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Factor Considerations for Adoption of New Agricultural Technologies: A Theoretical Perspective

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Abstract:

The many priorities and concerns associated with attaining sustainable agriculture have resulted in a variety of approaches and application capabilities. New agricultural technology is viewed as a critical step toward ensuring food production sustainability while also reducing environmental deterioration. However, technology adoption for sustainable agriculture is a very broad term and it presents numerous challenges for farmers, agricultural businesses and regulatory bodies being a very dynamic subject. Therefore, the aim of this study is to give some insight on the factors that influence agricultural technology adoption. It accomplishes this by examining prior research on technology adoption. Technological, economic, institutional and farmer-specific aspects were discovered to be factors that determine agricultural technology adoption. Accessibility and implementation at the farm level forms the basis of successful adoption of such technologies. Education, training and awareness, which form the foundation of a farmer's knowledge base is a significant factor with potential to promote wide spread adoption. It's also worth noting that, because the majority of these technologies were created outside of the agriculture sector, appropriate communication about their application and productivity is essential. Farmers' decisions are heavily influenced by agricultural yield. As a result, effective communication is the foundation upon which widespread adoption of new agricultural technologies can be achieved.

Key Words: Sustainable Agriculture, Agricultural Technology, Environmental Awareness, Technology Adoption.

Introduction:

Agriculture and environment interactions are becoming key factors in determining agricultural strategies. The central premise is that farmers need to have the appropriate support framework, expertise and technology to ensure that agriculture produces enough food while also preserving the environment (Farmer 304-319). It also means that consistent regulations must be in place, built on sound scientific grounds, to ensure that actions are

both reasonable and environmentally beneficial. Because of rising manifestations of environmental problems like as shortage of water, soil degradation and increased greenhouse emissions, sustainable agriculture has become a necessity (Gomiero, et al. 6-23). Because agriculture's primary function is to produce food for humans, it's only inevitable that the main objective of long-term agricultural development is to ensure enough food for current and future generations (Gil, et al. 685-698). Agriculture's long-term development is vital, due to its significance as a primary source of food. As a result, for sustainable agriculture, a system that preserves and improves the natural resource base while increasing yield is required (Smith & McDonald 15-37). New agricultural technologies that are developed and introduced as a means of increasing productivity while ensuring minimal environmental damage present viable prospects in this regard (Mottaleb 126-135). New agricultural technologies, on the other hand, are in most cases accepted reluctantly, and numerous components of adoption are still faintly understood (Takahashi, et al. 31-45). In this context, it becomes crucial to examine such factors that would enable wide adoption of new technologies.

Need to Adopt New Agricultural Technologies:

Agricultural technologies encompass a wide range of enhanced systems and technologies that drive agricultural productivity (Lybbert, et al. 114-123). New varieties of seeds, innovative management approaches, soil fertility treatment, water management and weed and pest control are some of the most significant areas of agricultural technological development. New technology tends to raise output and lower average cost of production, resulting in significant increases in farm income in the backdrop of ensuring sustainability with lowest possible impact on the environment (Feder, et al. 423-428). The farmer’s choices of technology have been traditionally influenced by their desire to enhance production to increase revenues (Moore, et al. 327). Therefore, effective policy practices were very basic, referring mostly to raising output, and the goal of agricultural policies was to boost agricultural productivity.

Agriculture now has more diverse objectives to accomplish: it must be competitive and productive while meeting sustainability standards (Batie 1083-1101). Farmers therefore, face increase challenges as well as opportunities. They must not only be profitable, but also ensure minimum damage to the environment. In reaction to agricultural policies that involve environmental aspects, farmers must also adapt accordingly optimizing production and management practices. Increasing agricultural production and fostering agricultural development has relied greatly on technological advancement (Rhoades 127-137). Additionally, research has an impact on farming system productivity by developing new technologies. Hence, a new agricultural technology based on sound research and environment friendly technology that improves long term food production is vital for food security and sustainable economic development.

