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Adoption Theory and IPM Practices in Sindh Province of Pakistan: A Qualitative Study

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ABSTRACT

Today farmers are making significant efforts to deal with food insecurity while trying to enhance their yield or profitability, therefore applying chemical fertilizers and using pesticides markedly, while ignoring the IPM practices deliberately. This study highlights the reluctance of local farmers in Sindh to adopt IPM practices, despite their numerous benefits. Hence, a study was staged to investigate factors using Adoption Theory lenses that may create hindrances in adopting IPM practice/techniques by the local farmers of Sindh Province of Pakistan. Thus, primary data was collected through in-depth interviews with fifteen (15) participants using purposive sampling method, since NVIVO software was used to analyze qualitative data collected through primary sources. Thus, the study highlights multiple factors as indicated by Rogers (1995) and validates that the relativity, complexity, compatibility, trialability, and observability were potentially functioning as main factors contributing to this reluctance/adoption of IPM practices. Moreover, these factors were merely led by fear of economic disadvantages and lack of market. To promote IPM adoption, policymakers and stakeholders must provide targeted support, resources, and incentives while establishing specific markets.

Keywords: *adoption, Integrated Pest Management (IPM), Qualitative analysis, Sustainable agriculture*

INTRODUCTION

The process by which new ideas, technologies, or practices are communicated and adopted is referred to as the diffusion of innovations that may lead to ensuring social change and transformation in society (Rogers, 1995) . The adoption theories basically help understand 'how individuals and organizations embrace innovations, technologies, behaviors, or ideas, highlighting the main factors that shape the speed and manner of adoption'. Innovation involves the creation and implementation of new ideas (Ayanwale & Ndlovu, 2024), introducing something new, or making substantial improvements to existing technologies, practices, or concepts. The adoption process encompasses a series of stages through which an individual or organization progresses from first learning about an innovation to fully integrating it into their operations or daily life (Peres, et al., 2010) . This process aids in comprehending how and why people decide to embrace and use innovations (Indah & Hakim, 2023) . This phenomenon is extensively researched in fields like sociology, marketing, and technology (Rogers, 1995) . The Adoption Theory provides a significant framework for understanding this process, outlining the stages and factors involved in the adoption of innovations. The theory of 'Adoption' by Roger (1995) is theoretically explained while

categorizing various factors that may be involved in the diffusion of innovation, mainly including relativity, complexity, compatibility, trialability, and observability.

In parallel, Integrated Pest Management (IPM) is an agricultural approach to crop pest management while ensuring ecological safety and aims to achieve higher yield/production (Yadav, et al., 2023). The concept of IPM was developed emphasizing the use of selective pesticides so that bio-friendly essentials have been conserved inside the system (Richard, et al., 2022) , mainly to minimize health issues and the environment, as well (Rejesus & Jones, 2020) . IPM was believed to be the most effective solution to reverse those negative trends in pest management, e.g., overuse of pesticide spray. In the 1970s, the concept of IPM was introduced in Pakistan to reduce the excessive use of chemical spray and cover up production and quality issues, simultaneously (Shahid, et al., 2016) . This integration of management plans became improved in later years by involving different/various control alternatives which include resistant crop varieties, crop rotation, different methods, and comprising weeds and sicknesses as pests (Trivedi & Ahuja, 2011). A range of (IPM) practices, such as soil amendment, sex pheromones traps, the release of natural pest enemies, the collection and destruction of infected fruits with larvae, yellow sticky traps for aphids, sanitation, and highlighting of virus-infested plants, are recommended for control of diseases, and pest (Rahman, 2021). Hence, many IPM projects/programs/workshops have been staged in Sindh in the last three decades (Lankinen, et al., 2024). Food and Agriculture Organization, the European Union, and the Asian Development Bank funded the National Integrated Pest Management (Nat-IPM) Programme for farmers from 2001 to 2004 and delivered a new extension training method as Farmer Field School (FFS) (Siddiqui & Siddiqui, 2012). The primary principle of FFS training changed to enable farmers to be self-sufficient, the usage of IPM practices which might be agro-environment ecosystem friendly. But today a significant majority of farmers are afraid of this type of farming system and therefore nonserious to adopt IPM practices (Palis, 2006), merely because of expensive output and little market demand (Akter, et al., 2016) . Moreover, shortage of IPM materials, availability of pesticides at frequent levels, lack of management between farmers and extension agents, lengthy process, the non-significant price value of crops, demotivation by the pesticide agents, and need for more labor to apply (Kabir & Rainis, 2015) . The attempted study is therefore well-organized, in which related issues/causes that are creating hindrances in the adoption of IPM practices in the Sindh province of Pakistan were tried to discover while sharing the situation and conditions of local farmers contributing towards social policy and agricultural planning.

