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Agricultural experts' attitude towards precision agriculture: Evidence from Guilan Agricultural Organization, Northern Iran

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ABSTRACT

Identifying factors that influence the attitudes of agricultural experts regarding precision agriculture plays an important role in developing, promoting and establishing precision agriculture. The aim of this study was to identify factors affecting the attitudes of agricultural experts regarding the implementation of precision agriculture. A descriptive research design was employed as the research method. A research-made questionnaire was used to examine the agricultural experts' attitude toward precision agriculture. Internal consistency was demonstrated with a coefficient alpha of 0.87, and the content and face validity of the instrument was confirmed by a panel of experts. The results show that technical, economic and accessibility factors accounted for 55% of the changes in attitudes towards precision agriculture. The findings revealed that there were no significant differences between participants in terms of gender, field of study, extension education, age, experience, organizational position and attitudes, while education levels had a significant effect on the respondent's attitudes.

1. Introduction

Innovation is an important factor in the success and survival of knowledge-based organizations. The innovation process is managed for the creation of value, services, products, technology and new business systems [1]. With the introduction of agricultural informatization, the traditional agriculture has been reformed by advanced ICTs, eventually contributing to the significant improvements in agricultural productivity and sustainability [2]. Precision agriculture (PA) is this century's most valuable innovation in farm management that is based on using ICTs. This most recent innovation technology is based on sustainable agriculture and healthy food production, and it follows three principles: profitability and increasing production, economic efficiency, and the reduction of side effects on the environment [3]. PA is such a new emerging and highly promising technology, that it is spreading rapidly in the developed countries. PA research started in the US, Canada, Australia, and Western Europe in midtolate 1980s. Although a considerable research effort has been expended, it is still only a portion of farmers who have practiced any type of PA technologies [4]. PA is conceptualized by a

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system approach to re-organize the total system of agriculture towards a low-input, high-efficiency, and sustainable agriculture [5]. Precision agriculture is a management strategy that uses information technology to bring data from multiple sources to bear on decisions associated with crop production [6,7]. It is aimed at diversifying the management of situations and time in order to achieve maximum utility in various parts of the field; it should be pathological, since there is heterogeneity in different parts of the field. Quantifying the impact of changes in crop function plays an important role in precision agriculture because the overtime changes are unstable. Precision agriculture requires advanced technology for its implementation, such as intelligent agricultural machinery, and it is also time-consuming. Primarily, the farmer must accept it as a management system, trust it and, finally, apply it in order to achieve full utility. Along with the various attempts to achieve sustainable agriculture in communities, various strategies have been implemented [8].

For the optimal and stable use of agricultural lands, proper planning and the utilization management of land is essential so that the implementation of maximum seminal utilization can be accomplished, and economic and social development and improvement, as well as environmental protection, can be expressed [9]. Agricultural development in Iran actually requires the participation of specialists and the application of scientific principles to crop production [10] thus, the importance of precision agriculture with a sustainable approach for development. It is first necessary to examine the factors relating to seminal attitudes in order to promote and expand it.

The results indicated that attitude to use, is the most determinant of intention to adoption of precision agriculture technologies. Various studies have shown that an antecedent to adoption or decision to adoption is creating suitable attitude toward new technology [11]. An attitude can be seen as a special preparation of a person's mental readiness to deal with phenomena, problems, matters and events, and a readiness with excitement which is due to each individual's past and their different experiences in life. All various definitions of attitude which are expressed refer to attitude as a learnable and partly durable reality which is expensed as the person's orientation and, based on it, the person judges about phenomena in a positive or negative way [12]. Oppenheim [13] defines an attitude as a state of readiness to act, a willingness to act or as a special reaction regarding a specific stimulus. He believes that they are strengthened by opinions and beliefs (perception factors) and that they often absorb strong feelings (sense factors), leading to certain types of behavior (motion factors). He suggests that attitude is only very rarely the product of a balanced conclusion after a careful assembly of evidence.

Studying the different attitudes of people regarding different themes/bases is important because it helps managers and stakeholders to understand the activators regarding thinking about certain issues [14]. Attitudes are shaped or changed by education (direct and indirect) [15]. Studying the attitudes of the Guilan Agricultural Organization's experts (as the most important executives in agriculture) can identify the strengths and weaknesses of organizations and empower them. According to Omidi Najafabadi et al. [16], the various challenges involved can be classified in terms of nine latent variables, namely: educational, economic, operator demographic, technical, data quality, high risk, time, educational institution, incompatibility challenges. The results suggest educational and economic challenges as the two most important challenges in the application of precision agriculture. Among the variables which contribute to educational challenges, a lack of local experts and a lack of knowledgeable research and extension personnel have more of an impact when compared to others, while a lack of allocations of funds to precision agriculture and initial costs have more of an impact among the economic challenges compared to the other variables.

Hosseini et al. [17] studied the infrastructures of precision agriculture's implementation possibility perspective of the Fars jihad-e-Keshavarzi Agriculture Organization experts in Iran. According to *F*-test results, educational, economic, technical, management and policy factors affect the possibility of precision agriculture's application. There were no significant differences between social factors and the possibility of precision agriculture's application/implementation. Moreover, educational, economic and technical factors accounted for 69% of the changes toward the dependent variable. A study by Mennalled et al. [18] on the evaluation of agricultural professionals' perceptions and knowledge of sustainable agriculture assessed the needs, knowledge and interests of agricultural professionals who were likely to enroll on an online extension course in sustainable agriculture. This study highlighted the importance of understanding the level of knowledge, concerns and interests of the target audience.

It is vital that Iran moves toward precision agriculture technologies quickly due to potential capacities and it cannot be actualized unless different agricultural operators are involved. Due to the key role of agricultural experts in innovation adoption by farmers [6], this study was conducted to determine the perceptions of agricultural experts in Guilan, regarding the implementation of precision agriculture. The following research objectives guided the study:

1. Describe the demographic characteristics of the agricultural experts.
2. Describe the perceptions of agricultural experts towards precision agriculture.
3. Identify factors underlying agricultural experts' perceptions of precision agriculture.

2. Materials and methods

Agricultural experts in Guilan Province, near the Caspian Sea, in the north of Iran were the statistical population of this study. Guilan covers an area of 14,711 km and has a population of 2,403,716. This province has 400,000 ha of agricultural land, 60% of which is allocated to rice cultivation. Guilan has 230,000 ha of paddy fields with an annual production of 700,000 tons of white rice (Fig. 1). This amount is equivalent to 30% of the country's rice production. This statewide study