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Research Article

PERCEPTION OF AGRICULTURAL SPECIALIST TOWARDS BIOTECHNOLOGY INNOVATIONS

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ABSTRACT
Biotechnology is a complement - not a substitute - for many areas of conventional agricultural research. It offers a range of tools to improve our understanding and management of genetic resources for food and agriculture. The purpose of this research is analyzing perception of agricultural specialist towards biotechnology innovations. The methodology used in this study involved a combination of descriptive and quantitative research and included the use of correlation, regression and descriptive analysis as data processing methods. The total population for this study was 135 specialists in Khouzestan Agricultural-Jihad organization that were involved in the biotechnology research and development. A series of in-depth interviews were conducted with some senior specialists in the organization to examine the validity of questionnaire. A questionnaire was developed based on these interviews and relevant literature. A pilot study was conducted with 25 specialists who had not been interviewed before the earlier exercise of determining the reliability of the questionnaire for the study. Computed Cronbach's Alpha score was 87.0%, which indicated that the questionnaire was highly reliable. Based on the results there was correlation between biotechnology knowledge, number of published paper about biotechnology by his or her, participation rate in biotechnology workshops, job satisfaction, interest in the environment, believed to have limited resources, appetite for risk, rate of foresight, rate of responsibility taking and perception of respondents on application of biotechnology in agriculture in 0.01 level. Also regression analysis indicates that 67% of the variances in the perception of respondents could be explained by the biotechnology knowledge, number of published paper about biotechnology by his or her, participation rate in biotechnology workshops, job satisfaction, interest in the environment, believed to have limited resources, appetite for risk, rate of foresight, and rate of responsibility taking.

Key words: *Perception, Biotechnology Innovations, Specialists*

INTRODUCTION
Agricultural biotechnology can play an important role in increasing production and improving the quality of food produced by farmers. Biotechnology promises to contribute to world food demands as well as deliver a range of environmental, health and economic advantages (Wheeler, 2005). Agricultural biotechnology and, specifically, the development of genetically modified (GM) crops have been controversial for several reasons, including concerns that the technology poses potential negative environmental or health effects, that the technology would lead to the (further) corporatization of agriculture, and that it is simply unethical to manipulate life in the laboratory (Bennett *et al.,* 2003). GM crops have been part of the agricultural landscape for more than 15 years and have now been adopted on more than 170 million hectares (ha) in both developed countries (48%) and developing countries (52%) (Bennett *et al.*, 2003). On the basis of this substantial history and data spanning many years, the economic and environmental impacts of GM crops can now be summarized with some certainty, and the analysis indicates that, on balance, many benefits have accrued from the adoption of GM crops. There continue to be many ethical issues that are being debated, and many are being resolved through institutional interventions. The future of agricultural productivity would be better served if the genetic modification debate were less polarized and were focused on the potential for complementarily of GM technologies within a diversified farming system framework (Bennett *et al.,* 2003). Several parameters have been identified as influencing the adoption behavior of farmers toward biotechnology. Social scientists

investigating farmers who adopt the biotechnology showing the demographic variables, technology characteristics, information source, knowledge, awareness, perception and group influence adoption behavior (Oladele, 2005).

Anunda (2014) indicate that the key factors to influence individual perception and foster change in their perception towards accepting biotechnology and foods are safety and benefits to society. Where people reject biotechnology, crucial factors are their concern with regard to adverse effects on wildlife and the environment, and their fear about unknown risks of biotechnology foods. It is interpreted that Kenyans, are yet to be convinced that biotechnology crops are safe for human consumption. In addition, as people believe that biotechnology foods are likely to pose health risks than non biotechnology foods, they are uncertain or undecided about accepting or rejecting them. This suggests that if people are convinced that eating biotechnology foods is not harmful for their health, then there is great potential to change their perceptions.

Hossain *et al.,* (2002) indicate that people's view of biotechnology and their approval of its use in plants and animals are influenced not only by their socio-economic attributes, but also by their social/political and religious orientation. An individual's education, especially his/her knowledge of science (relating to biotechnology), has significant influence on his/her acceptance of food biotechnology. Also, people's trust and confidence in private and public institutions (e.g., scientific community, biotechnology corporations and government regulators) have important influence on public perceptions of biotechnology and their willingness to approve its use in food production.

