

Analysis of Socio-Cultural Obstacles for Dissemination of Nanotechnology from Agricultural Experts Perspective in Iran

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ABSTRACT

The main purpose of this research was to analyze Socio-Cultural obstacles of disseminating of nanotechnology in Iran's agricultural section. One hundred twenty eight out of a total of 190 researchers with different levels of expertise in and familiarity with nanotechnology were randomly selected and questionnaires completed by them. Face validity have been done by expert's suggestion and correction, reliability by using Cronbach-Alpha formula. The results of a factor analysis showed variation for different factors. For cultural factors 19/475 percent, for management 13/139 percent, information factor 11/277 percent, production factor 9/703 percent, social factor 9/267 percent, and for attitude factor it became 8/947 percent. Also results indicated that socio-cultural factors were the most important obstacle for nanotechnology dissemination in agricultural section in Iran.

Keywords: Agricultural nanotechnology; Social and cultural obstacles; Public perception; Iran

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INTRODUCTION

Agriculture plays an important role in each society. At present time, more than one billion hectare of the world's lands is dedicated to cultivate crops. If this efficiency is maintained for agricultural plants and given the growth of population by 2050, there should be available three billion hectares of lands to be dedicated to cultivate crops worldwide. (Gharayazi, 2001). Undoubtedly, providing food needs for millions of people in coming decades will require a drastic change into existing capacities.

During recent decade, some countries have made huge progresses in developing new technologies such as nanotechnology, biotechnology, IT and knowledge - based technology (Rafi'i Tabar, 2006). nano sciences and technology has occupied the center of these new and promising technologies. It should be noted that any development of other branches of new technologies are directly subjected to the progresses of nano sciences and technologies.

Nanotechnology provides capabilities required for making deepest changes into whole of dimensions of human society. The biggest changes whether in the realms of health and hygiene, industry and economy or agriculture and environment as the main fields of activities of human advanced societies will bring about by nanotechnology during the next 50- years . Convergence of the above-mentioned fields of new technology through Nanotechnology is considered as a coming horizon for the next 50-year period. (Rafi'i Tabar, 2006). With the help of new tools for molecular treatment of diseases, rapid diagnosis of diseases, upgrading plant's capability for absorption of nutrients, Nanotechnology can bring about fundamental modifications in the agriculture and food industries. Intelligent sensors and rapid transportation systems can help the viruses of agriculture industry to combat against pathogenic agents. Meanwhile, nanotechnology will indirectly protect environment by renewable resources and decrease the amount of pollution and removes existing pollution using catalyst filters (Joseph & Morrison, 2006).

However, nanotechnology is comparatively new and therefore will confront numerous hindrances, gaps and challenges specifically at next decade. Developing countries are confronted a series of problems and difficulties and then development of technology is a hard task for them. The lack of national feelings and pride and public support of the leaders and policy-makers and the lack of technology and renovation culture are viewed as the major difficulties by Safavi (2002). Salehi Vaziri *et al.* (2004) mention that the lack of infrastructures required for development of new technologies, lack of rules and regulations needed for development of new technologies and lack of targeted researches are the most important problems and difficulties of dissemination and expansion of Nanotechnology in the country.

Scientific and cultural assessment and control board of Cultural Revolution High Council (2003) considers the lack of effective legal and national tools and mechanisms required for securing and maintaining of material and intellectual rights of scientists, scholars, inventors, innovators and discoverers of the country, lack of participation by private sector in the research activities and the lack of necessary mechanisms for information in the science and technology domains as the main difficulties and barriers for development of science and technology in the country.

Nouri Daloui (2003) considers the lack of collaboration and international, proper and uninterrupted scientific exchanges with experienced and capable countries and lack or shortage of general knowledge of society about the role, position, advancements, achievements and the applications of new sciences and techniques as fundamental difficulties that management system of science and technology development are confronted with.

