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Attitude as a mediator in protected cultivation adoption: Evidence from structural equation modelling

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Abstract

The paper reveals the relationship between farmers' profiles, psychology, and communication attributes, attitude, and adoption behavior regarding protected cultivation technology (PCT). The use of Structural Equation Modelling (SEM) helped identify both the direct and indirect impacts, assuming that the farmer's attitude acted as a mediator.

It was found out that scientific orientation, management orientation, and extension orientation had a considerable influence on the attitude of farmers toward protected cultivation. The explanatory power of the model was high since 75.2 per cent of the variation in the attitude of farmers could be explained by the model. As far as the adoption is concerned, the farmers adopted drip irrigation (70.00%), shade net application (62.50%), ventilation system (60.00%), and fertigation (58.33%). The adoption level of capital-intensive components, including cold storage and packaging, was negligible.

The SEM analysis confirmed that attitude served as an effective mediator between farmers' attributes and adoption behavior. In other words, farmers with a high level of scientific knowledge, management skill, and extension orientation held positive attitudes that fostered the adoption process.

Keywords: Protected Cultivation Technology (PCT), Structural Equation Modelling (SEM)

Introduction

Protected Cultivation Technologies (PCT) represent an important tool that helps improve productivity, resource utilization, and stable incomes due to varying climatic circumstances. The application of PCT allows the creation of artificial growing conditions thus ensuring a possibility of all-year production and better yield of crops. However, the use of this technology varies depending on the country since its introduction is affected by different barriers such as high initial investments, difficulty of mastering the technology, etc.

While many studies focused on the impact of socio-economic variables on technology adoption, it should be noted that farmers' psychological and communication attributes play an essential role in the process. For instance, farmers' attitude is an important factor that determines whether technology will be adopted or rejected. In order to develop efficient approaches to farmers' technology promotion, it is vital to explore the complex interactions between socio-economic, communication, and psychological factors and their impact on adoption behavior.

Therefore, in this study, the structural relationships among farmers' socio-economic characteristics, attitude, and their adoption of Protected Cultivation Technologies will be investigated using the Structural Equation Modelling method. Special attention will be paid to the mediating effect of attitude.

Objective of the Study

This paper attempted to examine the structural relationships between profile variables, attitude, and the behavior of adoption of farmers using PCT. The Structural Equation Modeling (SEM) methodology was used for the purpose of this study.

Results and Discussion

Profile Characteristics of Respondents

The results from respondents' distribution show that the largest number of respondents was in the middle age category (54.17%), while young farmers constituted 26.67% and the older farmers

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comprised 19.17%. In respect of educational attainment, the majority of the respondents were educated up to secondary level (34.17%), whereas only few (6.67%) were more educated. In regard to land possession, the large percentage of semi-medium farmers (47.50%) indicated that resources were moderately available to them. Concerning annual income, 50.83 per cent of respondents were at medium level of income.



Social, Communication and Psychological Characteristics

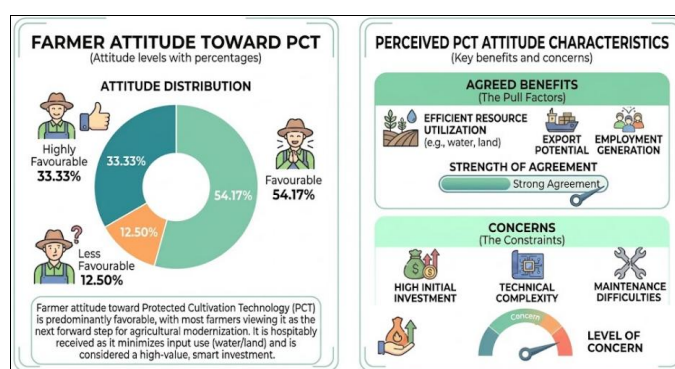
Most of the respondents demonstrated moderate involvement in social activities (45.00%), extension (49.17%), and mass media (35.83%). In terms of psychological attributes, more than half of the respondents showed high risk orientation (52.50%) and management orientation (49.17%), while scientific orientation was mostly moderate (55.83%). These attributes are important because they determine the farmers' ability to make decisions and accept innovations.