To promote a broad based acceptance of this technology among the general population, it is vitally important that the actions and policies of private and public institutions be undertaken in ways that work to promote people's trust and confidence in these institutions. Effective communication among scientific community, private corporations, government and the general public can make enormous contribution towards general acceptance of food biotechnology among ordinary citizens.

Moon and Balasubramanian (2001) found that consumer acceptance of biotechnology was significantly influenced not only by their perceptions of risks and benefits associated with GM products, but also by their moral and ethical views. In addition, consumers' views about corporations, knowledge of science, and trust in government had significant influence on their acceptance of biotechnology. In an extensive international study of public perceptions of biotechnology conducted by Environics International (2000), almost three-fifths of the people surveyed in the Americas, Asia and Oceania agreed that the benefits of the use of biotechnology outweigh the risks.

In Iran, a radical approach to spread and to promote the adoption of biotechnology by farmers is underway. For instance, the establishment of the National Council for Scientific Research improves the status of biotechnology in the agriculture sector.

The promising development was to include both agriculture and biotechnology among the top priorities for funding at the national level (Ghareyazie, 1999). The application of biotechnology by farmers in Iran faces challenges and obstacles. Infrastructural obstacles, lack of good and skillful trainers and insufficient fund are among some of the challenges.

There is no single appropriate way to introduce and promote biotechnology in the developing countries: constraints and opportunities vary from country to country and therefore require location specific approaches (Hosseini *et al.,* 2008).

Farmers and pastoralists have manipulated the genetic make-up of plants and animals since agriculture began more than 10 000 years ago. Farmers managed the process of domestication over millennia, through many cycles of selection of the best adapted individuals.

This exploitation of the natural variation in biological organisms has given us the crops, plantation trees, farm animals and farmed fish of today, which often differ radically from their early ancestors (see Table 1) (FAO, 2004).

Table 1: An agricultural technology timeline

Technology	Era	Genetic interventions
Traditional	About 10 000 years BC	Civilizations harvested from natural biological diversity, domesticated crops and animals, began to select plant materials for propagation and animals for breeding
	About 3 000 years BC	Beer brewing, cheese making and wine fermentation
Conventional	Late nineteenth century	Identification of principles of inheritance by Gregor Mendel in 1865, laying the foundation for classical breeding methods
	1930s	Development of commercial hybrid crops
	1940s to 1960s	Use of mutagenesis, tissue culture, plant regeneration. Discovery of transformation and transduction. Discovery by Watson and Crick of the structure of DNA in 1953. Identification of genes that detach and move (transposons)
Modern	1970s	Advent of gene transfer through recombinant DNA techniques. Use of embryo rescue and protoplast fusion in plant breeding and artificial insemination in animal reproduction
	1980s	Insulin as first commercial product from gene transfer. Tissue culture for mass propagation in plants and embryo transfer in animal production
	1990s	Extensive genetic fingerprinting of a wide range of organisms. First field trials of genetically engineered plant varieties in 1990 followed by the first commercial release in 1992. Genetically engineered vaccines and hormones and cloning of animals
	2000s	Bioinformatics, genomics, proteomics, metabolomics

(Source: FAO, 2004)

In modern societies, acceptance of new technologies is highly related to the public perception. Therefore, Public perceptions of biotechnology have received extensive consideration in recent years in most countries and several surveys have been done in this regards (Hoban, 1997; Angus, 2000; Morris and Adley, 2001). These surveys have shown that people's perception toward biotechnology is different and a number of inter-related factors have major influences on consumer acceptance or rejection of the technology. Overall the people's knowledge levels, awareness of benefits, confidence and trust have an important effect on acceptance of biotechnology, while, more negative media coverage and activist opposition have negative effect on it (Hoban, 1997). Sheikhha *et al.*, (2006) indicated that public's knowledge about biotechnology is low in Iran and more efforts are needed to improve their understanding of different aspects of biotechnology.