RESEARCH METHODOLOGY

The attempted study is exploratory in design, in which mainly a qualitative approach was applied, whereas 'exploratory' studies require most of the time in-depth information to reveal (Kalu & Bwalya, 2017), therefore purposive sampling method was adopted and a total of fifteen (15) in-depth interviews were conducted (Campbell, et al., 2020) . While trying to cover the whole province (Sindh), the researchers considered five (05) participants from each division (Mirpur Khas, Shaheed Benazir Abad, and Sukkur), well-educated, experienced, and between the ages of 40 and 55 years to get mature information (Singh, et al., 2014) . Again, choosing farmers to participate in the research study serves multiple purposes. Selecting farmers who are experts in their field and non-absentees can be benefited from gathering in-depth knowledge (Hoffmann, et al., 2007; Su, et al., 2017) . Hence, the selected participants were almost all expert/model farmers, containing innovative techniques and the best agricultural practices (Ma & Abdulai, 2019).

The structured part of the interviews, which averagely lasted for 50-60 minutes, asking specific questions related to the investigation. This time frame allowed for a comprehensive exploration of the participant's knowledge, experiences, and perspectives regarding IPM practices (Sharifzadeh, et al., 2023). There was also an informal session before the start of the in-depth interview, lasting almost half an hour per

participant in which salutations, cultural greetings, and journey story and purpose were shared. During this informal time, the researcher also tried to build rapport and discuss some related topics in a relaxed manner. The researcher recorded the interviews using mobile phones which rejected the need for notetaking and allowed researchers to focus entirely on the interview interaction (Göker & Myrhaug, 2008). Consequently, this can lead to more profound and meaningful discussions, as the interviewer can actively listen, review, and reply to the participant's responses in real time (Nowell, et al., 2017) . Participants were also informed in advance about the recording and got consent following ethical standards regarding informed consent and confidentiality (Cychosz, et al., 2020).

Followed by the collected data was transcribed and translated into English for further analysis (Nikander, 2008). When it comes to organizing and analyzing qualitative data, NVivo software was conceived as a powerful tool, that allowed researchers to develop 'word cloud, word tree, and word frequency' in the shape of qualitative data analysis. When interpreting the results, researchers synthesized findings, provided context, and drew appropriate conclusions that were supported by the data. This comprehensive approach offers a strong method for studying and reporting on qualitative research (Mortelmans, 2019).

RESULTS AND DISCUSSION

Results revealed through the analysis of qualitative data that the word 'afraid' was used most repeatedly by the participants against the questions related to IPM. Followed by 'rates, serious, tools, agents and market' were also used by the participants while responding to the questions related to IPM practices in the study area (Mirpur Khas, SBA, and Khairpur districts).

Figure-1: Word cloud (Factors affecting adoption of IPM practices)

During interviews, mainly the issue of IPM was highlighted, and common reasons that might emerge as hurdles were investigated. In this regard, it was observed that most of the participants were afraid of or lacking trust in IPM methods, therefore IPM is not a common practice in the selected areas. Local farmers did not have enough knowledge about IPM since local farmers have been using traditional/conventional pest control methods.