Adoption of new technical advancements has the ability to meet a wide range of agricultural needs. In contrast to traditional predetermined dose and schedules, increased use of monitoring and insight tools could help farmers to be more efficient with pest management measures, by spraying them only when it is required (Dara

12). Increased use of technology that delivers fertilizers just when and in the amounts needed is projected to boost crop yields while lowering soil leaching. Expanding the use of technologies like precise irrigation tools, which combine more accurate detection of crop demands with ways to dispense water with minimal losses, potentially improve resource consumption and efficiency even more (Mittal 83-88). New agricultural technologies based on the sustainability quotient allow for the most effective resource usage while limiting environmental impact.

The commitment to sustainable development includes addressing global challenges such as climate change, natural resource management and biodiversity conservation which necessitates the integration of economic, environmental and social considerations into policy-making, aided by the innovation and advancements in environmentally sound technologies in particular (Streimikis, et al. 1702-1712). Traditionally individual choices, risk, instability, institutional limitations, input availability and infrastructure have all been used in analyzing technology adoption. On the other hand, sustainable agriculture entails not only the development and implementation of new technologies, but also the integration of ecological and socio-economic aspects.

Promoting Adoption of New Agricultural Technologies:

Agriculture industry must employ a wide range of advancing technology and farm practices across several different agricultural systems and structures to address a spectrum of evolving and varying demands, often with unpredictable outcomes in terms of their implications on sustainability (Lee 1325-1334). Technological advancement that is driven by markets has typically resulted in the intensification of farming systems, the use of more agricultural inputs, and the adoption of management practices that emphasize low costs and high returns (Takeshima, et al. 1230-1236). However, in many cases, the goal of production and efficiency has put a strain on the natural resource base. It has also raised public concerns about the safety and quality of produce in such market oriented high producing farming systems with sole objective of increased production and profitability.

The development of technologies that would enable sustained agricultural growth to meet rising food demand forms the core of the issue. The agricultural expansion process must be based on equity and developed in such a way that the natural resource base is preserved and environmental damage is minimal (Jin 916-930). This sort of agricultural development, which is backed by innovative agricultural technology, ensures productivity while conserving the resource base. Agricultural developments through ecological approaches, which focus on favorable growing conditions for plants and animals as part of a wider ecosystem, are gaining popularity as a way to avoid excessive reliance on external inputs (Hernández-Mogollón 1911-1921).

Ease of use and productive utility in meeting output targets and low capital expenditure are important aspects of a technology that promote its eventual acceptance and needs to be factored while promoting any new technology. Farmers who sense that the technology is compatible with their needs and their situations are more inclined to adopt it since they perceive it as a prospective investment (Kshirsagar 1239-1246).

Therefore, a farmer's perceptions of the technological performance have a considerable impact on their decision to adopt the new technology. Adoption is found to be more rapid when the benefits of adoption are quickly realized. In addition, the accessibility of tools for adoption, the risk involved with the adoption of new technology and how easily the shift to new technology can be integrated into the continuing system of agricultural practices form the major factors that are found to influence and determine adoption of new technologies. Simultaneously, adoption is also based on various individual, traditional, social and institutional factors.

Farmers are highly concerned about their profitability (Cary, et al. 13-21). Deciding where and in what to spend is challenging for the farmers given the wide range of accessible technologies, uncertainties on the outcome in the backdrop of governmental and financial schemes. Seeing a fellow farmer invest in new technologies with similar facilities and resources can often aid decision-making and influence the farmer's choice and eventually promotes adoption especially when positive outputs are evident (Nakano, et al. 336-351). Adoption is highly inhibited by a perception of basic inability to demonstrate a link between profitable technology adoption and sustainable production. The net profit to the farmer from adoption, including total costs of procuring and using the new technology, is a crucial parameter of technology adoption. Clearly, the high cost factor involved in the new agricultural technology would be a significant barrier to widespread adoption (Chavas, et al. 42-53).