Attitude towards Protected Cultivation Technology

The study indicated that there was a generally positive attitude towards the adoption of protected cultivation technology (PCT). A majority of 54.17% had a favourable attitude toward protected cultivation, while 33.33% had a highly favourable attitude towards the use of protected cultivation. On the other hand, 12.50% of the respondents had a less favourable attitude towards protected cultivation. It is clear that a majority of the farmers were aware that adopting protected cultivation would be a beneficial step for future agriculture.

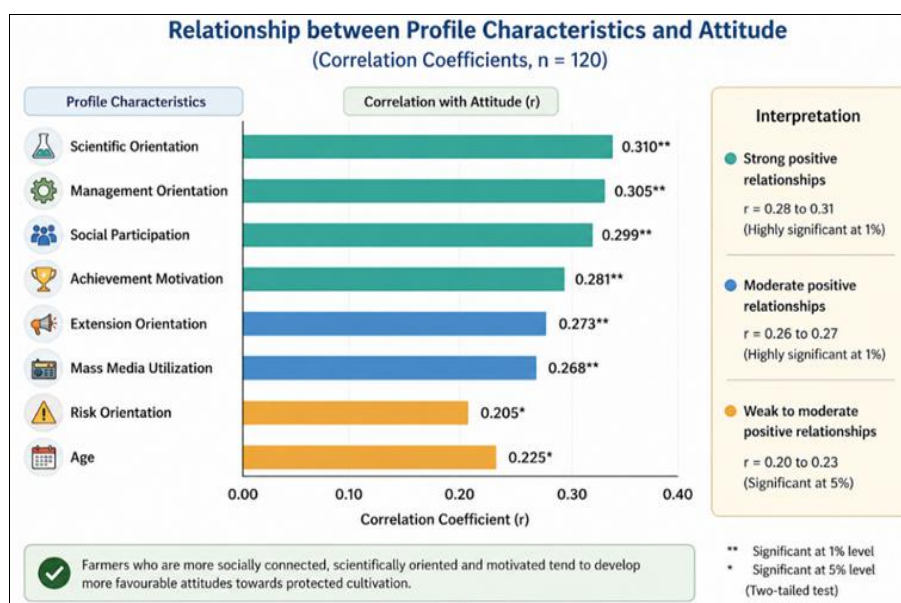
Furthermore, the mean score analysis revealed the particular areas which led to the development of such a positive attitude towards protected cultivation technology. Firstly, the farmers felt that using protected cultivation technology would enable them to make better use of resources like water, nutrients, and land during agriculture, especially when resources were limited. In addition to this, they felt that using protected cultivation would give them a chance to have year-round production, ensuring that they earn continuously without being restricted by seasons.

Nonetheless, even with all these positive outlooks, there are still some constraints that affect the behavioural orientation of the farmers. Some of the respondents mentioned that a major constraint in adopting the practice is that of the huge amount needed in putting up the protection structure at the start. The technical aspect, as well as the expertise needed, also poses as a factor that constrains the farmers. Maintenance is also noted as a constraint.



Relationship between Profile Characteristics and Attitude

The correlation analysis indicates that there is a significant positive correlation between attitude and certain factors. These include social participation ($r = 0.299^{**}$), management orientation ($r = 0.305^{**}$), scientific orientation ($r = 0.310^{**}$), and achievement motivation ($r = 0.281^{**}$). In addition, there is an association between extension orientation ($r = 0.273^{**}$) and mass media usage ($r = 0.268^{**}$). Based on this information, it can be concluded that farmers who are well connected socially and scientifically and are also highly motivated have better attitudes towards protected agriculture.