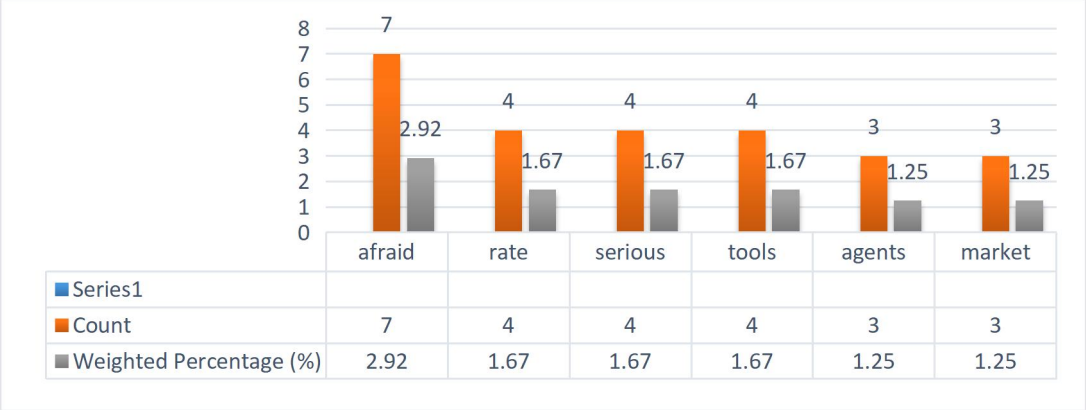

Figure-2: Word frequency (Factors affecting adoption of IPM practices)

Most of the participants were worried that IPM techniques could be risky or ineffective compared to conventional pesticide-based methods. Fear of failure or financial losses might discourage farmers from approving of something new. Additionally, farmers were worried that the IPM practices could lead to reduced yields, especially if they believe that chemical pesticides are more effective in pest control and IPM methods won't offer the same level of protection for their crops. Since IPM involves a more comprehensive approach to pest management, including techniques like crop rotation, environment operation, and biological control, therefore the complexity of IPM might be crushing for farmers, particularly if they lack the necessary knowledge or support to implement these methods effectively (Baker, et al., 2020) . The IPM may also demand an initial investment of time, resources, and possibly money for training, equipment, or infrastructure.

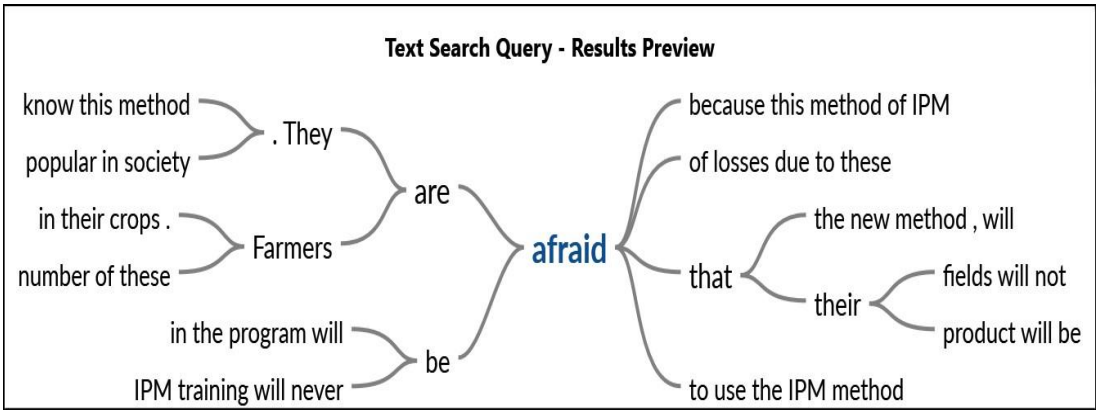

Figure-3: Word Tree (Afraid)

Figure-3 shows the results in the shape of a word tree, referring that the word ‘afraid’ was used frequently by the participants in the context of IPM practices/methods. Local farmers still consider IPM as a new induction and have a certain level of fear level about IPM practices to implement. Like any new approach, adopting IPM requires willingness/readiness, but farmers at large are resistant to change due to unfamiliar practices or doubtful results of IPM practices against the control of pests. Farmers facing immediate economic pressures or struggling to make ends meet may prioritize short-term gains over long-term sustainability (Clapp & Isakson, 2018). They may select quick fixes such as chemical pesticides instead of investing in more sustainable IPM practices. In addition, IPM requires a comprehensive understanding of pest ecology, monitoring techniques, and integrated control methods. Some farmers may find the

complexity of IPM daunting or may lack the technical expertise needed to implement it effectively (Bottrell & Schoenly, 2018). Farmers are uncertain about holding Integrated Pest Management (IPM) due to the perceived lack of financial benefits compared to conventional methods. Essentially, there is a lack of strong advantages or improved crop prices associated with the use of IPM techniques, leading to decreased interest among farmers in its adoption. Farmers are worried that there is no specific market for products grown using IPM methods (Rejesus & Jones, 2020). The absence of a dedicated market means that IPM growers do not have the opportunity to sell their products at premium prices or to distinguish them from conventionally grown products.