Karami (2001) acknowledges that cultural issues are one of the most important issues in the technology arena. According to special staff for development of Nanotechnology (2004), the lack of appropriate legal substructure to protect intellectual property is seen as difficult and barrier of investment in Nanotechnology in Iran. Gharayazi (2000) attributes the major difficulties of development of agriculture biotechnology existing in Iran to the weakness of communication between researchers and production administrators, lack of clarified rules and regulations and structural weakness of private sector. lack of understanding of customers and the lack of a consumption culture, the lack a constructive interaction among the researcher and capital holders

(cultural-social) are the most important challenges of developing nanotechnology in Iran. Mayez (2005) stresses that lowered level of knowledge and understanding of the public on the benefits and the potentials of Nanotechnology, the shortage of financial assistance and the lack of required activities in support of shaping risk-taking funds, the lack of intellectual property, the lack of information and communication networks, opposition and lack of planning for active participation of private sector are considered as the most important barriers to develop Nanotechnology. Simanga *et al.* (2004) have examined the factors influencing dissemination and admission of agricultural technologies. The results indicate that some factors such as state policies, technical consultation plans, development of infrastructures and access to the market and credit and educational policies play the most important role in the dissemination and admission of agricultural technologies. In his study, Harper (2008) has dealt with some of threats and opportunities resulting from the influence of world's economic stagnation on developing Nanotechnology and has classified them under five major issues influencing Nanotechnology at 2009 as follows: 1) joint venture on Nanotechnology and turnover of capital; 2) acquisition of worthless intellectual properties; 3) investments and companies derived from universities; 4) clean technologies and 5) applications of Nanotechnology.

Generally, according to above explanations, we can classify the barriers under four major ones as follows: weakness of communication among the researchers of Nanotechnology, lack of material and intellectual support of private institutes that work on Nanotechnology, lack of effective information systems on Nanotechnology in agricultural sector, lack of collaboration and international, uninterrupted and appropriate scientific exchanges with skillful and experienced countries that have a great and valuable experiences on Nanotechnology. So, this paper aims to study and analyze the cultural and social barriers of development of Nanotechnology from viewpoint of researchers of Centers and National Research Institutions of Ministry of Agriculture.

MATERIALS AND METHODS

Present research in terms of application, supervision and controlling of non-experimental variables and in terms of data collection is considered as descriptive one. Knowledgeable researchers that either work on Nanotechnology or have research projects on Nanotechnology and cooperate with national research centers and institutions constitute a statistical society of present research. This society has 190 members of which 123 members have been selected on the basis of simple random sampling according to Morgan's table for doing research. To enhance the accuracy and validity of findings, the number of participants increased to 128 persons. Questionnaire as a tool for data collection has two parts: a) cultural-social barriers of Nanotechnology development; b) personal and professional peculiarities of researchers. Permission required for questionnaire was issued by guidance counselors, advisors and authorized officials and was confirmed. The reliability of questionnaire, i.e. 0.823 was calculated by Chronbach's Alfa Coefficient. Collected data were analyzed by SPSS WIN13 software.

RESULTS AND DISCUSSION

Totally, 128 researchers were studied of which 85.2% were men and 14.8% were women. The findings of this research show that the average age of responders is 41 years old and the most frequency of age is within 36-40 years old. These findings also indicate that the average of work experience of the researchers is 14 years, while the most frequency of work experience is within 6-10 years. Collected data on publication activities of researchers indicate that on average 12.1 research and scientific articles were published nationwide. The majority of them have published 1-5 articles. On average, 7.2 research and scientific articles were published at international level. The majority of them have published 1-5 articles (43.7%). These researchers have completed 7.9 research plans on average.