MATERIALS AND METHODS

The methodology used in this study involved a combination of descriptive and quantitative research and included the use of correlation, regression and descriptive analysis as data processing methods. The total population for this study was 135 specialists in Khouzestan Agricultural-Jihad organization that were involved in the biotechnology research and development. A series of in-depth interviews were conducted with some senior experts in the organization to examine the validity of questionnaire. A questionnaire was developed based on these interviews and relevant literature. The questionnaire included both open-ended and fixed-choice questions. The open-ended questions were used to gather information not covered by the fixed-choice questions and to encourage participants to provide feedback. Content and face validity were established by a panel of experts consisting of faculty members at Islamic Azad University, Ahvaz and Shoushtar Branches and some specialists in the Biotechnology Research Institute (BRI). A pilot study

was conducted with 25 specialists who had not been interviewed before the earlier exercise of determining the reliability of the questionnaire for the study. Computed Cronbach's Alpha score was 87.0%, which indicated that the questionnaire was highly reliable. The dependent variable in this research study was the perception of agricultural specialist towards biotechnology innovations. For measurement of correlation between the independent variables and the dependent variable, correlation coefficient has been utilized.

RESULTS AND DISCUSSION

Results

Table 2 shows the demographic profile and descriptive statistics. The results of descriptive statistics indicated that the majority of specialists were men, the majority of specialists were 45-50 years old and had an MSc degree status. Information regarding the level of specialist perception about the biotechnology is recorded in Table 2. As can be seen from Table 3, the highest rank refers to the level of specialists' perception about economically affordable (CV = 0.253) and the lowest rank refers to makes it cheap and easy to produce (CV=0.376). Table 4 shows based on the number of items (n = 9), and minimum and maximum acquisition score (min = 1, max = 5), range perception scores between 9 and 45 will vary. This range was divided into 5 categories. People who score was 9 to 16 in very disagree group, who had scored 16 and 23 in the group disagree, people who 23 to 30 were in the group unsure, who had a score of 30 to 37 in the group agree, and those who score 37 to 45 were in the group very agree.

Table 2: Demographic Characteristics of specialists

Age	***f***	**%**	**Cumulative %**
20-25	3	2.22	2.22
25-30	4	2.96	5.19
30-35	27	20.00	25.19
35-40	30	22.22	47.41
40-45	24	17.78	65.19
45-50	34	25.19	90.37
50<	13	9.63	100.00
Total	135	100.00	
	Level of Education		
BSc	91	67.41	67.41
MSc	40	29.63	97.04
PhD	4	2.96	100.00
Total	135	100.00	
	Sex		
Male	116	85.93	85.93
Female	19	14.07	100.00
Total	135	100.00	

Table 3: Level of specialist perception about the biotechnology

	Very disagree		Disagree		Unsure		Agree		Very agree		mean	sd	cv	Rank
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	**3.45**	**0.89**	**0.258**	**2**
Economically affordable.	12	8.89	13	9.63	44	32.59	34	25.19	32	23.70	3.44	0.87	0.253	1
Socially acceptable.	10	7.41	17	12.59	39	28.89	41	30.37	28	20.74	3.36	0.94	0.280	5
Technically applicable.	9	6.67	15	11.11	51	37.78	38	28.15	22	16.30	3.38	0.99	0.293	7
Increases in disease resistance.	16	11.85	14	10.37	37	27.41	39	28.89	29	21.48	2.74	1.05	0.383	6
Increases resistance to stress.	21	15.56	29	21.48	61	45.19	12	8.89	12	8.89	2.99	0.93	0.312	8
Makes it cheap and easy to produce.	20	14.81	30	22.22	39	28.89	24	17.78	22	16.30	2.61	0.98	0.376	9
Environmental pollution is reduced.	27	20.00	39	28.89	43	31.85	12	8.89	14	10.37	3.41	0.92	0.269	4
To reduce dependence on chemical inputs.	12	8.89	24	17.78	31	22.96	32	23.70	36	26.67	3.39	0.88	0.260	3
Will increase product quality.	17	12.59	19	14.07	22	16.30	49	36.30	28	20.74	3.45	0.89	0.258	2