Additionally, the participants expressed concerns about the absence of a separate market for IPM products to gain maximum monetary benefits as indicated in Figure-2. Unlike conventional pesticides that often have a well-established market, IPM solutions may not have as clear of a market presence. This lack of a distinct market could present challenges for producers who want to adopt IPM practices and may require efforts to create awareness and demand for IPM products among consumers (Rossi, et al., 2019). This lack of differentiation reduces the incentive for farmers to invest in IPM practices (Dhawan & Peshin, 2009). Furthermore, participants may have been careful about potential conflicts of interest or biases in the information provided by various pesticide company agents, especially if they focus on selling conventional pesticide products rather than supporting IPM adoption (Norton, et al., 2019).

Furthermore, most of the local farmers are not serious about applying IPM methods to their crops for pest management as indicated in Figure-3. There are several reasons why farmers are not taking Integrated Pest Management (IPM) methods seriously. The adoption of Integrated Pest Management (IPM) practices among local farmers is constrained by a complex array of factors, including inadequate training, limited access to IPM materials and equipment, insufficient support from extension agents, and perceived high labor costs (Grasswitz, 2019; Kabir & Rainis, 2015).

The word agents explain that the company agents are working door to door and are meeting with the farmers who develop farmers' minds that ‘pesticides are necessary for getting satisfactory results from crops’ (Carvalho, 2017) . Misinformation spread by company agents regarding the necessity and advantages of pesticides can also undermine IPM practices. Uneducated farmers may place greater trust in them due to their perceived expertise, leading to skepticism about IPM methods. Aggressive marketing by agents can overshadow the benefits of IPM, making it appear less viable or effective. They also might offer financial incentives or discounts on pesticides, making them more attractive than IPM options. And often provide easy access to pesticides, while IPM methods might require more effort and resources to implement (Rother, 2013) . The limited understanding of Integrated Pest Management (IPM) methods among farmers, coupled with the influence of agents and peers, contributes to the persistence of pesticide use in agricultural practices. The immediate effects of pesticides can overshadow the long-term benefits of IPM, which may be less apparent or take longer to materialize (Parsa, et al., 2014). Continuous support and follow-up from company agents also reinforce the use of pesticides, whereas IPM may also lack such consistent support.

Theoretical Discussion

The adoption process encompasses a series of stages through which an individual or organization progresses from first learning about an innovation to fully integrating it into their operations or daily life (Peres, et al., 2010). This process aids in comprehending how and why people decide to embrace and use innovations (Indah & Hakim, 2023). This phenomenon is extensively researched in fields like sociology, marketing, and technology (Rogers, 1995) . Diffusion of Innovations theory provides a significant framework for understanding this process, outlining the stages and factors involved in the adoption of

innovations. Hence the researchers discussed the results of this study scientifically considering the theory of 'Adoption' by Roger (1995), which theoretically explained various factors that may be involved in the diffusion of innovation. In this regard, the first factor "relative advantages" signifies the perceived superiority of an innovation when compared to existing alternatives. It is supposed to be a crucial factor that may influence the adoption of new products, technologies, or ideas (Abbas & Mohtar, 2016) . Relative advantages encompass the perceived benefits or advantages that innovation provides over the status, including improvements in functionality, efficiency, cost-effectiveness, convenience, performance, or any other aspect valued by users (Andrade, et al., 2014). Whereas the perceptions of selected farmers divulge that the IPM technology has failed to fill out any gap as perceived by the local farmers. Comparatively, these techniques are even more costly, inconvenient, and less efficient but contain environmental/health benefits, which is not a prime objective of a local farmer (Pacifico & Paris, 2016). It was also shared that the farmers who use Integrated Pest Management (IPM) practices frequently face difficulties when comparing their yields to those farmers who primarily utilize chemical fertilizers and pesticides. Therefore, people believe that the average product yield obtained through IPM techniques is less than that obtained from conventional techniques. Chemical fertilizers and insecticides frequently provide noticeable effects quickly, allowing for immediate crop growth and pest control (Mauceri, et al., 2007).