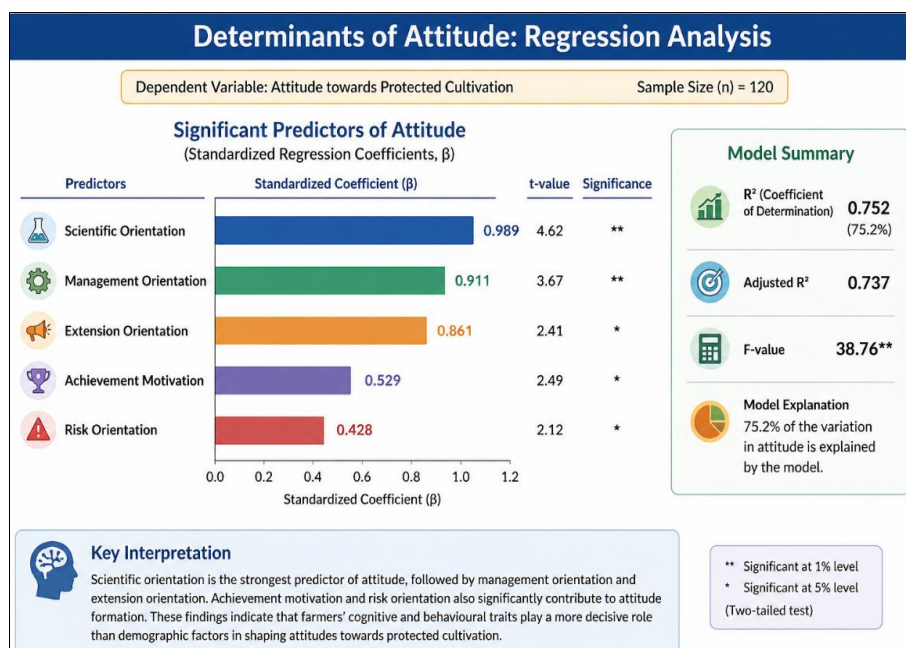
Determinants of Attitude: Regression Analysis

The multiple regression analysis further analyzed the relationships by finding out the important determinants of attitude. The regression equation accounted for 75.2 per cent of the variance in attitude ($R^2 = 0.752$), which clearly shows its high predictive strength.

Among other variables, scientific orientation ($\beta = 0.989$, $p < 0.01$) and management orientation ($\beta = 0.911$, $p < 0.01$) turned

out to be the important determinants of attitude. Extension orientation ($\beta = 0.861$, $p < 0.05$), achievement motivation ($\beta = 0.529$, $p < 0.05$), and risk orientation ($\beta = 0.428$, $p < 0.05$) also significantly influenced the formation of attitude.

Thus, one may conclude that farmer's behavioral and psychological attributes influence their attitudes rather than demographic attributes.



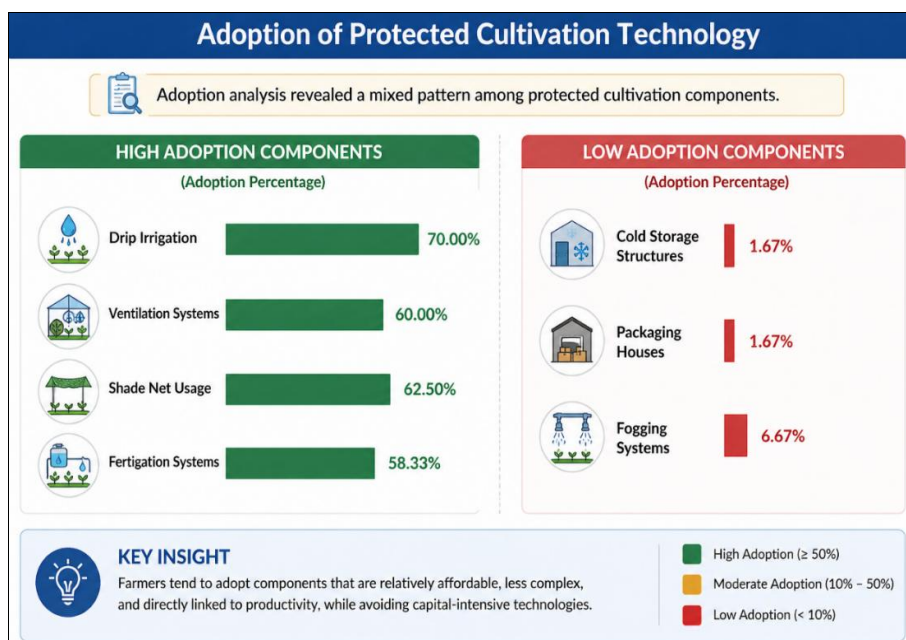
Adoption of Protected Cultivation Technology