Table 1: Prioritizing of cultural-social barriers of Nano technology dissemination in agriculture sector from researchers' viewpoint

Issue	Aver.	Std. Devi.	CV	priority
The lack of collaboration and international, uninterrupted and appropriate scientific exchanges with those countries that have a great and valuable experiences on Nanotechnology	4.254	0.692	0.162	1
The lack of effective information systems on Nanotechnology in agricultural sector	3.730	0.833	0.223	2
Distrusting of senior managers of Ministry of Agriculture against the capabilities and the role of Nanotechnology in economic development of the country	3.816	0.855	0.224	3
Oversight and carelessness of the press and Radio & Television Organization to propagate and introduce Nanotechnology (at agriculture sector)	3.396	0.839	0.247	4
The lack of material and intellectual support of private institutions that work on Nanotechnology	3.548	0.866	0.249	5
The lack of collaboration and interaction of state organization	3.661	0.944	0.257	6
The lack of deep appreciation of officials of Ministry of Agriculture against the importance of Nanotechnology	3.846	0.996	0.258	7
The lack of effective information for introduction of people who are active in the realm of Nanotechnology	3.500	0.918	.0262	8
Inadequate knowledge, examination and studying on Nanotechnology	3.656	1.007	0.275	9
The lack of work team culture among the researchers of Nanotechnology	3.825	1.081	0.282	10
The lack of appropriate social culture among the public to familiarize with achievements and capabilities of Nanotechnology	3.472	1.022	0.294	11
The weakness of communication between researchers of Nanotechnology	3.382	1.008	0.296	12
The lack of timely information of the public	3.328	1.004	0.301	13
The lack of or lowering of public knowledge on Nanotechnology	3.640	1.106	0.303	14
The lack of Nanotechnology and renovation at social level	3.492	1.078	0.308	15
The lack of proper culture at public level on Nanotechnology	3.261	1.005	0.308	16
Nonobservance of intellectual properties	3.425	1.080	0.315	17
The lack of propagation of entrepreneurship culture of Nanotechnology at agriculture sector	3.480	1.125	0.323	18
The lack of appropriate understanding of customers against Nanotechnology	3.585	1.239	0.345	19
Not to take into consideration of development of human resources	3.520	1.235	0.350	20
The lack of national pride and determination on production and renovation of Nanotechnology in reliance on research	2.992	1.110	0.370	21
Lack of establishment of science and Nanotechnology culture and lack of its admission by the public	2.881	1.077	0.373	22
Disproportion between Nanotechnology and culture and social conditions of the country	2.812	1.127	0.4	23
The lack pride and public support of the leaders and policy-makers of Nanotechnology	2.991	1.278	0.427	24
Negative propagation on the consequences of Nanotechnology	2.608	1.204	0.461	25

1= very low ; 2= low ; 3= medium ; 4= high ; 5= very high

The results obtained by research conducted on the most important cultural-social barriers of dissemination of Nanotechnology in agriculture sector are shown in Table 1. The lack of collaboration and international, uninterrupted and appropriate scientific exchanges with skillful and experienced countries that have a great and valuable experiences on nanotechnology, lack of effective information systems on nanotechnology in agricultural sector, distrusting of senior managers of Ministry of Agriculture against the capabilities and the role of nanotechnology in economic development of the country, oversight and carelessness of the press and Radio & Television Organization to propagate and introduce Nanotechnology (at agriculture sector) and the lack of material and intellectual support of private institutions that work on nanotechnology are the main impediments mentioned by the researchers. The lack of pride and public support of the leaders and policy-makers of Nanotechnology and negative propagation on the consequences of Nanotechnology as other barriers are of little importance.

Factor analysis

The listed barriers were examined by factor analysis. Initial statistical calculations confirmed the relative fitness of data required for factor analysis. KMO's value is equal to 0.705 and its Bartlett's value is equal to 1514/991 that became significant at the level of 1%. This proves the fitness of correlation between the variables applied for factor analysis.

Extracted factors with their special value, % of variance and their accumulated % of variance are reflected in Table 2.

Table 2: Extracted factors with their special value, % of variance and their accumulated % of variance

Factors	Special value	% of variance of special value	Accumulated % of variance
1 st	4.284	19.475	19.475
2 nd	2.891	13.139	32.614
3 rd	2.481	11.277	43.891
4 th	2.135	9.703	53.594
5 th	2.039	9.267	62.861
6 th	1.968	8.947	71.808

According to the findings of the Table (2), all six factors explain 71.808% of total variance. It proves high percent of variance explained by these factors. The first factor with special value of 4.284 explains individually 19.475 % of total variance. But the position of variables (25 main variables) among the factors assuming positioning of variables with factor load of greater than 0.5, the factors after rotation will be named as shown in Table (3).