Secondly, when it comes to adopting innovations, compatibility' also plays a crucial role. Innovations that support existing systems, practices, values, and infrastructure are more likely to be embraced long-term successfully (Alfayez, 2024). In this regard, IPM innovation is indeed well-demanded by the UNO, and advanced countries as well, therefore supposed to be well-compatible with sustainable development. However, local farmers are less educated to identify the compatibility of innovation by themselves whereas the Pakistani Government also failed to attract/motivate local farmers at large to adopt IPM practices. In addition to that, there is no separate market for the IPM growers, that could help them to boost their profitability by gaining charmful rates. In terms of innovation adoption, the third factor, complexity' connects to the perceived level of difficulty associated with comprehending, implementing, and utilizing a new product, technology, or idea. This could play a fundamental role in the adoption process, as innovations are believed to be overly complex and may face resistance from potential adopters (Gopalakrishnan & Bierly, 2001) . Since IPM adopters require proper knowledge of different types of pests, their life cycles, and management strategies to a certain extent, which could be complex for many uneducated farmers therefore implementing IPM approaches in practice could create puzzles and difficulties (Dhawan & Peshin, 2009) . IPM offers solutions for a selected pest problem, however, one insecticide may control multiple insects at a time and have a very vast scope. Some IPM techniques, such as biological control agents, are not easily or frequently available and these biological agents are complex enough to implement and require more knowledge to gain effective results (Baker, et al., 2020) . IPM methods may also contain advanced tools and techniques, which are expensive and complicated. Therefore, IPM practices may encompass the complexity, and difficulty involved in adopting and utilizing innovation.

'Trialability', is a fourth reason that is all about giving potential adopters a chance to test an innovation before fully committing. It is vital in the sense that it may help to reduce uncertainty and perceived risk by allowing users to experience the benefits firsthand (Ramadhan, et al., 2024). Successful IPM trials would serve as a model for other farmers in the community, encouraging widespread adoption and leading to overall improvements in agricultural practices. Similarly, trialability is considered a main factor for adopting innovative, therefore Farmer Field Schools (FFSs) were introduced, in which farmers are gathered/invited, educated, and motivated mainly through conducting trials of various IPM techniques (Rejesus & Jones, 2020) . Creating demonstration plots where IPM practices are implemented allows farmers the physical benefits of IPM compared to conventional methods. Seeing healthier crops and

reduced pest damage would serve as a strong motivator (Sherman & Gent, 2014). By observing IPM practices and their outcomes during these sessions, farmers can gain a better understanding and be encouraged to adopt IPM. Yet there are certain limitations to accessing interested farmers and gathering all the farmers in one place. In addition, projects have limited resources thereby planning to conduct limited trials (Doss, 2006). Finally, the 'Observability' identified by Everett Rogers in his Diffusion of Innovations theory, is one of the fifth attributes of innovations, referring to how visible the results of an innovation are to others. When the benefits of innovation are easily seen by potential adopters, it can accelerate the adoption process (Gounaris & Koritos, 2012). In the context, FFSs have interactive learning sessions where farmers receive training on IPM techniques in a practical, field-based setting and deeply observe the IPM practices and their outcomes as well, during these sessions. Hence, observability could provide in gaining a better understanding and be encouraged to adopt IPM (Guo, et al., 2015). When farmers directly observe the economic benefits of IPM, such as cost savings from reduced pesticide use and higher yields, it could drive adoption (Rossi, et al., 2019).

CONCLUSION AND RECOMMENDATIONS

This study investigated the reluctance of local farmers in Sindh to adopt Integrated Pest Management (IPM) practices, despite their benefits. The findings identify fear of economic and marketing disadvantages as the primary operational factor driving this reluctance. Theoretically, the study validates Rogers' (1995) Adoption Theory, emphasizing the significance of relativity, compatibility, complexity, trialability, and observability in shaping adoption decisions, therefore failing to adopt it accordingly. To promote IPM adoption, policymakers/donors must also provide technical assistance, expand project coverage, and offer incentives to close stakeholders.

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