Agriculture must be approached holistically by public policy, taking into account the complete system and structure including varied system of production, resource management and income. It needs to strengthen the sector by enhancing farmer knowledge and assisting farming practices to become more sustainable (Youngberg, et al. 167-185). Educating farmers therefore, forms an important factor that would enable wide adoption of sustainable technologies. Farmers must be informed of upcoming technological developments and related schemes and benefits. Consequently, it is found that new technologies should be complemented with farmer's education in order to promote adoption.

Environmental policies that define performance requirements rather than requiring the use of certain technology tend to foster innovation. When a truly essential and useful technology emerges, there may be a desire to accelerate its adoption. It is critical to communicate technology based comprehensive information to the farmers (El Bilali, et al. 456-464). Farmers, generally, are conservative and require more time and satisfactory information to persuade them to adopt new technologies. Farmers will be highly motivated to use relevant new technologies for sustainable farming if the information is communicated to them effectively. Therefore, it is critical to promote the diffusion of improved agricultural technology and practices as well as to expand existing resource planning capabilities and improve research and extension capabilities.

In some circumstances, variables unrelated to a farmer's decision to accept new technology that plainly outperforms traditional practises may impact acceptance. In this sense, Andersson and D'Souza (116-132),

differentiate between adoption limitations and requirements. While farm-specific limitations may exist, such as a lack of financial capacity, workforce availability, or poor soil fertility, requirements refer to the larger organizational, economical and social circumstances that must exist for adoption to take place. The farmer will choose not to adopt a new technology if the necessary conditions for adoption are not met, such as input availability and functional markets.

Farmers will adopt sustainable technologies and farming practices if they believe the investment will bring them prospective returns which are enabled through access to the necessary knowledge, information and incentive along with clear government policies and initiatives (Adimassu, et al. 1005-1023). Agricultural policy, on the other hand, can impact the cost farmers pay for their influencing their investment decisions and perhaps influencing adoption of new technology. If the costs of current farming activities are covered by other enterprises, farmers will have no incentive to adopt environmentally sustainable technologies. When the environmental benefits of using sustainable technologies are expected to flow to persons other than farmers and there are no channels for those benefits, adoption levels may be sub-optimal from a society standpoint. Switching farming technologies to one that is more sustainable might occasionally result in a decrease in production. As a result, compensation through government schemes or subsidies for lost income during the transition time may be necessary. This entails the use of appropriate government incentives and a sound legislative framework to ensure wide adoption of new agricultural technology that ensures sustainable agriculture allowing for a healthy agricultural sector and a thriving agriculture-environment relationship.

Conclusion:

Governments and research organizations have long pushed new agricultural technologies as viable means to boost farm output while ensuring environment sustainability. However, such novel technologies that appear to be advantageous have a poor adoption rate. The elements that influence the adoption of new agricultural technology for long-term productivity have been highlighted in this study. Technological advancements and modernization are defining the boundaries of what is possible in terms of increasing resource efficiency. Sustainable agricultural technology decreases farming's negative environmental implications while also improving soil resilience. Across diverse farming systems, the variety and types of challenges connected with such agricultural techniques increases attributed to limiting factors highly based on individual farmer decision choices. New agriculture technology has proved potential to improve economic and environmental sustainability.

Farmers' perceptions of a new technology are a critical requirement for adoption. Relevant aspects such as financial, productivity and supportive framework considerations have all been found to influence agricultural technology adoption. According to the findings, the determinant of agricultural technology adoption does not always have the same influence on adoption, but rather changes based on the type of technology being promoted. Education helps in positive adoption of improved technologies and environment

friendly infrastructure through addressing presumptions and skepticism towards any new technology. Adoption is heavily influenced by the farmer's decision and policy issues. In order to plan and implement technology-related programmes to address the issues of sustainable food production, it is necessary to first understand the factors that influence or limit adoption of agricultural technology. As a result, in order to improve new agricultural technology adoption, policymakers and promoters of new technology must first understand the factors that influence adoption and effectively address the challenges to achieve widespread adoption.

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