Table 4: Frequency of specialists based on perception level

Groups	***f***	**%**	**Cumulative %**
Very Agree	26	19.26	19.26
Agree	48	35.56	54.81
Unsure	29	21.48	76.30
Disagree	15	11.11	87.41
Very Disagree	17	12.59	100.00
Total	135	100.00	

Spearman coefficient was employed for measurement of relationships between independent variables and dependent variable. Table 5 displays the results which show that there is a relationship between perception of respondents on application of biotechnology in agriculture as dependent variable and specialist characteristic. Based on the results there was correlation between biotechnology knowledge, number of published paper about biotechnology by his or her, participation rate in biotechnology workshops, job satisfaction, interest in the environment, believed to have limited resources, appetite for risk, rate of foresight, rate of responsibility taking and perception of respondents on application of biotechnology in agriculture in 0.01 level.

Table 6 shows the result for regression analysis by stepwise method. Independent variables that were significantly related to the perception of respondents about application of biotechnology in agriculture were entered. The result indicates that 67% of the variances in the perception of respondents could be explained by the biotechnology knowledge, number of published paper about biotechnology by his or her,

participation rate in biotechnology workshops, job satisfaction, interest in the environment, believed to have limited resources, appetite for risk, rate of foresight, rate of responsibility taking.

Table 5: Relationship between perception of respondents on application of biotechnology in agriculture as dependent variable and specialist characteristic

Independent Variable	Dependent variable	r	p
biotechnology knowledge	perception of respondents on application of biotechnology in agriculture	0.657	0.000
number of published paper about biotechnology by his or her		0.698	0.000
participation rate in biotechnology workshops		0.745	0.000
job satisfaction		0.539	0.000
interest in the environment		0.665	0.000
believed to have limited resources		0.609	0.000
appetite for risk		0.873	0.000
rate of foresight		0.450	0.000
rate of responsibility taking		0.561	0.000

Table 6: Multivariate regression analysis (perception of respondents on application of biotechnology in agriculture).

Multivariate regression analysis	B	Beta	T	Sig
biotechnology knowledge	0.673	0.339	2.734	0.000
number of published paper about biotechnology by his or her	0.981	0.432	3.981	0.000
participation rate in biotechnology workshops	1.098	0.712	3.098	0.000
job satisfaction	0.890	0.340	2.980	0.000
interest in the environment	0.781	0.412	3.087	0.000
believed to have limited resources	2.092	0.612	2.976	0.000
appetite for risk	0.789	0.314	3.901	0.000
rate of foresight	0.996	0.302	4.905	0.000
rate of responsibility taking	0.801	0.309	2.981	0.000
Constant	2.980	----	3.907	0.000

R^2=0.67 F=12.903 Sig= 0.000

Discussion and Recommendation

The perception of specialists about the perception of respondents on application of biotechnology in agriculture was discussed in this article. Based on the results, specialists did agree about application of biotechnology in agriculture. Wheeler (2005) and Oladele (2005) supported this result. Dingman (2008) pointed out that many researchers believed that nanotechnology and related food products are safe and causes no harm to human being.

Based on the results there was correlation between biotechnology knowledge, number of published paper about biotechnology by his or her, participation rate in biotechnology workshops, job satisfaction, interest in the environment, believed to have limited resources, appetite for risk, rate of foresight, rate of responsibility taking and perception of respondents on application of biotechnology in agriculture in 0.01 level. Oladele (2005) and Anunda (2014) supported this result.

The result indicates that 67% of the variances in the perception of respondents could be explained by the biotechnology knowledge, number of published paper about biotechnology by his or her, participation

rate in biotechnology workshops, job satisfaction, interest in the environment, believed to have limited resources, appetite for risk, rate of foresight, rate of responsibility taking.

It is recommended that these characteristics must be considered by planners. Considering the above-mentioned characteristics will be improving expert perception to use of biotechnology in agriculture.

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