Adoption of protected cultivation technologies (PCT) showed a mixed pattern among farmers. High adoption was observed for components directly linked to productivity and resource efficiency, such as drip irrigation (70.00%), shade net usage (62.50%), ventilation systems (60.00%), and fertigation (58.33%). These technologies are relatively affordable, easy to manage, and provide immediate benefits in terms of yield and efficient input use, which explains their wider acceptance.

In contrast, adoption of capital-intensive components was very low. Cold storage structures and packaging houses recorded only

1.67 per cent adoption each, while fogging systems were adopted by just 6.67 per cent of respondents. These technologies require high initial investment, technical expertise, and regular maintenance, making them less accessible to farmers.

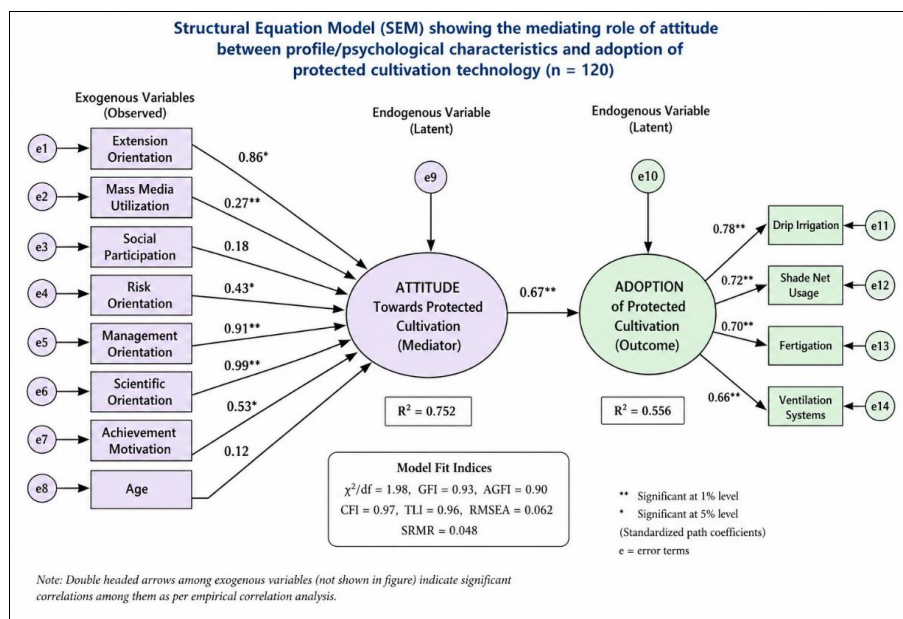
Overall, the findings indicate that farmers prefer simple, cost-effective technologies with quick returns, while avoiding complex and expensive interventions. This highlights the need for financial support, technical guidance, and infrastructure development to encourage comprehensive adoption of protected cultivation systems.



SEM-Based Interpretation: Role of Attitude as Mediator

SEM model showed that attitude was playing a mediating role in between the variables and the adoption process. Variables like scientific orientation, management orientation, and extension orientation were having a significant impact on attitude, which ultimately impacts adoption behaviour. Therefore, it can be said that there is an indirect effect of such factors on adoption, and

that this happens through attitudinal shift. When farmers have scientific orientation, they are able to recognize how PCT would be beneficial to them from a technical perspective, thus developing an attitude conducive for adopting PCT. Also, when farmers have management orientation, they are able to handle the difficulties of protected cultivation and are more likely to adopt.