However, it should be considered that after rotation of variable, they were removed from the analysis due to its lower factor load (less than 0.5) and consequently insignificance of correlation between each other. The main cause of this omission is that the common area of these variables was covered already by the most important factors and then the said factors could be summarized.

Table 3: The variables of each factor and coefficient values resulting from rotated matrix

Factor	Variables	Coefficient value
cultural	The weakness of communication between researchers of Nanotechnology	0.647
	The weakness of communication between researchers of Nanotechnology	0.797
	Inadequate knowledge, examination and studying on Nanotechnology	0.629
	The lack of material and intellectual support of private institutions that work on Nanotechnology	0.636
	The lack of appropriate understanding of customers against Nanotechnology	0.758
	The lack of work team culture among the researchers of Nanotechnology	0.746
	The lack of effective information for introduction of people who are active in the realm of Nanotechnology	0.578
managerial	The lack of effective information systems on Nanotechnology in agricultural sector	0.660
	Distrusting of senior managers of Ministry of Agriculture against the capabilities and the role of Nanotechnology in economic development of the country	0.800
	The lack of deep appreciation of officials of Ministry of Agriculture against the importance of Nanotechnology	0.781
	The lack of collaboration and international, uninterrupted and appropriate scientific exchanges with those countries that have a great and valuable experiences on Nanotechnology	0.643
informational	The lack of or lowering of public knowledge on Nanotechnology	0.671
	The lack of timely information of the public	0.601
	The lack of appropriate social culture among the public to familiarize with achievements and capabilities of Nanotechnology	0.778
	The lack of proper culture at public level on Nanotechnology	0.677
production	The lack of national pride and determination on production and renovation of Nanotechnology in reliance on research	0.574
	The lack of propagation of entrepreneurship culture of Nanotechnology at agriculture sector	0.519
social	Disproportion between Nanotechnology and culture and social conditions of the country	0.875
	Lack of establishment of science and Nanotechnology culture and lack of its admission by the public	0.790
conceptual	The lack pride and public support of the leaders and policy-makers of Nanotechnology	0.615
	Negative propagation on the consequences of Nanotechnology	0.830

Given to examination of the variables constituting each factor and given to the variables positioned at each factor, the main factors of cultural-social barriers of dissemination of Nanotechnology in agriculture sector are enumerated as cultural factors, managerial factors, informational factors, production factors, social factors and conceptual factors.

CONCLUSION

Present research was conducted with the purpose of analyzing of social-cultural barriers of dissemination of nanotechnology in agriculture sector from the viewpoint of the researchers of national researches institutes and governmental centers in this field. The findings of this research indicated that, the barriers of disseminating of nanotechnology in agriculture sector in Iran are as: cultural factors, managerial factors, informational factors, production factors, social factors and conceptual factors.

These results also, indicated that cultural factor is considered as the first factor and this is complied with the results obtained by Safavi (2002), Nouri (2003) and Ebrahimi *et al.* The second factor is known as managerial factor and this is in accordance with studies by Rasouli (2007), Nouri (2003) and special staff for development of nanotechnology (2004). The third factor is known as information factor and this is complied with the results obtained by scientific and cultural assessment and control board of Cultural Revolution High Council (2003) , Nouri (2003) and special staff for development of Nanotechnology (2004). The fourth factor is production factor and findings by Rasouli (2007) and Safavi (2002) confirmed this finding.

The next one is known as social factor and this is complied with the results obtained by Heidari (2005). The last one is conceptual factor (barriers: The lack pride and public support of the leaders and policy-makers of nanotechnology and negative propagation on the consequences of nanotechnology) and this is complied with the results obtained by Gharrayazie (2000) and Safavi (2002).

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