.e., the adopters and non-adopters, for every variable indicate that when excluding the median for the variable ‘circulation of expired materials like medicine, etc.’, the median for all variables of non-adopters is beyond for the adopters, which implies that the typical non-adopter for every variable is facing problems at the next level (Likert scale/levels are given in Table 2) than the adopters, which affects his or her adoption of innovations. The interquartile is that the difference between the primary and third quartile of variables. this suggests that the interquartile range is that the range of values within which the center 50 you look after the score resides. It are often seen that the interquartile range for the variables exaggerated prices and unbalanced weight is 3. However, interquartile ranges for the non-availability of tariffs, adulteration, supply of alternate similar-looking commodities in situ of the particular suggested commodities, and also the circulation of expired materials like medicine, etc., and counterfeit materials (such as drugs, pesticides, etc.) within the market is 2. this means that exaggerated prices and unbalanced weight are variables that deserve the utmost attention: the differences among the farmers are much greater for these variables than for the opposite variables, as for these variables, the information deviate from the center value (most of the responses are clustered together at a moderate extent). The separate interquartile ranges of both groups, i.e., the adopters and non-adopters, for every variable indicate that the differences between adopters and non-adopters on some variables are much greater which the information deviate from the center value for adopters. this suggests that in terms of facing problems, for the variables of adulteration, unbalanced weight and also the circulation of expired materials like medicine, etc., 50 you look after the adopters are on the size at a coffee level compared with the non-adopters.
4.3. Results of the Mann-Whitney U tests
Mann-Whitney U results for the data on the variables indicated by the pilot study as important for adoption and their adoption levels are presented in Table 4. In general, the comparison of the 2 mean ranks for every variable shows that both groups have different central tendencies for every variable. The mean rank of non-adopters for every variable on facing problems within the markets that ultimately affect their decision to buy innovations and eventually adoption is over that of the adopters. Table 4 shows the mean rank of both groups for every variable and therefore the test statistics results.
Table 4. Mean rank of every variable of both groups of adopters and non-adopters and also the test statistics results.
Variables Adaption Status N Mean Rank Mann-Whitney U Wilcoxon W Z Sig. (2-tailed)
Source: Authors’ estimation supported field survey data (2017).
The leads to Table 4 show the importance level of variables with adoption. It may be seen that the P value for the variables exaggerated prices, non-availability of tariffs, adulteration, unbalanced weight and provide of alternate similar-looking commodities in situ of the particular suggested ones is a smaller amount than 0.05. this suggests that the importance level for every variable is a smaller amount than 0.05, rejecting the null hypotheses. this means that the two groups for every variable have different medians, assuming that the shapes of their distributions don't seem to be similar. Similarly, the P value for the variables circulation of expired materials like medicine, etc., P = .245, and counterfeit materials (such as drugs, pesticides, etc.) within the market, P = .378, means the importance level for every variable is bigger than 0.05, accepting the null hypotheses; this means that the two groups have the identical median, assuming that the shapes of their distributions are similar. to work out the importance among the differences in both groups, Mood's median test is employed, and therefore the results are given in Table 5.
Show significance at the extent of 5 %.
Source: Authors’ estimation supported field survey data (2017).
Mood's median test results confirm significant differences among the medians of both groups on variables that include the non-availability of a listing, adulteration, unbalanced weight, and therefore the supply of alternate similar-looking commodities in situ of the particular suggested ones. The results for the non-availability of the worth list show that 106 out of 174 farmers who score above the median are non-adopters. Since p-value = .004 < .05 = α, we therefore conclude that there's a major difference between the 2 population medians. Similarly, the results for adulteration show that 103 out of 166 respondents who score beyond the median are non-adopters. Since the p-value = .002 < .05 = α, we therefore conclude that there's a big difference between the 2 population medians. The results for unbalanced weight show that 116 out of 185 respondents who score on top of the median are non-adopters. Since p-value = .000 < .05 = α, we therefore conclude that there's a major difference between the 2 population medians. The results on the provision of alternate similar-looking commodities in situ of the particular suggested ones show that 98 out of 161 respondents who score beyond the median are non-adopters. Since p-value = .009 < .05 = α, we therefore conclude that there's a major difference between the 2 population medians.
5. Conclusions and policy recommendations
Existing studies on agricultural information dissemination largely ignore the influence of data asymmetry within the imperfect competitive market on the farmers’ decision to get inputs for the adoption of agricultural innovations for sustainable agricultural land use, which could be a gap that this study fulfils. The empirical results revealed that farmers perceived the input prices and quality as unsatisfying services provided by the domestic markets. However, this nonsatisfaction was mostly thanks to an information asymmetry that resulted within the farmers’ inability to adopt innovations. Farmers were suspicious of exaggerated prices, the non-availability of tariffs, adulteration, unbalanced weight and also the supply of alternate similar-looking commodities in situ of the particular suggested commodities, which effected their decision to adopt innovations and hence affected their farmland use. There was a big difference within the medians of adopters and non-adopters and people who were suspicious of asymmetric information and hence didn't adopt innovations. As technology adoption is that the most vital driving factor for productivity enhancement and sustainable use of agricultural land and therefore the significant role of knowledge in technology adoption can't be denied, it's important to reflect on the role of the govt.. Concerned departments may pay more attention to formulating integrated policies, including input market regulations that affect the adoption of innovation and hence sustain agricultural land use. a correct check-up/inspection could also be required for controlling the intentional shortage of suggested commodities created within the market by traders to extend price levels within the future. Prices should even be frequently regulated, and one price for every commodity should be ensured for each farmer across the region. Regulations should be formulated and their implementation should even be ensured by the local regulatory authorities to sustain and boost agricultural land use. Controlling adulteration, unbalanced weight, the provision of alternate similar-looking commodities in situ of the particular suggested ones and people involved in such activities is also controlled by the authorities. Precise and timely information on various innovations should be made freely available to the farmers. the general public authorities must intervene to regulate the asymmetry of data in order that the farmers have appropriate knowledge of quality and costs so that they need the motivation to adopt innovation. this might not only help sustain and boost the productivity level and farm income but also cause the sustainable use of agricultural lands in Pakistan.