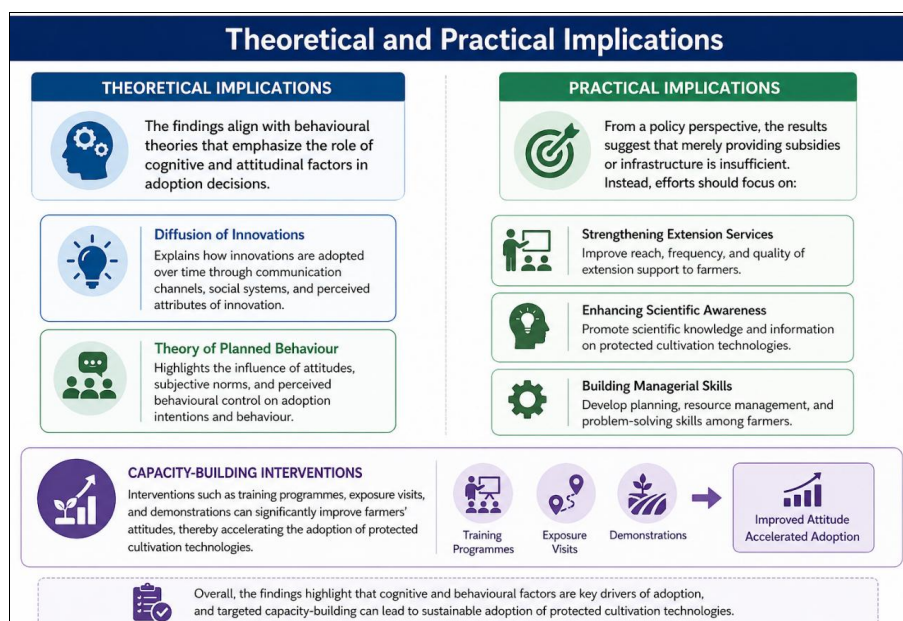
Theoretical and Practical Implications

The results confirm the behavioral theories like the theory of diffusion of innovations and theory of planned behavior, which highlight the importance of cognition and attitude toward innovation adoption.

In terms of policy recommendations, the results indicate that simply providing subsidies or infrastructure will not suffice; rather, it is important to:

- Promote extension services
- Scientific literacy
- Managerial skills for farmers

Capacity development activities like training, exposure trips, and demonstrations can considerably change the attitudes of farmers, thus hastening the adoption process.



Concluding Observations from an SEM Viewpoint: It can be clearly seen that the SEM analysis has indicated that the adoption of protected cultivation technology is not only influenced by socio-economic factors alone, but it is highly dependent on farmers' attitude towards such technology.

Psychological and communication factors are important in determining the attitude of farmers. Therefore, actions taken to improve the knowledge and skills of farmers can have a ripple effect on adoption behavior.

Conclusion

It has been found out that the adoption of protected cultivation technologies is not only dependent upon socio-economic factors of farmers, but it is heavily mediated by farmers' attitude towards these new technologies. The Structural Equation Modeling clearly indicated that the variables such as scientific orientation, managerial orientation, extension orientation, risk orientation, and achievement motivation were significantly responsible for creating favorable attitudes amongst farmers.

The changes in attitudes have played a crucial role in the adoption of new technologies. Farmers who possess sound scientific knowledge and managerial competencies can easily understand and adopt the technology related to protected cultivation. Extension activities have also made the farmers more aware and confident of adopting these types of technologies.

Moreover, different adoption rates indicate that farmers like to adopt such technologies which are not costly and easy to adopt with immediate benefits; whereas farmers tend to avoid technologies that involve high costs and technical skills.

Thus, it can be said that capacity development programs for the farmers may prove helpful in changing their attitude towards adopting new technologies.

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